*Report*

# Diabetes mellitus in Egypt: risk factors, prevalence and future burden

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## Introduction

During the past 20 years, major sociodemographic changes have occurred in the Eastern Mediterranean Region [*1*]. The total population of the Region has almost doubled. The birth rate has remained high but infant and childhood mortality rates and the crude death rate have decreased. Life expectancy has improved dramatically, urbanization has occurred and per capita income has increased. The transition to urban environments and greater economic affluence have been associated with changes in physical activity and dietary patterns that have promoted the development of noncommunicable diseases.

Because clinical experience suggested that diabetes was an emerging problem in Egypt, the Egyptian Ministry of Health and Population and the United States Agency for International Development conducted a study to gather information about the prevalence of diabetes risk factors, diagnosed diabetes mellitus and previously undiagnosed diabetes in the population 20 years of age and older by age, sex, residence and socioeconomic status (SES) [*2*]. In this report, we summarize the results of that study and project the future burden of diabetes in Egypt by applying age-specific, sex-specific, and rural and urban residence-specific diabetes prevalence rates to population projections for Egypt developed by the United Nations [*3*].

## Patients and methods

The study was conducted between 1992 and 1994. Survey methods have been described in detail elsewhere [*2*]. In brief, the target population for urban sampling was persons ≥ 20 years of age living in the metropolitan Cairo area where systematic household sampling was performed from each of three socioeconomic strata. The target population for rural sampling was persons ≥ 20 years of age living in three rural agricultural villages in Kaliubia, a delta region approximately 50 km north of Cairo. In each village, all households were identified from census tables and all were sampled. In both urban and rural areas, teams visited each selected household, enumerated the members of the household who were

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≥ 20 years of age and randomly selected one individual to participate in the study regardless of whether he or she had diabetes. Following informed consent, the selected person answered a questionnaire, underwent a physical examination and had a random capillary glucose level measurement. A total of 4620 people completed the household examination (76% response rate). All respondents at higher risk for diabetes (random capillary glucose ≥ 5.6 mmol/l) and a random sample of those at lower risk for diabetes (random capillary glucose < 5.6 mmol/l) were invited to undergo a more extensive medical examination at the Diabetes Institute, Cairo. The medical examination included assessment of physical activity, height and weight and measurement of fasting serum glucose and serum glucose two hours after a 75 g oral glucose load. The detailed medical examination was completed for 1450 persons (72% response rate). Diabetes was defined according to World Health Organization (WHO) criteria [*4*].

Sedentary lifestyle was defined on the basis of occupation and activity outside the job including transportation to and from work, sports activities and other leisure-time physical activity. Obesity was defined according to WHO criteria as body mass index (BMI) greater than or equal to 30 kg/m$^2$.

To determine the prevalence of risk factors for diabetes and the prevalence of diabetes, appropriate sample weights were calculated [2]. To estimate the prevalence of diabetes in Egypt, we applied age-, sex- and residence-specific survey rates to the Egyptian population as a whole [*5*]. To estimate future trends in the burden of diabetes, age-specific, sex-specific, and rural and urban residence-specific estimates were applied to population projections developed by the Population Division of the United Nations in its report on world urbanization prospects [*3*].

## Results

Rural residents were least sedentary (52%), lower SES urban residents were more sedentary (73%) and higher SES urban residents were the most sedentary (89%) (Table 1). In general, women were more sedentary than men and older persons were more sedentary than younger persons [*2*].

Obesity was less prevalent in rural areas (16%) than in urban areas (Table 1). Among urban residents, obesity was relatively uncommon in men in lower SES areas (19%) but was common in men in higher SES areas (56%). Obesity was very common in women in both lower SES urban areas (64%) and higher SES urban areas (45%). In general, women were more obese than men and older persons were more obese than younger persons [*2*].

By WHO criteria, 2.4% of rural residents, 8.4% of lower SES urban residents and 10.0% of higher SES urban residents ≥ 20 years of age had diagnosed diabetes (Ta-

**Table 1 Prevalence of sedentary lifestyle and obesity in the population ≥ 20 years of age by residence and socioeconomic status, 1992–1994**

| Residence and socioeconomic status | Prevalence (%) Sedentary | Obese |
|---|---|---|
| Rural | 52 | 16 |
| Urban, lower SES | 73 | 37 |
| Urban, higher SES | 89 | 49 |
| Total[a] | 63 | 27 |

*[a] Weighted total for the Egyptian population ≥ 20 years of age*
*SES = socioeconomic status*

Table 2 **Prevalence of diagnosed diabetes mellitus, previously undiagnosed diabetes and total diabetes in the population ≥ 20 years of age by residence and socioeconomic status, 1992–1994**

| Residence and socioeconomic status | Prevalence (%) | | |
|---|---|---|---|
| | Diagnosed diabetes mellitus | Undiagnosed diabetes mellitus | Total diabetes mellitus |
| Rural | 2.4 | 2.5 | 4.9 |
| Urban, lower SES | 8.4 | 5.1 | 13.5 |
| Urban, higher SES | 10.0 | 10.0 | 20.0 |
| Total[a] | 5.4 | 4.0 | 9.3 |

*[a] Weighted total for the Egyptian population ≥ 20 years of age*
*SES = socioeconomic status*

ble 2). The prevalence of previously undiagnosed diabetes increased progressively from 2.5% in rural residents to 10.0% in higher SES urban residents (Table 2). Thus, the combined prevalence of diagnosed and undiagnosed diabetes among persons ≥ 20 years of age ranged from 4.9% in rural areas to 20.0% in higher SES urban areas (Table 2). Considering the population distribution of Egypt, we estimated in 1993 that 5.4% had diagnosed diabetes and 4.0% had previously undiagnosed diabetes, and the combined prevalence of diagnosed and undiagnosed diabetes in the Egyptian population ≥ 20 years of age was 9.3% (Table 2).

When these age-, sex- and residence-specific diabetes prevalence rates are applied to the projected demographics of the Egyptian population for the years 1995, 2000 and 2025, we estimate that the total number of persons with diagnosed and undiagnosed diabetes in Egypt will increase from 3.24 million in 1995 to 3.80 million in 2000 and to 8.80 million by the year 2025 (Table 3). Between 1995 and 2025, the number of people with diabetes ≥ 65 years of age will increase 3.6 times, from approximately 515 000 to 1.87 million. The number of urban residents with diabetes will increase 3.2 times from approximately 2.28 million to 7.21 million. By the year 2025, 13.3% of the population ≥ 20 years of age will have diabetes. The elderly will represent 21% of the total population with diabetes and urban residents will represent 82%.

## Discussion

Diabetes mellitus is a major emerging clinical and public health problem in Egypt. Recent surveys from Oman [6] and Pakistan [7] suggest that this may be a regional phenomenon. Alwan and King have invoked the "thrifty genotype" hypothesis to explain this observation [8]. Populations that lived in formerly harsh environmental conditions, such as are found in much of the Middle East, have developed an efficient metabolism in order better to survive. This former advantage proves detrimental once a modern lifestyle, characterized by inactivity and a high-energy diet, is adopted. Our data are consistent with this hypothesis and appear to illustrate this phenomenon in cross-section. Rural popu-

Table 3 **Projected counts and prevalence of diabetes in Egypt (population ≥ 20 years), 1995 to 2025**

| Year | Sex | Age (years) | Number of cases of diabetes | | | Total population | Diabetes prevalence (%) |
|---|---|---|---|---|---|---|---|
| | | | Urban | Rural | Total | | |
| 1995 | Male | 20–44 | 557 732 | 145 202 | 702 934 | 11 592 000 | 6.1 |
| | | 45–64 | 378 061 | 210 471 | 588 532 | 3 738 000 | 15.7 |
| | | 65+ | 86 130 | 50 578 | 136 708 | 1 202 000 | 11.4 |
| | Female | 20–44 | 348 628 | 231 084 | 579 712 | 10 817 000 | 5.4 |
| | | 45–64 | 602 904 | 250 663 | 853 587 | 3 860 000 | 22.1 |
| | | 65+ | 304 279 | 73 832 | 378 111 | 1 446 000 | 26.1 |
| *Total* | | | *2 277 734* | *961 830* | *3 239 564* | *32 655 000* | *9.9* |
| 2000 | Male | 20–44 | 648 653 | 152 121 | 800 774 | 12 845 000 | 6.2 |
| | | 45–64 | 471 931 | 247 043 | 718 974 | 4 639 000 | 15.5 |
| | | 65+ | 103 765 | 55 848 | 159 613 | 1 403 000 | 11.4 |
| | Female | 20–44 | 394 847 | 252 667 | 647 514 | 12 002 000 | 5.4 |
| | | 45–64 | 737 147 | 287 760 | 1 024 907 | 4 686 000 | 21.9 |
| | | 65+ | 363 687 | 85 768 | 449 455 | 1 680 000 | 26.8 |
| *Total* | | | *2 720 030* | *1 081 207* | *3 801 237* | *37 255 000* | *10.2* |
| 2025 | Male | 20–44 | 1 361 271 | 184 926 | 1 546 197 | 19 938 000 | 7.8 |
| | | 45–64 | 1 331 913 | 388 474 | 1 720 387 | 9 776 000 | 17.6 |
| | | 65+ | 382 450 | 106 845 | 489 295 | 3 681 000 | 13.3 |
| | Female | 20–44 | 843 414 | 316 573 | 1 159 987 | 19 233 000 | 6.0 |
| | | 45–64 | 2 070 309 | 438 577 | 2 508 886 | 9 388 000 | 26.7 |
| | | 65+ | 1 221 145 | 156 214 | 1 377 359 | 4 109 000 | 33.5 |
| *Total* | | | *7 210 502* | *1 591 609* | *8 802 111* | *66 125 000* | *13.3* |

lations with more traditional lifestyles exhibit lower rates of diabetes risk factors and diabetes, whereas urban populations, and particularly those of a higher socioeconomic status, have higher rates of both risk factors and diabetes.

Left unchecked, further sociodemographic transformation of this population will be associated with a growing epidemic of diabetes mellitus. We estimate that by the year 2025, nearly 9 million Egyptians (over 13% of the population ≥ 20 years of age) will have diabetes. If anything, our projections are conservative in that we have only considered future changes in the age distribution and urbanization of the Egyptian population. To the extent that diabetes risk factor profiles worsen and socioeconomic status improves within age- and residence-specific levels, we have underestimated the future burden of diabetes.

Comprehensive strategies to address the problem of diabetes in the Eastern Mediterranean are urgently needed. The WHO Regional Office for the Eastern Mediterranean has recognized this problem and developed a plan for prevention and control [8]. Implementation of this plan deserves particular emphasis and support.

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