

Symposium: Obesity in Developing Countries: Biological and Ecological Factors

Diet Culture and Obesity in Northern Africa¹

Najat Mokhtar,^{*,2} Jalila Elati,[†] Rachida Chabir,^{*} Abdelatif Bour,^{*} Khalid Elkari,^{*} Nina P. Schlossman,^{**} Benjamin Caballero[‡] and Hassan Aguenau^{*}

^{*}Laboratory of Physiology and Nutrition, Ibn Tofail University, Kenitra, Morocco, [†]National Institute of Nutrition, Tunis, Tunisia, ^{**}Global Food & Nutrition Inc., Silver Spring, MD and [‡]Johns Hopkins University, School of Hygiene and Public Health, Center of Human Nutrition, Baltimore, MD

ABSTRACT The etiology of obesity in North Africa is not well understood and few studies shed any light on its development among women. This study compiles what is known about the prevalence of obesity and its determinants in Morocco and Tunisia. Results from the authors' two surveys on nutrition-related disease among reproductive-age women (sample size: 2800) and their children (1200 children under 5 y and 500 adolescents) were combined with data from four national income and expenditure surveys (dating from 1980) to assess obesity trends and development in Morocco and Tunisia. Overall levels of obesity, identified by body mass index (BMI) ≥ 30 kg/m², were 12.2% in Morocco and 14.4% in Tunisia. Obesity is significantly higher among women than among men in both countries (22.7% vs. 6.7% in Tunisia and 18% vs. 5.7% in Morocco) and prevalence among women has tripled over the past 20 y. Half of all women are overweight or obese (BMI > 25) with 50.9% in Tunisia and 51.3% in Morocco. Overweight increases with age and seems to take hold in adolescence, particularly among girls. In Tunisia, 9.1% of adolescent girls are at risk for being overweight (BMI/age ≥ 85 th percentile). Prevalence of overweight and obesity are greater for women in urban areas and with lower education levels. Obese women in both countries take in significantly more calories and macronutrients than normal-weight women. The percentage contribution to calories from fat, protein and carbohydrates seems to be within normal limits, whereas fat intake is high (31%) in Tunisia and carbohydrate intake (65–67%) is high in Morocco. These are alarming trends for public health professionals and policy makers in countries still grappling with the public health effects of malnutrition and micronutrient deficiencies. Health institutions in these countries have an enormous challenge to change cultural norms that do not recognize obesity, to prevent significant damage to the public's health from obesity. *J. Nutr.* 131: 887S–892S, 2001.

KEY WORDS: • Tunisia • Morocco • obesity • women • Northern Africa

The etiology of obesity in North Africa (NA) is not well understood and few studies shed any light on its development among women. This study compiles what is known about the prevalence of obesity and its determinants from secondary data (Government of Morocco Ministry of Socio-Economic Affairs 1998) and the authors' original research on nutrition in Morocco and Tunisia (Mokhtar et al. 1997, Tunisian National Institute of Nutrition 1997). The authors attempt to place their findings in a broader global context to determine what NA can learn from the situation and experience of other

countries already dealing with the health problems associated with nutrition and lifestyle.

The culture and dietary patterns of this region are shaped by its historic and geographic place on the continent. NA, including Morocco, Tunisia and Algeria, is on the trade route from Europe to sub-Saharan Africa and populated by Berber, Arab and Saharoui ethnic groups. NA countries are classified as middle income countries according to gross domestic product (GDP) and other development indices (UNDP 1999). However, they still are grappling with the sequelae of undernutrition and micronutrient deficiencies so familiar in developing countries. This is evident in most national public health programs and policies, as well as national-level research. Nutrition studies in NA focus on undernutrition and its effects on survival, mortality and development of mothers and children (PAPCHILD 1997, DHS 1987, 1992). Similar to developing countries, those of NA are moving along epidemiologic, demographic and nutrition transitions (Martorell et al. 1998, Popkin 1994). Changes in lifestyle, the increase of food availability and dietary diversification certainly have protected many groups from nutritional deficiencies but not from nutri-

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² To whom correspondence and reprint requests should be addressed. E-mail address: mokhtarnajat@yahoo.com.

tion imbalance (WHO 1990, Padilla et al. 1995). Accelerated urbanization and immigration to the city result in new diseases. Western culinary influences lead to new consumption patterns, which affect dietary habits and even the rhythm of consumption. These new dietary habits have created conditions for chronic diseases like obesity and diabetes to take hold.

Obesity is a growing problem in these countries, especially since female fatness is viewed as a sign of social status and is a cultural symbol of beauty, fertility and prosperity. In Morocco results from the 1984 national household consumption and expenditure survey (Government of Morocco Ministry of Socio-Economic Affairs, 1984/1985) already showed high levels of overweight and obesity among women in urban areas [20% of women with body mass index (BMI) > 28]. More recently, in 1998, the pharmaceutical company ROCHE funded a national level survey in Morocco on 1500 men and women 15 to 60 y of age. Preliminary results indicate that the prevalence of obesity among women is 17.8% (ROCHE 1999). In Tunisia, the National Nutrition Institute completed a national survey in 1997, revealing female obesity to be a serious public health problem in that country. The prevalence of overweight and obesity (BMI \geq 25) increased from 28.3% in 1980 to 51% in 1997. Obesity has tripled in 17 y. At present, one out of every two women becomes overweight or obese. There is reason to be concerned about the level of obesity in NA. Obesity is strongly associated with a number of chronic diseases, including diabetes mellitus, hypertension and cardiovascular diseases (CVD), and increases the risks of mortality from these conditions (Solomon and Manson 1997). In Morocco and Tunisia, the prevalence of mortality from CVD (25–30%) and diabetes (10%) is high. It is important for policy makers to have accurate information not only about obesity at the national level but also about how obesity varies across different populations and by socioeconomic and demographic factors. It is critical to understand the links between nutrition and obesity development in these countries, as well as related dietary patterns. The objectives of this report are as follows: 1) to provide estimates of the prevalence of obesity in NA countries based on data from national surveys; 2) to investigate how specific sociodemographic factors affect obesity (e.g., age, location of residence, education and dietary intake) from our own research in Morocco and Tunisia; and 3) to determine trends of obesity in both countries.

MATERIALS AND METHODS

Results from the authors' two surveys on nutrition-related disease among reproductive-age women (sample size: 1500 women, age range 15 to 45 y old in Morocco, and 1300 in Tunisia) and their children (600 children under 5 y in Morocco and 900 in Tunisia and 500 adolescents, age range 11 to 19 y old in Tunisia) were combined with data from four national income and expenditure surveys dating from 1980, to assess obesity trends and development in Morocco and Tunisia. This study bases most of its findings on Tunisia and Morocco because data were not available from Algeria at the time this report was prepared.

National-level data. National-level data are from the 1997 Tunisian National Nutritional Status survey of 2760 individuals, covering all 22 districts (Tunisian National Nutrition Institute 1997). Moroccan national trend data come from 17,203 people participating in a 1998 national survey on income, consumption and expenditure (Government of Morocco Ministry of Socio-Economic Affairs 1998).

Anthropometric measures. Obesity among children under 5 y of age was determined by weight-for-height Z scores (WHZ) of WHZ >2SD above the WHO/NCHS reference mean weight-for-height (WHO 1995). Comparison with the reference population is based on the assumption that well-nourished young children in all populations follow similar growth patterns (Martorell and Habicht 1986, Sommerfeld and Steward 1994). Body mass index (BMI, in kg/m²), the most widely accepted indicator, was used to assess obesity among adolescents and adult men and women (Kuczmarski et al. 1995, WHO 1995). The risk of overweight among adolescents is determined at the 85th percentile (Must et al. 1991). BMI \geq 30 and 25 \leq BMI < 30 indicate obesity and overweight, respectively (WHO 1995).

Dietary data. Dietary and food composition patterns were assessed from dietary recall and record data. Dietary information from 24-h dietary food recall from two successive days was averaged to determine dietary intake of Moroccan women. In Tunisia intake values are an average from 3-d dietary records. Mean daily dietary intake and composition were estimated from food composition tables compiled by the Tunisian Institute of Statistics and a French database completed with 235 Tunisian and 50 Moroccan dishes.

Statistical analysis. The Statistical Package for the Social Sciences, version 7.5 (SPSS 1998) was used to perform the statistical analyses presented here. Results are expressed as means \pm SD. Statistical comparison of means among groups was performed with the Student's *t* test; differences are considered statistically significant at *P* < 0.05.

RESULTS

Obesity among men and women. Prevalences of overweight and obesity in Morocco and in Tunisia are presented in Table 1. Obesity (BMI \geq 30 kg/m²) is 12.2% in Morocco and

TABLE 1

Distribution of Moroccan (18 y and +) and Tunisian population (20–60 y) according to their BMI (kg/m²) and gender

	Sample size	BMI < 18.5	18.5 \leq BMI < 24.9	25.0 \leq BMI ¹ < 29.9	BMI ¹ \geq 30
Morocco ²					
Males	9120	6.3	60.0	28.0a	5.7
Females	8200	4.8	43.9	33.0a	18.3a
Total	17,320	5.5	51.5	30.8a	12.2a
Tunisia ³					
Males	926	9.1	60.9	23.3b	6.7
Females	1834	5.8	43.3	28.2b	22.7b
Total	2760	8.6	49.6	27.4b	14.4b

¹ Prevalence values that have the same letters are not significantly different, that is, a, b, *P* < 0.01.

² Source: Socio-Economic Affairs Ministry. Statistics Department, Report of National Survey on Household Income, Consumption and Expenditure, Morocco, 1998/99.

³ Source: National Survey Report on Nutritional Status of Tunisian Population, 1997.

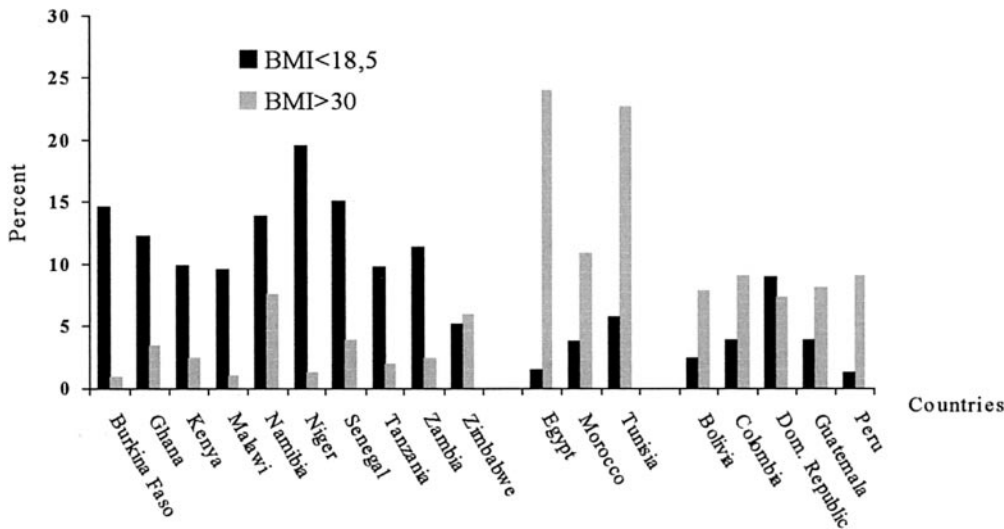


FIGURE 1 Chronic energy deficiency (undernutrition) and obesity among women (15–49 y): comparison of North African, sub-Saharan and Latin American countries. [Source: Demographic and Health Surveys Comparative Studies (DHS, 1997).]

14.4% in Tunisia. In both countries, obesity prevalence is threefold higher in women than in men (22.7% vs. 6.7% in Tunisia and 18.3% vs. 5.7% in Morocco) and a third of both populations is overweight.

NA in the global context. Figure 1 shows chronic energy deficiency (undernutrition) and obesity among women (age range 15 to 49 y) in NA, compared to sub-Saharan African and Latin American countries. Obesity is significantly higher than undernutrition in NA countries. Undernutrition (BMI < 18.5) is still high in the sub-Saharan countries where famine and food security are important factors. In Latin American countries, undernutrition and obesity coexist; obesity is less prevalent than in NA (9.4% in Peru, 8% in Guatemala, 9.2% in Colombia and 7.6% in Bolivia).

Demographic and educational factors. Mean BMI of Moroccan women ranging in age from 15 to 75 y by location of residence is given in Figure 2. BMI increases significantly with age but more dramatically so in urban areas. Maximum value is observed at 55 y of age, after which time it decreases. Table 2 presents female obesity for 20- to 49-y-old women by location of residence and educational level in Morocco and Tu-

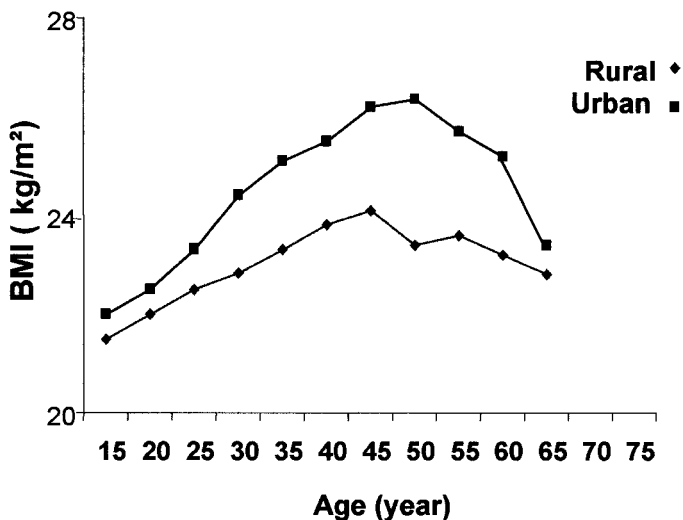


FIGURE 2 BMI for age of women in urban and rural areas in Morocco. (Source: National Household Income and Expenditure Survey, Morocco, 1984/1985.)

nia. Obesity is high in urban areas and among women with little or no education in both countries; however, obesity is twice as high in urban compared to rural women in Tunisia.

Obesity trends. Figure 3 shows trends in obesity and overweight in Tunisia and in Morocco. Prevalence of obesity has been rising in both countries since 1980. Rates of obesity have increased in women in Tunisia from 8.7% to 22.7% and Morocco from 5% to 18%. In contrast, among men, obesity rates have remained low. Overweight is on the rise for both sexes in both countries.

Obesity among children. Figure 4 examines the prevalence of obesity in children in Tunisia and Morocco. Obesity measured by WHZ > 2 SD appears early, at 5 mo of age: 6.3% in Tunisia and 14.9% in Morocco. The highest prevalence is seen among 6- to 11-mo-olds in both countries. After 24 mo of age, obesity decreases significantly in both countries but more so among Tunisian children.

Obesity in adolescence. The risk of overweight (BMI/age ≥ 85th percentile) among Tunisian adolescent boys and girls is shown in Figure 5. The risk of overweight among adolescent girls increases with age. In contrast to girls, the risk of obesity in boys decreases with age; the risk of obesity at 19 y of age is 9.5% in girls compared to 5.1% in boys ($P < 0.05$).

Dietary patterns. Table 3 shows daily energy and macronutrient (fat, protein and carbohydrate) intakes in Moroccan and Tunisian women by BMI class. Moroccan women consume significantly more calories than their Tunisian counterparts ($P < 0.05$). In both countries obese women take in significantly more energy, protein, carbohydrate and fat than do normal-weight women ($P < 0.05$). Dietary patterns for obese women are similar to those of normal-weight women in terms of percentage of energy from carbohydrate, protein and fats. However, Tunisian women eat more fat (30% vs. 22%); Moroccan women eat more carbohydrate (65 vs. 57%).

DISCUSSION

The findings reported here allow us to study, for the first time, the dynamics and patterns of obesity in Morocco and Tunisia. Within the limits of the research and data available, we have tried to provide an explanation of obesity patterns and trends in NA countries as they fit into the continuum of data from other countries in the region and beyond. The three countries of NA have many similarities in dietary habits, lifestyle, religion and culture. Where they differ, however, is in

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TABLE 2

Percentage of obese (BMI ≥ 30) women from Morocco and Tunisia by area of residence and educational level

Country (year)	Area of residence ¹		Education ¹		
	Urban	Rural	None/primary	Second	High
Morocco (1996) ²	14.6 ^a (n = 753)	10.3 ^b (n = 380)	15.0 ^a (n = 884)	7.5 ^b (n = 201)	2.1 ^c (n = 48)
Tunisia (1997) ³	28.3 ^b (n = 1151)	12.3 ^a (n = 683)	21.5 ^a (n = 1438)	18.7 ^b (n = 312)	1.4 ^c (n = 66)

¹ Prevalence values that have the same letters are not different significantly, that is, a, b; a, c; b, c: $P < 0.05$.

² Source: Regional Survey on Nutritional Status of Gharb Women, Morocco 1996.

³ Source: National Survey Report on Nutritional Status of the Tunisian Population, 1997.

their stage of economic development, which has some implications for lifestyle, diet and related health conditions. At least half of the population in all three countries live in urban areas, a sign that they are experiencing transitions from their earlier rural roots. Illiteracy is still high in NA, and particularly worrisome among women in Morocco, where almost 70% are illiterate. These indicators are even more shocking, considering that the countries rank among middle-income countries (UNDP 1999). Like many countries in their income group, NA countries are undergoing a demographic transition (Popkin 1993).

Sociodemographic factors and the development of obesity

Demographic trends show that population is on the rise in NA. In Morocco it has practically doubled from 15 million in 1970 to almost 30 million in 1999, even though fertility rates have dropped significantly. The urban population has swelled to almost 55%, which most certainly affects lifestyles. Urbanization generally is associated with increased chronic diseases such as obesity (Popkin 1994). However, Morocco and the other NA countries are still very preoccupied with the problems of undernutrition. For example, of children under 5 y of age in Morocco 24% are stunted (DHS 1992) and in Tunisia,

18% (DHS 1988). Ministries of Health are not yet prepared to direct their limited resources to develop strategies to prevent obesity. The general public in NA does not recognize obesity as a risk factor for life-threatening conditions like cardiovascular disease, hypertension and diabetes. Yet obesity levels are high in NA, about threefold higher among women than among men. Female obesity has worsened over time in Morocco and Tunisia. Comparisons with other Arab countries with higher GDP (i.e., Gulf countries) and Latin American nations with similar GDPs (e.g., Peru, Colombia and Guatemala) (DHS 1997, Martorell et al. 1998) to those in NA countries, indicate that there is not a simple relationship between obesity and national economic level. The more significant dichotomy is between urban and rural women in Morocco and Tunisia. The effects of urbanization are more pronounced in Tunisia, which has a higher prevalence of obesity among women, than in Morocco, which is less urbanized. In Tunisia the rural areas are more connected to services and infrastructure than are rural areas in Morocco. Low education level is another factor that exacerbates the problem of obesity in both countries. Women without much education do not recognize the risks and health consequences associated with overweight and obesity. It is more worrisome that these women (and their male partners) consider fatness and obesity to be desirable, because these traits are associated with higher social status, fertility and prosperity. With 70% of women illiterate or not educated past primary school in Morocco, the risk of obesity is on the rise. There appears to be an age effect

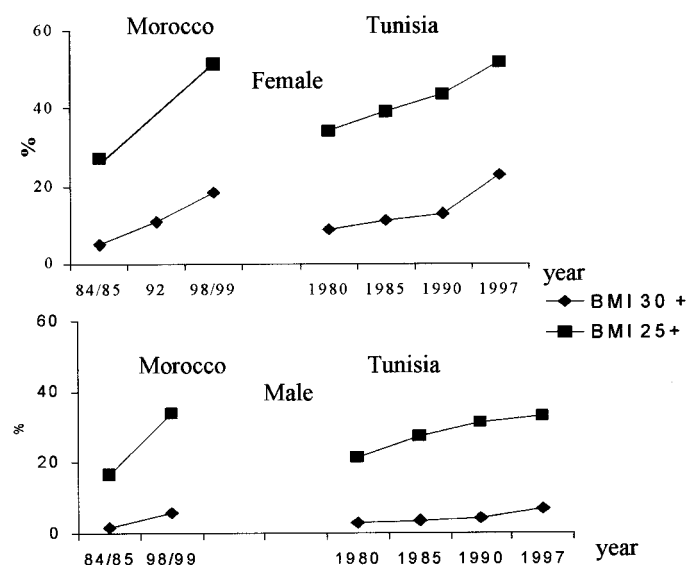


FIGURE 3 Trends in obesity and overweight prevalence among women in Morocco and Tunisia. (Source: Household Income, Consumption and Expenditure Surveys in Morocco and Tunisia since 1980.)

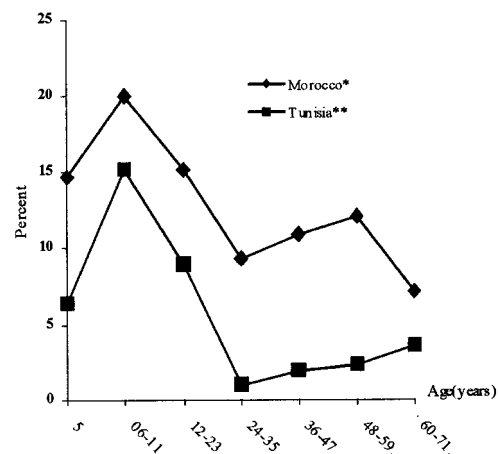


FIGURE 4 Obesity (WHZ > 2 sd) prevalence in children under 5 y of age in Morocco and Tunisia. [Sources: Regional Survey on Nutritional Status of Moroccan Children (n = 900), 1996; National Survey Report on Nutritional Status of Tunisian Children (n = 1119), 1997.]

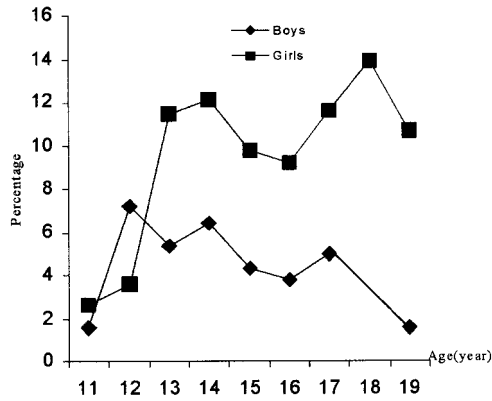


FIGURE 5 Prevalence (%) of risk of overweight (BMI/age \geq 85th percentile) among adolescents in Tunisia. (From National Survey Report on Nutritional Status of the Tunisian Population, 1997.)

in the development of obesity in NA, with obesity taking hold significantly in adulthood. However, adolescent girls around age 13 begin to be at risk of overweight, which, unchecked, could easily develop into obesity any time after early adulthood. Children, on the other hand, seem to be protected from becoming overweight and obese during childhood, but this is largely because this age group still is affected mainly by problems and sequelae of undernutrition.

Dietary factors and obesity

Our results also shed some light on dietary patterns and obesity. In both Morocco and Tunisia, calorie intake of obese and overweight women is higher than recommended levels (2000–2200 kcal) in the United States (USDHHS 1994). In both countries, the percentages of calories coming from protein, fat and carbohydrate seem to be similar to those promoted in the dietary guidelines of many countries including the US Dietary Guidelines (USDHHS 1994). In Tunisia, however, the fat intake is at the upper limit of recommendations (i.e., 30% kcal from fat) (OMS 1990), leading us to wonder whether fat does not explain the high level of obesity in Tunisia, as suggested in other studies (Popkin 1998). The Moroccan diet is high in carbohydrates (65–70% kcal from

carbohydrate). Our current analysis is investigating the types and ratios of fats (i.e., saturated:trans, mono:polyunsaturated fats) and carbohydrates (i.e., simple:complex), to provide a better understanding of dietary patterns. The authors believe that physical activity plays a critical role in obesity development in NA. However, our studies did not include any measure of physical activity. The sociodemographic analysis also corroborates this hypothesis, because urban women are more sedentary than are their rural counterparts.

The level of obesity in NA poses a significant public health problem, particularly among women; it is likely to become worse in the future. Urbanization and demographic trends in these countries continue to change lifestyles and consumption patterns, yet obesity still is viewed as a sign of high social status, fertility and prosperity. There is an urgent need for health institutions to wake up to the existence of obesity in their countries and the significant health implications that will need to be addressed. This is no small challenge in the presence of such entrenched cultural norms of behavior and beauty. Unfortunately, undernutrition is still a major public health priority. In Morocco and Tunisia for example, food fortification and supplementation programs to combat hidden hunger and micronutrient deficiencies are just taking hold. Scarce public health resources may lead policy makers to abandon one priority for the other, but in fact undernutrition and overweight are two symptoms at either end of the same continuum. Indeed, policy makers and public health institutions would be wise to address nutrition in a holistic manner, with a global strategy and public health campaign. Just as people ignore the signs of undernutrition because they do not see them, they do not recognize overweight or even obesity because these traits are prized culturally. Even the clothing style makes it difficult to see a woman's shape. For this reason, we propose the term Hidden Fatness or Hidden Obesity to describe this complex phenomenon in our countries. It is hard for us, as nutrition professionals, to accept that society, families and even women themselves do not see the link between obesity and cardiovascular risk factors. Some of the factors that we know need to be addressed are dietary patterns and intakes, physical activity, lifestyle choices and behavior within the cultural and ethnic context.

TABLE 3

Daily energy and macronutrient intakes among Moroccan and Tunisian women by BMI class

BMI	Energy ¹	Protein ¹	Fat ¹	Carbohydrate ¹
	kcal	g		
Morocco²				
< 18.5	1796 ± 384a	57.1 ± 13.3a	47.7 ± 19.7a	284.9 ± 78.8a
18.5 ≤ BMI < 25	2319 ± 544b	72.5 ± 20.2b	53.4 ± 24.6a	387.2 ± 112.2b
25 ≤ BMI < 30	2396 ± 595b	76.2 ± 21.7c	57.9 ± 28.8b	392.7 ± 117.8cb
BMI ≥ 30	2530 ± 652c	82.3 ± 25.9d	62.0 ± 26.7b	410.9 ± 131.8c
Tunisia³				
< 18.5	2124 ± 370b	60.5 ± 12.1cb	71.7 ± 18.2cb	312.6 ± 57.8c
18.5 ≤ BMI < 25	2132 ± 345b	60.0 ± 11.9c	71.3 ± 16.8c	317.7 ± 55.3c
25 ≤ BMI < 30	2205 ± 359a	61.7 ± 11.4b	75.3 ± 17.9b	322.7 ± 57.3b
BMI ≥ 30	2330 ± 367a	67.0 ± 11.6a	79.0 ± 19.3a	337.0 ± 57.5a

¹ Prevalence values that have the same letters are not significantly different, that is, a, b; a, c; b, c: *P* < 0.05.

² Source: Regional Survey on Nutritional Status of Women, Morocco 1996.

³ Source: National Survey Report on Nutritional Status of the Tunisian Population, 1997.

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