

## Prevalence and risk factors of overweight and obesity in elementary schoolchildren in the metropolitan region of Tunis, Tunisia

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### R É S U M É

**Prérequis :** La progression de la prévalence de l'obésité dans le monde intéresse également la Tunisie. Les facteurs de risque liés à cette pathologie méritent d'être identifiés afin de mettre en place des stratégies de prévention.

**But :** Déterminer la prévalence de l'obésité et du surpoids et en étudier les facteurs de risque dans une cohorte d'écoliers tunisiens âgés de 6 à 12 ans.

**Méthodes:** Etude descriptive transversale portant sur un échantillon de 1335 écoliers (637 garçons, 698 filles) âgés de 6 à 12 ans (médiane : 9,71 ± 1,5 ans) et vivant dans le Grand Tunis. Les données personnelles et parentales ont été recueillies par des questionnaires remplis par les parents. Le poids et la taille ont été mesurés et l'indice de masse corporelle (IMC en kg/m<sup>2</sup>) calculé. La prévalence du surpoids et de l'obésité a été déterminée en se basant sur les critères de l'IOTF.

**Résultats :** La prévalence du surpoids et de l'obésité selon l'IOTF était de 19,7% et de 5,7% respectivement. Les facteurs de risque associés au surpoids étaient : le niveau d'instruction élevé de la mère et du père : 17,3% vs 11,7% (p=,01) (OR (95% CI): 1,58; 1,09-2,29) et 26% vs 17,4% (p=0,002) (OR: 1,66; 1,21-2,29), respectivement ; et la profession de cadre de la mère et du père : 7,2% vs 3,6% (p=0,009) (OR: 2,1; 1,2-3,7) et 14% vs 9% (p=0,014) (OR: 1,6; 1,1-2,48), respectivement.

**Conclusion :** La prévalence globale du surpoids et de l'obésité dans cette cohorte d'écoliers tunisiens était respectivement de 19,7% et 5,7%. Le choix des aliments est un des facteurs de risque responsable du développement de l'obésité.

### S U M M A R Y

**Background:** Local data about prevalence of obesity in emerging countries are rather scarce. Risk factors for obesity, well known in most industrialized countries, are poorly understood in Tunisia.

**Aims:** To assess prevalence of overweight and obesity and to investigate associations with possible risk factors in a group of 6-12 year- old schoolchildren in Tunis, Tunisia.

**Methods:** A descriptive transversal study including a sample of 1335 schoolchildren (6-12 years; mean: 9.7 ± 1.5 years) was conducted in Tunis. Personal and parental data were collected by questionnaires completed by parents. Height and weight were measured and body mass index was calculated. Prevalence of overweight and obesity was defined based on international agreed cut-off points.

**Results:** Prevalence of overweight and obesity was 19.7% and 5.7%, respectively. Risk factors associated with overweight were: high degree- educated mother and father: 17.3% vs 11.7% (p=.01) (OR (95%CI): 1.58; 1.09-2.29) and 26% vs 17.4% (p=.002) (OR: 1.66; 1.21-2.29), respectively; mother, father high in occupational hierarchy: 7.2% vs 3.6% (p=0.009) (OR: 2.1; 1.2-3.7) and 14% vs 9% (p=.014) (OR: 1.6; 1.1-2.48), respectively. Overweight children had a significantly higher consumption of bread (p=.044), of snack intake (p=0.046) and of soft drink consumption (p=.035).

**Conclusions:** Prevalence of overweight and obesity in this cohort are 19.7% and 5.7%, respectively. Substantial differences in food choices in families with the highest socio-economic status are among risk factors contributing to obesity development.

### Mots-clés

Surpoids; Obésité; Science; Nutrition Infantile; Epidémiologie; Facteurs de risque

### Key- words

Overweight; Obesity; Science; Child Nutrition; Epidemiology; Risk factor.

Although prevalence of obesity 1 has increased worldwide (1), local data about this pathology in emerging countries are rather scarce. As in many other African countries, Tunisia is now facing the phenomenon of epidemiologic transition. This has led to new health problems in the country; such as childhood overweight and obesity. Risk factors for obesity, well known in most industrialized countries, are poorly understood in Tunisia. The aims of this study was to determine the prevalence of overweight and of obesity in a group of 6-12 year-old school children in the metropolitan region of Tunis, Tunisia and to investigate the association with possible risk factors.

## SUBJECTS/METHODS

We performed from April through May 2007 a descriptive transversal study in 77 elementary public schools sorted among 515 schools of the metropolitan region of Tunis, Tunisia. For each sorted school, the day before the survey a class is sorted among classes present on that day. Questionnaires were distributed to a total of 1636 schoolchildren. Were included in the study children aged 6-12 years old present on the day of the survey and who had a written authorization signed by parents to participate to the survey. Were excluded from the study children aged less than 6 years old and more than 12 years; children whom their parents refused participation; children who did not or incompletely filled in the questionnaires and children who were not present on the day of the survey. A total of 1335 elementary schoolchildren (637 males, 698 Females) (6-12 years; mean age:  $9.71 \pm 1.53$  years) participate to the study. Personal data such as age, sex, birth weight, breastfeeding history and parental data including parental weights and heights, parental education level and occupation were collected by questionnaires completed by parents. Data concerning frequency and composition of breakfast and of snacks, amount of soft drink consumption in addition to data concerning physical activities (PA), television (TV) viewing and personal

computer (PC) usage were also collected by interviews. Height and weight were measured with a weighing-scale ([www.detectoscale.com](http://www.detectoscale.com)) and body mass index (BMI; kg/m<sup>2</sup>) was calculated. We received ethics approval from the National Ethics Committees. The prevalence of overweight and obesity was defined based on international agreed cut-off points proposed by the International Obesity Task Force (IOTF) (2). Study group was divided into overweight including obesity and non-overweight non obese subgroups and risk factors were studied. Statistical quantitative parameters were analysed by the Chi square and the exact Fischer tests. A p value of  $< 0.05$  was considered as significant. The data was analyzed by logistic regression analysis using SPSS 11.0 version (SPSS Inc. Chicago, IL, USA).

## RESULTS

In this cohort of schoolchildren, according to IOTF cut off points (2) overall prevalence of overweight and obesity was 19.77% and 5.77%, respectively; 10.98% and 5.96% in boys and 16.67% and 5.58% in girls ( $p=0.01$ ). One hundred eighty seven children were overweight (F/M: 117/70; mean age:  $9.91 \pm 1.48$  years), 77 children were obese (F/M: 39/38; mean age:  $9.66 \pm 1.63$  years) ( $p=0.138$ ) while 1071 schoolchildren were non overweight, non obese (F/M: 542/529; mean age:  $9.67 \pm 1.51$  years). No significant difference was found between overweight and non overweight schoolchildren in birth weight and in breastfeeding duration. Parental factors associated with overweight were: high degree educated mother and father: 17.3% versus (vs) 11.7% ( $p=0.01$ ) (OR: 1.58; 95% CI: 1.09-2.29) and 26% vs 17.4% ( $p=0.002$ ) (OR: 1.66; 95% CI: 1.21-2.29), respectively; mother, father high in the occupational hierarchy (HOI): 7.2% vs 3.6% ( $p=0.009$ ) (OR: 2.1; CI 95%: 1.19-3.71) and 14% vs 9% ( $p=0.014$ ) (OR: 1.6; CI 95%: 1.1-2.48), respectively; and mothers overweight:  $25.8 \pm 4.03$  vs  $26.4 \pm 3.9$  (OR: 0.63; CI 95%: 0.47-0.84) ( $p=0.019$ ) (table 1).

**Table 1 :** Risk factors in overweight and non overweight schoolchildren

	Overweight*	Non overweight non Obese	P value
Birthweight (gram)	$3239 \pm 599$	$3274 \pm 659$	0.46
Breastfeeding duration (months)	$7.5 \pm 6.9$	$8.2 \pm 7.8$	0.21
Exclusive breast feeding	20%	21%	0.09
Highly educated mother	17.3%	11.7%	0.01 OR: 1.58 (CI 95%: 1.09-2.29)
Highly educated father	26%	17.4%	0.002 OR: 1.66 (CI 95%: 1.21-2.29)
Mother in HOI	7.2%	3.6%	0.009 OR: 2.1 (CI 95%: 1.19-3.71)
Father in HOI	14%	9%	0.014 OR: 1.6 (CI 95%: 1.1-2.48)
Mother's BMI (Kg/m <sup>2</sup> )	$25.8 \pm 4.03$	$26.4 \pm 3.9$	0.019 OR: 0.63 (CI 95%: 0.47-0.84)

HOI: high occupational hierarchy - CI: confidence interval

**Table 2 :** Eating habits and exercise in overweight and non overweight schoolchildren

	Overweight*	Non overweight non Obese	P value
Frequency of breakfast intake	6.1 ± 1.82	6.08 ± 1.82	0.8
Sorghum at breakfast	19.7%	11.9%	0.042
Bread and butter at breakfast	43.4%	32%	0.044
Cereals at breakfast	24.4	18.4	0.02
Snack intake frequency (days per week)	5.6 ± 1.7	5.3 ± 1.8	p=0.046
Soft drink consumption (days per week)	6.6 ± 4.2	5.9 ± 3.7	0.035
Physical activity (hours per week)	2.89 ± 3.42	2.91 ± 3.63	0.94
TV Viewing (hours per day)	2.07 ± 1.33	2.12 ± 1.47	0.58
Videogames (hours per day)	0.35 ± 0.7	0.37 ± 0.85	0.84
PC usage (hours per day)	0.48 ± 0.92	0.43 ± 0.92	0.42

HOI: high occupational hierarchy

\* Obesity included

CI: confidence interval

No significant difference was found between overweight and non overweight schoolchildren in frequency of breakfast intake. Compared with non overweight schoolchildren, overweight schoolchildren had at breakfast a significantly higher consumption of sorghum (19.7% vs 11.9%;  $p=0.042$ ), of slices of bread and butter (43.4% vs 32.0%;  $p=0.044$ ) and of cereals (24.4% vs 18.4 %;  $p=0.02$ ), and a significantly higher snack intake per week (5.6 days/week vs 5.3 days/week;  $p=0.046$ ) (table 2). On the 1 other hand, compared with normal weight children obese children had a significantly higher consumption of fruits (13.2% vs 5.9 %;  $p=0.009$ ). Proportions of energy intake per day have not been calculated. Forty four per cent of children have dinner watching TV without any difference between overweight and non overweight groups. There is no significant difference between overweight and non overweight or for lunch or diner in family: 85% vs 88%;  $p=0.08$ ; 74.5% vs 73.9%;  $p=0.87$ , respectively.

Overweight children (obesity included) drink however significantly more soft drink at dinner per week (6.6 ± 4.2 days vs 5.9 ± 3.7 days;  $p=0.035$ ). No significant difference was found in weekly school PA between overweight children (obesity included) and non overweight schoolchildren (2.89 ± 3.42 hours vs 2.91 ± 3.63;  $p=0.94$ ). Compared with overweight children (obesity included), non overweight schoolchildren spend a mean time of 2.12 ± 1.47 hours vs 2.07 ± 1.33 hours in

TV viewing ( $p=0.58$ ), 0.37 ± 0.85 hours vs 0.35 ± 0.7 ( $p=0.84$ ) in videogames and 0.43 ± 0.92 hours vs 0.48 ± 0.92 in PC usage ( $p=0.42$ ) (table 2). Concerning leisure activities, overweight children (obesity included) are significantly fond of reading than non overweight non obese children (43.5% vs 36.2%;  $p=0.028$ ).

## DISCUSSION

This survey confirms that childhood overweight has become a major public health challenge in Tunis. Almost 1 in every 5 children in Tunis public elementary school students is overweight; a third of whom are obese. Comparison of our results to previous surveys in Tunisian elementary schools showed that prevalence of obesity has increased during the last decade. Based on the data of the Tunisian National Nutrition Survey (3), a cross-sectional population-based survey, conducted in 1996 on a large nationally representative sample including 7 regions of Tunisia (Tunis, North eastern, North western, Centre western, Centre eastern, south western and south eastern), which included 2761 children and adolescents aged 2-19 years, prevalence of overweight and of obesity according to references of the National Health and Nutrition Survey I (4) was 7.4% and 2.2%, respectively. In a population

study conducted in 1997, based on a sample of 951 schoolchildren, aged 6-12 years, in the region of Ariana, Tunis, Tunisia, prevalence of obesity defined as BMI higher than 97th percentile issues from French survey (5) was 5.25% (6).

Assessment of obesity prevalence according to IOTF cut off points is one of the strengths of this study. This standard definition allows international comparison of trends in overweight and obesity and can be readily adapted for clinical use. It is however relatively arbitrary and might not be suitable for some populations.

High parental education level and parents HOI are among risk factors associated with overweight in our cohort. In another Tunisian study conducted on a sample of 3148 schoolchildren, aged 6-12 years, obesity risk was 5 fold higher in children from households with a high income (OR [95% CI]; 5.3 [2.15-13.8],  $p < 0.0001$ ) (7). The Millennium Cohort Study which studied a total of 13 113 children aged 3 years, reported that children are more likely to be overweight for every 10 hours a mother worked per week (OR [95% CI]; 1.10 [1.04, 1.17]) (8). Contrasting with these data, other studies reported protective effect of educational level against overweight and obesity. In cross-sectional study which included 35434 five to seven year-old children, in East and West Germany, educational level was reported to be inversely associated to increase the odds of overweight and obesity (9). The increased prevalence of overweight in high social groups in our cohort might be explained by insufficient nutrition knowledge of some parents to food choice, belief in some families that obesity is synonymous of wealthiness and healthiness, lack of adherence to breast-feeding and use of formula, food availability when living in a family with the highest socioeconomic status. This implies an education program targeting high social and highly educated parents. Contrasting with literature data, mothers overweight was a protector factor against overweight in our cohort. In another Tunisian study, 69% of obese children versus 41% of non obese children have one obese parent (OR: 3.18) and 70% of obese children versus 19.1% have both parents obese (OR: 9.67) (7). Parental obesity is an increasingly important predictor of adult obesity; it more than doubles the risk of adult obesity among both obese and non obese children below 10 years of age (10). Substantial differences in food choices at breakfast; excess of sorghum, bread and butter, of cereals together with excess of consumption of snacks and soft drink are among dietary factors contributing to overweight development in our study.

However, one of the limitations of this study was the lack of data on energy intake. We found no significant difference between overweight and non overweight schoolchildren in frequency of breakfast intake. In a Dutch study performed on 25 176 adolescents, skipping breakfast was the most important risk factor for overweight and obesity with an adjusted OR for the association with overweight of 2.17 ([95% CI]; 1.66-2.85) (11). On the other hand, not only that breakfast consumption itself is associated with BMI, but that the type of food eaten at breakfast also affects BMI. The analysis of data from the Third National Health and Nutrition Examination Survey (NHANES III), a large, population-based study conducted in the United States

from 1988 to 1994, provides evidence that eating ready-to-eat or cooked cereal or quick breads for breakfast is associated with significantly lower BMI compared to skipping breakfast or eating meats and/or eggs for breakfast ( $p \leq 0.01$ ) (12). Frequent intake of breakfast at home along with early awakening to allow breakfast preparation and consumption should be considered a priority for health promotion efforts. Fruit intake, even though is higher in obese children compared with normal weight children, could be targeted for further increase in primary schools as part of promoting a healthy diet. We found no significant difference between overweight and non overweight children or for lunch or dinner in family or for consumption patterns. This might be due to the age class (6-12 years old) of our study group. The analysis of data from the Early Childhood Longitudinal Study-Kindergarten Cohort, a nationally representative sample of children who entered kindergarten during 1998-1999, provides evidence that children who watched more TV (OR 1.03), ate fewer family meals (OR 1.08) were more likely to be persistently overweight (13). Eating family meals is associated with healthful dietary intake patterns, including more servings per day of fruits and vegetables, less fried food and soda, less saturated fat, more micronutrients from food. Frequency of snack intake in overweight schoolchildren was higher than in non overweight children. Compared with normal weight children obese children had a significantly higher consumption of fruits at midmorning snack. In a cross-sectional survey of primary school foods in 1681 5-12 years old, conducted in the South-Western region of Victoria, Australia, 68% of children had fruit in their lunchboxes; however, over 90% of children had energy dense, micronutrient-poor snacks (14). Morning snack at school is inadequate and unnecessary. For children who had breakfast before school- almost all- it brings an additional food intake responsible for energy excess leading to weight gain. In terms of horary it is not adapted; too far from the awake and too close to lunch. It is then a source of reduction of food intake at lunch and may alter the nutritional equilibrium of the day. Overweight children (obesity included) drink significantly more soft drink at dinner per week. In another Tunisian study, soft drink consumption was significantly higher in obese children: 77% vs 25% in non obese children (OR [95% CI]; 9.95 [4.6-21.8];  $p < 0.008$ ) (7). In a cross-sectional study which included a total of 856 children aged 4-7 years living in Crete, Greece, high consumers of sugar-added beverages have higher BMI levels and two times greater risk of being overweight and/or obese than non or low consumers (OR: 2.35,  $p = 0.023$ ) (15). High intake of sugar added beverages must be corrected by promoting a strategy of prevention and nutritional education. We found no significant difference in weekly school PA between overweight children (obesity included) and non overweight schoolchildren. In an epidemiological survey based on a representative sample of 1569 urban school children aged 13-19 years conducted in 1999 in the region of Sousse, in Tunisia, overweight was significantly higher in children who did not practice sport at school: 22 versus 13.1% ( $p < 0.002$ ), in groups of youngsters who were not affiliated to school sport or city associations (16). Physical inactivity has been associated

with overweight in worldwide literature. Adjusted OR for the association with overweight for physical inactivity was 1.73 ([95% CI]; 1.19-2.51) in the study of Croetzen et al. (11) and 1.35 ([95% CI]; 1.066-1.94) in the study of Mahfouz et al. (17). In a study including 557 Swedish children ( $9.5 \pm 0.3$  years) and 517 adolescents ( $15.6 \pm 0.4$  years) from the European Youth Heart Study, Ortega et al. showed that children and adolescents who had a low level of vigorous PA, were more likely to be overweight (including obesity) and to have a high-risk waist circumference, than those with a high level of vigorous PA (18). No statistical differences were found between overweight children (obesity included) and non overweight schoolchildren in time spent in TV viewing, in videogames and in PC usage. Lack of data on energy expenditure was another limitation of this study. TV viewing should be regarded as an important contributing factor to childhood obesity. In a meta-analysis of the empirical evidence of associations between TV viewing, video/computer game use and body fatness, and PA among samples of children and youth aged 3-18 y, a statistically significant relationship was reported between TV viewing and

body fatness. A cross-sectional study, in 2343 children, aged 9-12 years, from New Hampshire and Vermont public schools provides evidence that children with a TV in their bedroom who watched at least one session of TV or movies per day were more likely to be overweight compared to those without a TV in their bedroom (OR [95% CI]; 1.32 [1.03, 1.70]) (19).

## CONCLUSION

In the metropolitan region of Tunis, Tunisia, overall prevalence of overweight and obesity in schoolchildren are 19.77% and 5.8%, respectively. Substantial differences in food choices at breakfast and midmorning snack are among dietary factors contributing to obesity development in schoolchildren. High education level and social status can also have influence on children's eating behaviours. These results must be taken into account in order to design preventive strategies to counteract the increasing prevalence of obesity in schoolchildren.

**Conflict of interest:** The authors declare no conflict of interest.

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