OCCUPATIONAL PHYSICAL ACTIVITY AND COLON CANCER RISK IN TURKEY


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A case-control study of 107 colon cancer cases and 486 controls from an oncological clinic in Istanbul was conducted to examine the association between occupational physical activity and colon cancer in Turkey, where incidence of this disease is low. Only two of the four activity measures showed evidence of an increased colon cancer risk for sedentary jobs (time spent sitting OR = 1.5 and occupational energy expenditure OR = 1.6); neither was statistically significant. Subjects below age 55 showed higher risk associated with sedentary jobs than did the older age group, probably due to their adoption of a more western lifestyle, including dietary habits, less activity, and other factors that may interact to increase the risk of colon cancer.

INTRODUCTION

Colon cancer incidence varies considerably around the world (5, 41). High rates occur in North America and New Zealand, intermediate rates in Europe, and low rates in Asia, Africa and Latin America. The subsite distribution throughout the colon is generally similar in these areas (7). Rates decrease from ascending colon towards the descending colon with a sharp increase at the sigmoid colon, although there may be a deficit of sigmoid cancers in low-risk areas. Dietary factors are generally thought to be the major determinant of colon cancer (28), although precise dietary constituents and mechanisms remain to be clarified. In recent years, however, several studies have investigated the association between colon cancer and physical activity. The majority of these studies, all but one in developed countries, have shown an increased risk among physically inactive men (2-4, 11, 12, 14, 15, 21-25, 28, 29, 32, 36-38, 40).

We conducted a case-control study of colon cancer in the Marmara region of Turkey to investigate the influence of occupational physical activity in a developing country. No statistics are available on colon cancer specifically in Turkey, but with a mortality rate of 3.22/100,000 among men and 3.15/100,000 among women, cancer of the intestines is the sixth and fifth most common tumors, respectively (10). Turkish mortality rates for intestinal cancer are about 1/5 of the U.S. rates, 1/4 of the European rates, and are similar to Costa Rica and Venezuela (5).

MATERIALS AND METHODS

Study population

The Turkish Social Security Agency (SSA) provides medical care for all workers (including...
retirees) in Turkey. Within this organization is the Oncological Clinic in Istanbul, the largest cancer therapy center (treating all except hematopoietic cancers) for employees in the Marmara Region. Marmara is the most industrialized area in Turkey and includes Istanbul. Due to its reputation, this clinic also provides services to some employees from other regions in Turkey. To evaluate occupational risk factors for cancer we identified 7,242 cancer cases at the SSA between 1979-84. For each case, we obtained a complete work history from the patient at the admission time, diagnosis with histological verification, and information on alcohol and tobacco use.

In this report we describe a case-control study of colon cancer aimed at investigating the influence of occupational physical activity. Cases included 94 males and 13 females. The controls were 486 cancer cases other than colon, rectum, and lung cancer randomly chosen from the 7,242 patients attending the Oncological Clinic during the same period. After removing subjects with no information on occupation or smoking, 87 male and 13 female cases and 371 controls remained.

**Physical activity indices**

Assessment of occupational physical activity was based on job title and industry names. Measures of activity scales included sitting time, energy expenditure, and two occupational activity scales. The sitting time scale and the total energy expenditure scale were developed by two of the authors, an occupational physician (R.V.), and an industrial hygienist (M.D.) with experience in Turkish work environments. The sitting posture scale was to develop a measure of motionless posture especially for the abdomen. Low activity level was defined as more than 80% of working hours (more than 6 hours a day) spent sitting. Moderate activity was 20-80% of time (2-6 hours a day) spent sitting, and high activity was sitting less than 20% of the time (less than 2 hours a day). These categories parallel those previously used in occupational physical activity studies (4, 12, 14, 25).

The energy expenditure measure was based on a rating system developed by Hettinger et al. (17). Low activity included work with an energy expenditure less than 8 KJ/min corresponding to activities such as sitting with only hands working, moderate one arm work or light two arm work (e.g. office work, light sorting work or driving a car). Moderate activity was defined as work energy expenditure of 8-12 KJ/min, corresponding to activities such as walking on a flat surface with a speed of 3 km/h, heavy one arm work or moderate two arm work (e.g. picking or sweeping). High activity was an average work expenditure of more than 12 KJ/min, corresponding to activities like walking on a flat surface with a speed of more than 4 Kmph, heavy two arm work, or light to heavy body work (e.g. wall painting, wall paper hanging, tile setting up to gravel shoveling or jack hammer operating).

Midpoint of sitting time (sedentary = 7 hr; moderate = 4 hr; or highly active = 1 hr) and energy expenditure (sedentary = 4 KJ/min; moderate = 10 KJ/min; or highly active = 14 KJ/min) scales was used as weight for each job activity to be multiplied with the duration of employment at that particular job held by the subject for the calculation of cumulative occupational physical activity scores for the subject. Cumulative activity scores were then divided by total duration of employment to obtain average level of physical activity over lifetime employment.

We also applied the occupational activity scheme developed by Garabrant et al. (5): highly active (when physical activity was required more than 80% of the time), moderately active (20-80% of the time), and sedentary (less than 20% of the time). Finally, we used the physical activity indices as rated by the Department of Labor (DOL) in their Estimates of Worker Trait Requirements (35). The DOL observed workers performing their jobs and classified them in five degrees of physical activity considering the physical requirements of lifting, pushing, and pulling taking into account intensity and duration. To make this index comparable to the other scales we collapsed the two highest and two lowest activity measures. In addition to the occupational activity indices, a socio-economic status index was assigned for every case and control based on job titles.

**Statistical analysis**

The odds ratio (OR) was the measure of association between physical activity indices and colon cancer. ORs were adjusted for age and smoking. Smoking was inversely associated with colon cancer in our data. Gart's method (13) was used to calculate maximum likelihood estimates of the odds ratio and corresponding 95% confidence intervals. The highest level of physical activity served as the referent group. We evaluated the linearity of trends in risk corresponding to the level of activity using Mantel's one tailed test (20). ORs were also computed for colon subsites and histologic types (e.g., adenocarcinoma and the subtype of mucinous adenocarcinomas) when more than 8 cases were available.

**RESULTS**

Table 1 presents the number of subjects by age, sex, colon subsite, and histologic type. Age distribution ranged from 14 to 97 years, with a median age of 50 years. ORs adjusted for age and smoking are shown for males in Table 2. ORs were not related to activity indices developed by Garabrant et al. (12) or DOL (35), but the ORs associated with low activity level were 1.5 for sitting timer and 1.6 for energy expenditure. For females (not shown), the risk was increased for sedentary jobs in the DOL index (OR = 1.8) and sitting time index (OR = 1.5). None of these ORs in either sex were statistically significant, nor were the trends.