

Burden of cancer attributable to insufficient physical activity in Tunisia

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Abstract

Background: Insufficient physical activity is a risk factor for several types of cancer. Therefore, estimating the burden of cancer attributable to insufficient physical activity is essential to evaluate the effect of health promotion and prevention interventions.

Aims: We estimated the number of incident cancer cases, deaths and disability-adjusted life years (DALYs) attributable to insufficient physical activity in the Tunisian population aged 35 years and older in 2019.

Methods: We estimated the age-specific population attributable fractions by sex and cancer site to estimate the proportion of cases, deaths and DALYs that could be avoided with optimal levels of physical activity. We used data on cancer incidence, mortality and DALYs from the Global Burden of Disease study estimates for Tunisia in 2019, and data on physical activity prevalence from a Tunisian population-based survey in 2016. We used site-specific relative risk estimates from meta-analyses and comprehensive reports.

Results: The prevalence of insufficient physical activity was 95.6%. In 2019, 16 890 incident cancer cases, 9368 cancer-related deaths and 230 900 cancer-related DALYs were estimated to have occurred in Tunisia. We estimated that 7.9% of incident cancer cases, 9.8% of cancer-related deaths and 9.9% of cancer-related DALYs were attributable to insufficient physical activity. At cancer sites known to be associated with inadequate physical activity, 14.6% of cancer cases, 15.7% of deaths and 15.6% of DALYs were attributable to insufficient physical activity.

Conclusion: Insufficient physical activity contributed to almost 10% of the cancer burden in Tunisia in 2019. Reaching optimal physical activity levels would considerably reduce the burden of associated cancers in the long-term.

Keywords: cancer, exercise, physical activity, health promotion, DALY, Tunisia

Citation: Mallekh R; Khiari H; Hammami O; Hsairi M. Burden of cancer attributable to insufficient physical activity in Tunisia. *East Mediterr Health J.* 2023;29(2):110–118. <https://doi.org/10.26719/emhj.23.009>

Received: 16/12/20; accepted: 19/10/22

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Introduction

About 30–50% of cancer cases are attributable to modifiable risk factors and are thus preventable (1). This figure varies by country, mostly according to the prevalence of exposure to different risk factors (2,3). According to a recent study, half of male cancer cases and a quarter of female cancer cases in Tunisia in 2012 were considered preventable (4).

Insufficient physical activity is a risk factor for several noncommunicable diseases including cancer. Strong evidence exists that an adequate level of physical activity is associated with a lower risk of colorectal, postmenopausal breast and endometrial cancer (5).

In 2018, breast cancer was the leading cancer type among Tunisian women in terms of incidence and the second most common cause of cancer-related deaths (6). The breast cancer burden in Tunisia is projected to rise substantially by 2030 in the absence of control interventions (7). Colorectal cancers had the fourth highest incidence (6) and an increasing trend was predicted mainly because of the epidemiological transition and the prevailing risk factors, namely physical inactivity, unhealthy diets, overweight and obesity (8).

The World Health Organization (WHO) estimates that 6% of annual global deaths are attributable to insufficient physical activity, making it the fourth leading risk factor for death after hypertension, tobacco smoking and high blood sugar (9). WHO recommends a minimum of 150 minutes of moderate physical activity a week or an equivalent regular activity (9). According to the Tunisian Health Examination survey, 57.7% of the Tunisian population aged 15 years and older did not do enough physical activity and only 8.7% engaged in moderate or vigorous intensity leisure-time physical activity (10). Estimating the burden of cancer attributable to insufficient physical activity is essential to evaluate the need for health promotion and primary prevention interventions to reduce this burden. Of the cancer cases in women attributable to preventable risk factors in the WHO Eastern Mediterranean Region in 2012, two thirds were attributable to insufficient physical activity and infections (4). This study used data from various sources to estimate the prevalence of exposures but did not provide age-specific and site-specific population attributable fractions (PAF) by country (4). Attributable deaths and years of life lost were also not considered (4).

The aim of our study was to estimate: (i) the number and proportion of incident cancer cases and cancer-related deaths attributable to insufficient physical activity among Tunisian population aged 35 years and older in 2019 and (ii) the attributable fraction of burden in terms of disability-adjusted life years (DALYs).

Methods

Data sources

To estimate the burden of cancers attributable to insufficient physical activity, the following data elements were required: age-specific cancer incidence, mortality rates and DALYs by sex; prevalence estimates for different levels of physical activity by age and sex; and relative risk (RR) estimates for insufficient physical activity by cancer site. Because of the lack of recent nationwide data from the cancer surveillance system and exhaustive national causes of death statistics in Tunisia, we used age-specific incidence data, mortality data and DALYs by sex and cancer site for Tunisia in 2019 obtained from the Global Burden of Disease study estimates for Tunisia in 2019 (11). These estimations were based on data from north and central Tunisia cancer registries. These registries record all confirmed new primary invasive cancer cases diagnosed among residents of north and central Tunisia, excluding non-melanoma skin cancers. Cancer diagnosis is based on clinical, biological, radiological and histopathological examinations.

We defined insufficient physical activity as low or moderate levels of recreational physical activity performed during a week. Prevalence estimates of the different levels of physical activity among the Tunisian population by age and sex were derived from the Tunisian Health Examination Survey carried out in 2016 (10). In this study, recreational physical activity levels were classified as vigorous or moderate using a standardized questionnaire administered by an interviewer.

Vigorous or moderate intensity activities were defined as performing recreational physical exercises that cause a large or small increase in heart and respiratory rates respectively for at least 10 minutes continuously. The participants self-reported achieving those levels of physical activity, the number of days they performed vigorous or moderate intensity sports in a typical week and the duration of the activity in hours or minutes in a typical day.

Levels of recreational physical activity were based on the overall duration of leisure physical activity in a typical week and its intensity. Energy expenditure estimation was predicated on the assumption that 60 minutes of moderate intensity physical activity equated 6 metabolic equivalents hours (METs-h), one MET being the resting energy expenditure (4.184 J/kg) (12). We accounted for the higher level of energy expenditure in vigorous intensity activities by multiplying by a weighting factor ($\times 2$) compared with the moderate intensity level (12). We classified levels of recreational physical activity

based on the weekly energy expenditure as: high (≥ 15 METs-h a week); moderate (7.5–14 METs-h a week); or low (< 7.5 METs-h a week) (13,14). Therefore, high-intensity recreational physical activity corresponded to at least 30 minutes a day of moderate intensity activities or 15 minutes a day of vigorous intensity activities, 5 days a week or any equivalent activity in terms of energy expenditure.

The RR for cancer sites with strong or probable evidence of causal association with insufficient physical activity were estimated from meta-analyses and comprehensive reports of the World Cancer Research Fund. The RR for postmenopausal breast cancer, endometrial cancer and colon cancer were obtained from the World Cancer Research Fund continuous update project (15). The RR for rectal, lung, bladder, renal, gastric and oesophageal cancers were extracted from recent meta-analyses (16–20) (Table 1).

Data analysis

We calculated age-specific PAFs by sex to account for the proportion of cases that would be avoided with an optimal level of recreational physical activity using the following equation (13).

$$PAF = \frac{\sum_x P_x (RR_x - 1)}{1 + \sum_x P_x (RR_x - 1)}$$

where P_x is the prevalence of the category of exposure x and RR_x is risk of cancer for the exposure level x relative to the reference category of exposure.

Age-weighted PAFs were calculated as the sum of the numbers of attributable cases, deaths or DALYs in each associated cancer site related to the total number of cases, deaths or DALYs respectively (in all cancer sites or in associated cancer sites).

We used SPSS version 24 for the estimation of weekly energy expenditure and the prevalence of insufficient physical activity. PAFs were calculated using Microsoft Excel 2019.

Ethical considerations

Ethical approval was not required for this study because data from the Global Burden of Disease study and the Tunisian Health Examination Survey were anonymized.

Results

Leisure-time physical activity

The prevalence of insufficient physical activity – defined as low or moderate levels of recreational physical activity – among Tunisian adults aged 35 years and older in 2016 was 95.6%. The prevalence of high-level recreational physical activity was significantly lower among women (2.6%) than men (6.1%; $P < 0.001$). The prevalence of high-level recreational physical activity in both sexes decreased significantly with age, from 5.2% in the age group 35–44 years to 2.6% in individuals aged ≥ 65 years ($P < 0.001$; Table 2).

Table 1 Relative risk of cancers for low and moderate levels of physical activity by sex

| Intensity level of physical activity | Relative risk (95% confidence interval) (13) | | | | | | | | | |
|--------------------------------------|--|------------------|------------------|------------------|-------------------|------------------|------------------|------------------|------------------|--|
| | Post-menopausal breast (15)a | Lung (17)a | Colon (15)a | Rectum (16)a | Endometrium (15)a | Stomach (20)a | Kidney (19)a | Bladder (18)a | Oesophagus (20)a | |
| Men | | | | | | | | | | |
| Low | NA | 1.22 (1.11–1.35) | 1.15 (1.06–1.25) | 1.14 (1.04–1.23) | NA | 1.22 (1.06–1.39) | 1.14 (1.00–1.30) | 1.24 (1.01–1.52) | 1.27 (0.98–1.66) | |
| Moderate | NA | 1.11 (1.05–1.16) | 1.07 (1.03–1.11) | 1.07 (1.02–1.11) | NA | 1.11 (1.03–1.18) | 1.07 (1.00–1.14) | 1.11 (1.00–1.23) | 1.11 (1.07–1.66) | |
| High | NA | 1 | 1 | 1 | NA | 1 | 1 | 1 | 1 | |
| Women | | | | | | | | | | |
| Low | 1.15 (1.06–1.23) | 1.22 (1.01–1.45) | 1.15 (1.06–1.25) | 1.14 (1.04–1.23) | 1.25 (1.08–1.45) | 1.22 (1.06–1.39) | 1.14 (1.00–1.30) | 1.24 (1.01–1.52) | 1.27 (0.98–1.66) | |
| Moderate | 1.07 (1.03–1.11) | 1.11 (1.00–1.20) | 1.07 (1.03–1.11) | 1.07 (1.02–1.11) | 1.11 (1.04–1.20) | 1.11 (1.03–1.18) | 1.07 (1.00–1.14) | 1.11 (1.00–1.23) | 1.11 (1.07–1.66) | |
| High | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |

NA = not applicable.
 a Source of data.

Inadequate physical activity and cancer

Incident cases

In Tunisia in 2019, of the 16 890 estimated incident cancer cases among adults aged ≥ 35 years, 1334 cases were attributable to inadequate physical activity, accounting for a PAF of 7.9% (8.9% in men and 6.7% in women). This proportion was 19.7% for endometrial cancer, 12.2% for colorectal cancer and 10.5% for post-menopausal breast cancer. The PAFs for lung, gastric, kidney, bladder and oesophageal cancers ranged from 11.5% to 20.3% (Table 3). For cancer sites that are known to be associated with inadequate physical activity, 14.6% of incident cancer cases were attributable to insufficient physical activity: 16.2% in men and 12.6% in women (data not shown in tables).

Deaths

Among an estimated 9368 cancer-related deaths, 922 (9.8%) were attributable to insufficient physical activity (10.6% in men and 8.5% in women). Inadequate physical activity contributed to 431 deaths related to lung cancer, 141 deaths related to colorectal cancer and 101 deaths related to post-menopausal breast cancer with PAFs of 17.2%, 12.3% and 12.9% respectively (Table 4). Regarding associated cancer sites, the PAF was 15.7% of deaths: 16.5% in men and 14.3% in women (data not shown in tables).

DALYs

Of 230 900 DALYs related to cancer in 2019, 22 855 were attributable to insufficient physical activity, giving a PAF of 9.9% (10.9% in men and 7.1% in women). For all associated cancer sites together, 15.6% of DALYs were attributable to insufficient physical activity (14.2% in women and 16.4% in men). Cancer sites with the highest PAF for DALYs due to low or moderate levels of recreational physical activity were oesophageal cancer (20.1%) and endometrial cancer (19.7%) followed by bladder, lung and colorectal cancers (Table 5). The highest attributable burden in terms of DALYs was for lung cancer, 10426 DALYs (Table 5).

PAFs for incident cases, deaths and DALYs attributable to insufficient physical activity increased with increasing age.

Discussion

Our study showed that about 7.9% of incident cancer cases, 9.8% of cancer deaths and 9.9% of DALYs from cancer among Tunisian adults aged 35 years and older in 2019 could be attributed to insufficient physical activity. These proportions were 14.6%, 15.7% and 15.6% for cancer sites known to be associated with insufficient physical activity for new cases, deaths and DALYs, respectively.

Prevalence of insufficient physical activity

Despite limitations because of our method of assessing physical activity (self-reported), our results are similar to results from a repeated Canadian cross-sectional population survey conducted between 2007 and 2017, that used accelerometer-measured physical activity data, showing that 83.6% of adults aged 18–79 years did not meet the recommended levels of physical activity (21). The prevalence of insufficient recreational physical activity among Canadian adults in 2003 was 74.2% according to an interview-based population survey (13). These discrepancies

between self-reported and measured physical activity may be because respondents tend to overestimate their actual energy expenditure (22). Similarly, we could have underestimated the prevalence of insufficient physical activity, resulting in an underestimation of the burden of attributable cancer.

However, despite different methods, our estimations are considerably higher than average estimations worldwide. In fact, the global age-standardized prevalence of insufficient physical activity was estimated at 27.5% in 2016 and varied by country and world region (23). The crude prevalence of insufficient physical activity was consistently higher among women across different age groups and increased with age as was also observed in the 2016 Tunisian Health Examination Survey (10,23). In line with the increase in the prevalence of insufficient physical activity with increasing age, PAFs slightly increased across age groups in both sexes. Economic development was associated with lower levels of adequate physical activity as a result of urbanization, industrialization and greater use of motorized vehicles. These findings warrant the promotion of recreational physical activity to counter the lack of transportation and occupational activities, especially in urban communities (23).

Association of cancer with insufficient physical activity

We assumed a causal association of 8 cancer sites with insufficient physical activity based on the latest meta-analyses and biological plausibility through various pathways. Indeed, the preventive effect of physical activity on cancer risk may be explained by different mechanisms, including: reduction in levels of circulating hormones and growth factors which promote cell proliferation and carcinogenesis; improved insulin sensitivity which promotes lean body mass and thus reduces the metabolic effects of excess adiposity; decreased levels of pro-inflammatory cytokines,

which stimulate cellular immunity; enhanced DNA repair processes; and shorter exposure time of the gastrointestinal mucosa and lungs to foodborne and airborne carcinogenic agents by accelerating digestive transit and increasing pulmonary ventilation (24–26).

Our findings are similar to PAF estimates in Alberta, Canada in 2012 where 7.2% of all new cancer cases and 13.8% of site-specific cancer cases were attributable to insufficient physical activity (27). These figures were lower in Canada in 2015 as 4.9% of all cancer cases and 10.6% of site-specific associated cancer cases were attributable to insufficient recreational physical activity (13). Studies on cancer risk attributable to insufficient physical activity in France in 2015 reported a PAF of 0.8% for all cancer cases and 4.1% for site-specific associated cancer cases (28). Studies in the United Kingdom of Great Britain and Northern Ireland and Australia in 2010 reported PAFs of 1.0% and 1.6% respectively out of all cancers and PAFs of 4.0% and 6.6% of site-specific associated cancers attributable to insufficient physical activity (12,14). In the United States, the PAF was 2.9% of new cancer cases in 2014 (29).

These lower PAFs may be explained by the lower prevalence of suboptimal levels of physical activity depending on sex and country (12–14,28). Most studies took account of the total energy expenditure including all types of physical activity, while we considered only recreational physical activity. The RRs were expressed as a function of the deficit in MET-hours per week (12,13,28), which gave more precise PAF estimations. We included, based on recent meta-analyses, additional cancer sites compared with the studies in France, United Kingdom and Australia (12,14,28).

Although two of the cancer sites associated with insufficient physical activity were specific to females and the prevalence of insufficient physical activity was slightly higher among women, PAFs for men were higher than for women. This finding may reflect the high burden of lung cancer among men as this cancer contributed to

Table 2 Prevalence of level of recreational physical activity by age and sex, Tunisia, 2016

| Sex | Age (years) | Level of physical activity, % | | |
|-------------------|-------------|-------------------------------|----------|------|
| | | High | Moderate | Low |
| Men | 35–44 | 7.7 | 2.1 | 90.2 |
| | 45–64 | 6.4 | 1.3 | 92.3 |
| | ≥ 65 | 4.0 | 0.7 | 95.3 |
| | Total | 6.1 | 1.4 | 92.5 |
| Women | 35–44 | 3.3 | 1.2 | 95.5 |
| | 45–64 | 2.9 | 0.7 | 96.4 |
| | ≥ 65 | 0.9 | 1.3 | 97.8 |
| | Total | 2.6 | 1.0 | 96.4 |
| Both sexes | 35–44 | 5.2 | 1.6 | 93.2 |
| | 45–64 | 4.7 | 1.0 | 94.3 |
| | ≥ 65 | 2.6 | 0.9 | 96.5 |
| | Total | 4.3 | 1.2 | 94.5 |

Table 3 Cancer cases attributable to inadequate physical activity by age, sex and cancer site, Tunisia, 2019

| Age, in years | Cancer site | | | | | | | | | | | | | | | | | | | | | | |
|---------------|------------------------|------|------|-----|--------------|------|-------------|------|---------|----|--------|-----|---------|-----|------------|------|-----|-----|------|------|----|------|-----|
| | Post-menopausal breast | | Lung | | Colon/rectum | | Endometrium | | Stomach | | Kidney | | Bladder | | Oesophagus | | | | | | | | |
| | AC | PAF | OC | AC | PAF | OC | AC | PAF | OC | AC | PAF | OC | AC | PAF | OC | AC | PAF | OC | | | | | |
| Men | | | | | | | | | | | | | | | | | | | | | | | |
| 35-44 | NA | NA | NA | 10 | 16.7 | 59 | 5 | 11.6 | 46 | NA | NA | 3 | NE | 18 | 1 | NE | 13 | 6 | 17.6 | 32 | 1 | NE | 3 |
| 45-64 | NA | NA | NA | 165 | 17.0 | 968 | 47 | 11.9 | 400 | NA | NA | 25 | 17.0 | 148 | 9 | 11.3 | 80 | 69 | 18.0 | 381 | 7 | 19.9 | 36 |
| ≥ 65 | NA | NA | NA | 200 | 17.3 | 1157 | 64 | 12.1 | 528 | NA | NA | 45 | 17.4 | 259 | 10 | 11.5 | 91 | 138 | 18.3 | 751 | 10 | 20.3 | 51 |
| Total | NA | NA | NA | 375 | 17.2 | 2184 | 116 | 12.0 | 974 | NA | NA | 73 | 17.2 | 425 | 21 | 11.4 | 184 | 213 | 18.2 | 1164 | 18 | 20.1 | 90 |
| Women | | | | | | | | | | | | | | | | | | | | | | | |
| 35-44 | NA | NA | NA | 2 | NE | 14 | 6 | 11.9 | 50 | 4 | NE | 3 | NE | 19 | 3 | NE | 23 | 0 | NE | 1 | 0 | NE | 1 |
| 45-64 | 142 | 9.3 | 1532 | 17 | 16.6 | 101 | 36 | 12.3 | 289 | 31 | 19.6 | 14 | 17.6 | 80 | 8 | 11.7 | 65 | 2 | NE | 12 | 2 | NE | 10 |
| ≥ 65 | 99 | 12.9 | 764 | 25 | 16.9 | 147 | 57 | 12.6 | 451 | 22 | 19.9 | 113 | 17.9 | 146 | 6 | 11.9 | 48 | 10 | 18.9 | 53 | 4 | NE | 18 |
| Total | 241 | 10.5 | 2296 | 44 | 16.8 | 262 | 99 | 12.4 | 790 | 57 | 19.7 | 292 | 17.8 | 245 | 17 | 11.8 | 136 | 12 | 18.9 | 66 | 6 | 20.8 | 29 |
| Both | | | | | | | | | | | | | | | | | | | | | | | |
| 35-44 | NA | NA | NA | 12 | 16.6 | 73 | 11 | 11.7 | 96 | 4 | NE | 6 | 17.0 | 37 | 4 | 11.4 | 36 | 6 | 17.6 | 33 | 1 | NE | 4 |
| 45-64 | 142 | 9.3 | 1532 | 181 | 17.0 | 1069 | 83 | 12.1 | 689 | 31 | 19.6 | 39 | 17.2 | 228 | 17 | 11.5 | 146 | 71 | 18.0 | 393 | 9 | 20.0 | 46 |
| ≥ 65 | 99 | 12.9 | 764 | 225 | 17.3 | 1304 | 121 | 12.3 | 979 | 22 | 19.9 | 113 | 17.6 | 405 | 16 | 11.6 | 139 | 148 | 18.4 | 804 | 14 | 20.4 | 69 |
| Total | 241 | 10.5 | 2296 | 419 | 17.1 | 2446 | 215 | 12.2 | 1764 | 57 | 19.7 | 292 | 17.4 | 670 | 37 | 11.5 | 320 | 225 | 18.2 | 1230 | 24 | 20.3 | 119 |

AC= attributable cases, PAF= population attributable fraction; OC= observed cases; NA= not applicable; NE= not estimated because the total (denominator) was less than 25 so no percentages could be calculated. Note: AC and OC are numbers; PAF is a percentage.

more than 20% of the total incident cancer cases among Tunisian men in 2018, with incidence rates being 10 times higher than among women (6), reflecting the higher national prevalence of tobacco smoking among men (10).

In the Eastern Mediterranean region, the estimated PAFs attributable to insufficient physical activity for breast cancer and colon cancer were reported to be 14.1% and 13.8%, respectively, and to be 10.5% and 10.6% in Tunisia (30). Similarly, we estimated that 10.5% of postmenopausal breast cancer cases and 12.2% of colorectal cancer cases were attributable to insufficient physical activity.

PAFs for postmenopausal breast cancer varied considerable by country, from 3.4% to 9.0% (12-14,28,29,31). In Brazil, physical inactivity accounted for 12% of breast cancer deaths as well as years of life lost in 1990 and 2015 (32). As for colon cancer, PAFs ranged from 3.6% to 16.3% (12-14,29). Globally, insufficient physical activity contributed to 10.1% of the breast cancer burden and 10.4% of the colon cancer burden in 2008 (30). We estimated a PAF of 17.1% for lung cancer. A lower PAF was reported in Canada (11.7%) but a higher PAF was found in Europe (21.8%) (13,24).

As for oesophageal and gastric cancers, we estimated PAFs at 20.3% and 17.4%, respectively. PAFs in Canada for these cancers were 14.2% and 11.9%, respectively (13). We had a higher exposure to insufficient physical activity than the Canadian study. Besides, we did not consider the effect of modification of cancer histological subtype on the RR of cancer. In fact, the Canadian study only considered oesophageal adenocarcinoma as an associated cancer site. Our approach was based on evidence of significant reduction in gastro-oesophageal cancer incidence regardless of subtypes as the protective effect of physical activity was based on the same mechanisms (5,20).

We estimated that 921 deaths and 22 855 DALYs would be preventable with optimal levels of recreational physical activity. If such optimal levels were achieved, it is estimated that there would be a median gain of 0.64 year, 0.95 year and 0.69 year in life expectancy in Tunisia, the Eastern Mediterranean region and the world, respectively (30).

Table 4 Cancer deaths attributable to inadequate physical activity by age, sex and cancer site, Tunisia, 2019

| Age, in years | Post-menopausal breast | | | Lung | | | Colon/rectum | | | Endometrium | | | Stomach | | | Kidney | | | Bladder | | | Oesophagus | | |
|---------------|------------------------|------|-----|------|------|------|--------------|------|------|-------------|------|----|---------|-----|----|--------|-----|----|---------|-----|----|------------|-----|----|
| | AD | PAF | OD | AD | PAF | OD | AD | PAF | OD | AD | PAF | OD | AD | PAF | OD | AD | PAF | OD | AD | PAF | OD | AD | PAF | OD |
| Men | | | | | | | | | | | | | | | | | | | | | | | | |
| 35-44 | NA | NA | NA | 9 | 16.7 | 55 | 2 | NE | 17 | NA | NA | 2 | NE | 13 | 1 | NE | 3 | 1 | NE | 4 | 1 | NE | 2 | |
| 45-64 | NA | NA | NA | 155 | 17.0 | 909 | 20 | 11.9 | 166 | NA | NA | 20 | 17.0 | 119 | 4 | 11.3 | 36 | 14 | 18.0 | 80 | 6 | 19.9 | 33 | |
| ≥ 65 | NA | NA | NA | 224 | 17.3 | 1293 | 46 | 12.1 | 378 | NA | NA | 45 | 17.4 | 257 | 7 | 11.6 | 64 | 61 | 18.5 | 329 | 11 | 20.3 | 56 | |
| Total | NA | NA | NA | 388 | 17.2 | 2257 | 68 | 12.0 | 561 | NA | NA | 67 | 17.3 | 389 | 12 | 11.4 | 103 | 76 | 18.4 | 443 | 18 | 20.1 | 91 | |
| Women | | | | | | | | | | | | | | | | | | | | | | | | |
| 35-44 | NA | NA | NA | 0 | NE | 12 | 3 | 11.9 | 26 | 0 | NE | 2 | NE | 14 | 0 | NE | 2 | 0 | NE | 1 | 0 | NE | 1 | |
| 45-64 | 50 | 12.9 | 386 | 15 | 16.6 | 88 | 22 | 12.3 | 175 | 5 | NE | 24 | 17.6 | 64 | 2 | NE | 13 | 2 | NE | 12 | 2 | NE | 8 | |
| ≥ 65 | 51 | 12.9 | 395 | 26 | 16.9 | 155 | 48 | 12.6 | 378 | 9 | 19.9 | 45 | 17.9 | 148 | 3 | 11.9 | 25 | 10 | 18.9 | 53 | 4 | NE | 19 | |
| Total | 101 | 12.9 | 781 | 43 | 16.8 | 255 | 73 | 12.5 | 579 | 14 | 19.8 | 71 | 17.8 | 226 | 5 | 11.9 | 40 | 12 | 18.9 | 66 | 6 | 20.8 | 28 | |
| Both | | | | | | | | | | | | | | | | | | | | | | | | |
| 35-44 | NA | NA | NA | 11 | 16.6 | 67 | 5 | 11.7 | 43 | 0 | NE | 2 | 17.0 | 27 | 1 | NE | 5 | 1 | NE | 5 | 1 | NE | 3 | |
| 45-64 | 50 | 12.9 | 386 | 169 | 17.0 | 997 | 42 | 12.1 | 341 | 5 | NE | 24 | 17.2 | 183 | 6 | 11.4 | 49 | 17 | 18.1 | 92 | 8 | 20.0 | 41 | |
| ≥ 65 | 51 | 12.9 | 395 | 250 | 17.3 | 1448 | 94 | 12.4 | 756 | 9 | 19.9 | 45 | 17.6 | 405 | 10 | 11.7 | 89 | 71 | 18.5 | 382 | 15 | 20.5 | 75 | |
| Total | 101 | 12.9 | 781 | 431 | 17.2 | 2512 | 141 | 12.3 | 1140 | 14 | 19.8 | 71 | 17.5 | 615 | 17 | 11.6 | 143 | 88 | 18.4 | 479 | 24 | 20.3 | 119 | |

AD= attributable deaths; PAF= population attributable fraction; OD= observed deaths; NA= not applicable; NE= not estimated because the total (denominator) was less than 25 so no percentages could be calculated. Note: AD and OD are numbers; PAF is a percentage.

Table 5 DALYs attributable to inadequate physical activity by age, sex and cancer site, Tunisia, 2019

| Age, in years | Post-menopausal breast | | | Lung | | | Colon/rectum | | | Endometrium | | | Stomach | | | Kidney | | | Bladder | | | Oesophagus | | |
|---------------|------------------------|------|--------|--------|------|--------|--------------|------|--------|-------------|------|------|---------|--------|-----|--------|------|------|---------|------|-----|------------|------|----|
| | AD | PAF | OD | AD | PAF | OD | AD | PAF | OD | AD | PAF | OD | AD | PAF | OD | AD | PAF | OD | AD | PAF | OD | AD | PAF | OD |
| Men | | | | | | | | | | | | | | | | | | | | | | | | |
| 35-44 | NA | NA | NA | 444 | 16.7 | 2 663 | 98 | 11.6 | 851 | NA | NA | 103 | 16.7 | 618 | 18 | 11.1 | 160 | 36 | 17.6 | 206 | 24 | 19.5 | 120 | |
| 45-64 | NA | NA | NA | 5 022 | 17.0 | 29 546 | 656 | 11.9 | 5 536 | NA | NA | 662 | 17.0 | 3 895 | 135 | 11.3 | 1200 | 491 | 18.0 | 2728 | 210 | 19.9 | 1059 | |
| ≥ 65 | NA | NA | NA | 3 946 | 17.3 | 22 871 | 745 | 12.0 | 6 183 | NA | NA | 722 | 17.3 | 4 165 | 128 | 11.5 | 1112 | 984 | 18.3 | 5369 | 64 | 19.8 | 324 | |
| Total | NA | NA | NA | 9 412 | 17.1 | 55 080 | 1499 | 11.9 | 12 570 | NA | NA | 1487 | 17.1 | 8 678 | 281 | 11.4 | 2472 | 1511 | 18.2 | 8303 | 298 | 19.8 | 1503 | |
| Women | | | | | | | | | | | | | | | | | | | | | | | | |
| 35-44 | NA | NA | NA | 93 | 16.3 | 566 | 152 | 11.9 | 1 280 | 23 | 19.2 | 120 | 17.3 | 684 | 11 | 11.5 | 94 | 10 | 18.3 | 55 | 8 | 20.2 | 38 | |
| 45-64 | 1690 | 12.8 | 13 237 | 482 | 16.6 | 2 894 | 727 | 12.3 | 5 886 | 166 | 19.6 | 847 | 17.6 | 2 119 | 52 | 11.7 | 442 | 75 | 18.6 | 405 | 55 | 20.6 | 269 | |
| ≥ 65 | 902 | 12.9 | 6 988 | 439 | 16.9 | 2 601 | 736 | 12.5 | 5 865 | 161 | 19.9 | 811 | 17.9 | 2 294 | 51 | 11.9 | 424 | 152 | 18.9 | 806 | 63 | 20.9 | 300 | |
| Total | 2592 | 12.8 | 20 225 | 1 014 | 16.7 | 6 061 | 1 615 | 12.4 | 13 032 | 350 | 19.7 | 1778 | 17.7 | 5 097 | 114 | 11.8 | 960 | 237 | 18.8 | 1266 | 126 | 20.7 | 607 | |
| Both | | | | | | | | | | | | | | | | | | | | | | | | |
| 35-44 | NA | NA | NA | 537 | 16.6 | 3 229 | 250 | 11.7 | 2 132 | 23 | 19.2 | 120 | 17.0 | 1 302 | 29 | 11.2 | 254 | 46 | 17.7 | 261 | 32 | 19.7 | 158 | |
| 45-64 | 1690 | 12.8 | 13 237 | 5 504 | 17.0 | 32 440 | 1 383 | 12.1 | 11 422 | 166 | 19.6 | 847 | 17.2 | 6 014 | 187 | 11.4 | 1642 | 566 | 18.1 | 3133 | 265 | 20.0 | 1328 | |
| ≥ 65 | 902 | 12.9 | 6 988 | 4 385 | 17.2 | 25 472 | 1 481 | 12.3 | 12 049 | 161 | 19.9 | 811 | 17.5 | 6 459 | 179 | 11.6 | 1536 | 1136 | 18.4 | 6175 | 127 | 20.3 | 624 | |
| Total | 2592 | 12.8 | 20 225 | 10 426 | 17.1 | 61 141 | 3 114 | 12.2 | 25 602 | 350 | 19.7 | 1778 | 17.4 | 13 775 | 395 | 11.5 | 3432 | 1748 | 18.3 | 9569 | 424 | 20.1 | 2110 | |

DALYs= disability-adjusted life years; AD= attributable DALYs; PAF= population attributable fraction; OD= observed DALYs; NA= not applicable. Note: AD and OD are numbers; PAF is a percentage.

Strengths and limitations of the study

To our knowledge, our study is the first to consider incidence, mortality and years of life lost to estimate the burden of cancer attributable to insufficient physical activity in Tunisia. Our findings clearly show the significant impact insufficient physical activity has on cancer risk, which are higher than previous estimates in 2012 that found that only 0.3% of new cancer cases among men and 2.5% among women in Tunisia were attributable to insufficient physical activity (4).

The main limitation of our study is that we assessed only leisure-time physical activity. This may overestimate the prevalence of insufficient physical activity, especially in rural settings where occupational and transportation physical activity is common (23). However, recreational physical activity may be more suitable for the estimation of PAFs. In fact, a meta-analysis of cohort studies demonstrated independent, strong or moderate inverse associations between recreational physical activity and the risk of cancer for 10 cancer sites (16).

The assessment of physical activity was self-reported, which may have caused recall and selection bias. Self-reporting could have resulted in an underestimation of the prevalence of insufficient physical activity as people tend to overestimate their physical activity level and respondents in health surveys may be more active than non-respondents. These limitations call for the standardization of the measure of physical activity in population surveys.

We used prevalence data from the Tunisian Health Examination Survey conducted in 2016 because of the lack of earlier prevalence data. Therefore, our estimation could not consider the 10-year latency period from exposure to diagnosis of cancer assumed in other studies

(12,14,28), based on evidence that insufficient physical activity is a promotor rather than an initiator of cancer (28). However, this lag time could be assumed, as the prevalence of exposure in 2016 could be used as a proxy for prevalence data in 2009. This assumption is possible because trends of insufficient physical activity were relatively steady worldwide from 2001 to 2016, especially in the Middle East and North Africa (23).

Conclusion

Our study showed that insufficient physical activity is an important modifiable risk factor of cancer contributing to about 10% of the cancer burden in Tunisia in 2019. Reaching optimal physical activity levels would considerably reduce the burden of all cancer sites associated with this risk factor in Tunisia in the long run.

Tunisia integrated the promotion of physical activity as a key factor in the National Strategy for Prevention and Control of Obesity (33). However, actions need to be strengthened to overcome several barriers such as the lack of safe environments to engage in physical activity in terms of personal security and road safety, and the lack of affordable and appropriate programmes (34). Thus, safe settings suitable for engaging in regular physical activity and equitably accessible to the population regardless of age, sex and abilities need to be created (34). Our findings can be used as an advocacy tool for decision-makers to support more efficient and population-wide implementation of these coordinated interventions to reduce the burden of cancer attributable to insufficient physical activity.

Funding: None.

Competing interests: None declared.

Charge du cancer attribuable à une activité physique insuffisante en Tunisie

Résumé

Contexte : Le manque d'activité physique est un facteur de risque pour plusieurs types de cancer. Par conséquent, l'estimation de la charge du cancer attribuable à une activité physique insuffisante est essentielle pour évaluer l'effet des interventions de promotion de la santé et de prévention.

Objectifs : Nous avons estimé le nombre de cas incidents de cancer, de décès et d'années de vie ajustées sur l'incapacité (DALY) imputables à une activité physique insuffisante dans la population tunisienne âgée de 35 ans et plus en 2019.

Méthodes : Nous avons évalué les fractions attribuables dans la population (FAP) selon l'âge, par sexe et site de cancer pour estimer la proportion de cas, de décès et de DALY qui pourraient être évités grâce à des niveaux optimaux d'activité physique. Nous avons utilisé des données sur l'incidence du cancer, la mortalité et les DALY provenant des estimations de l'étude sur la charge mondiale de morbidité pour la Tunisie en 2019, et des données sur la prévalence de l'activité physique issues d'une enquête en population tunisienne réalisée en 2016. Nous avons eu recours à des estimations du risque relatif spécifique aux sites provenant de méta-analyses et de rapports complets.

Résultats : La prévalence du manque d'activité physique était de 95,6 %. En 2019, les estimations indiquaient que 16 890 cas incidents de cancer, 9368 décès liés au cancer et 230 900 DALY dues au cancer sont survenus en Tunisie. Selon nos estimations, 7,9 % des cas incidents de cancer, 9,8 % des décès et 9,9 % des DALY liés au cancer étaient attribuables à une activité physique insuffisante. En ce qui concerne les sites de cancer connus pour être associés à une activité physique inadéquate, 14,6 % des cas de cancer, 15,7 % des décès et 15,6 % des DALY étaient attribuables à une activité physique insuffisante.

Conclusion : Le manque d'activité physique a contribué à près de 10 % de la charge du cancer en Tunisie en 2019. Atteindre des niveaux d'activité physique optimaux permettrait de réduire considérablement la charge des cancers associés à long terme.

عبء السرطان الناجم عن عدم كفاية النشاط البدني في تونس

ريم ملاح، هيام خياري، ألفة حمادي، محمد حصابيري

الخلاصة

الخلفية: يُعد عدم كفاية النشاط البدني عامل خطر يرتبط بأنواع عديدة من السرطان. ومن ثم، فإن تقدير عبء السرطان الناجم عن عدم كفاية النشاط البدني أمرٌ ضروري لتقييم أثر التدخّلات الرامية إلى تعزيز الصحة والوقاية.

الأهداف: هدفت هذه الدراسة إلى تقدير عدد حالات الإصابة بالسرطان والوفيات وسنوات العمر المُصحّحة باحتساب مُدد الإعاقة الناجمة عن عدم كفاية النشاط البدني لدى مجموعة من السكان في تونس تبلغ من العمر 35 عامًا فأكثر في 2019.

طرق البحث: قدّرنا النسب المعزّوة إلى عدم كفاية النشاط البدني ضمن مجموعة سكانية محددة العمر، وقسمنا النسب حسب نوع الجنس وموضع الإصابة بالسرطان، لتقدير نسب الإصابة بالسرطان والوفيات وسنوات العمر المُصحّحة باحتساب مُدد الإعاقة التي يمكن تجنّبها في حالة التمتع بمستويات مثلى من النشاط البدني. واستخدمنا بيانات عن معدلات الإصابة بالسرطان والوفيات وسنوات العمر المُصحّحة باحتساب مُدد الإعاقة مستقاة من تقديرات دراسة العبء العالمي للأمراض الخاصة بتونس لعام 2019، وبيانات عن معدل انتشار النشاط البدني من مسح سكاني أجري في تونس في عام 2016. واستخدمنا تقديرات للمخاطر النسبية الخاصة بمواضع إصابة محددة مستقاة من تحليلات تلوية وتقارير شاملة.

النتائج: بلغ معدل انتشار عدم كفاية النشاط البدني 95.6٪. وفي عام 2019، تشير التقديرات في تونس إلى حدوث 16890 حالة إصابة بالسرطان، و9368 حالة وفاة مرتبطة بالسرطان، و230900 حالة صُححت سنوات عمرها باحتساب مدد الإعاقة المرتبطة بالسرطان. وقدّرنا أن ما نسبته 7.9٪ من حالات الإصابة بالسرطان، و9.8٪ من الوفيات الناجمة عن السرطان، و9.9٪ من سنوات العمر المصححة باحتساب مدد الإعاقة المرتبطة بالسرطان يُعزى إلى عدم كفاية النشاط البدني. وفي مواضع الإصابة بالسرطان المعروفة بارتباطها بعدم كفاية النشاط البدني، كان ما نسبته 14.6٪ من حالات الإصابة بالسرطان، و15.7٪ من الوفيات، و15.6٪ من الحالات التي صُححت سنوات عمرها باحتساب مُدد الإعاقة يُعزى إلى عدم كفاية النشاط البدني.

الاستنتاجات: عدم كفاية النشاط البدني تسبّب في 10٪ تقريبًا من عبء السرطان في تونس في عام 2019. ومن شأن الوصول إلى مستويات النشاط البدني المثلى أن يقلل إلى حد كبير من عبء السرطانات المرتبطة بعدم كفاية النشاط البدني على المدى الطويل.

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