RESEARCH ARTICLE

Physical Activity and Cancer Prevention: Awareness and Meeting the Recommendations among Adult Saudis

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Abstract

Background: There is a scarcity of information about the proportion of the adult Saudi population that meet the recommended guidelines of physical activity (PA) to reduce cancer risk. Moreover, their awareness about the role of PA in cancer prevention is unclear. Objectives: This cross-sectional study aimed at estimating the proportion of adult Saudis meeting the PA guidelines, specifically those recommended by American Cancer Society (ACS) for cancer prevention, and to assess the public awareness about the role of PA in cancer prevention. Materials and Methods: Using a multistage sampling method, 2,127 adult Saudis of both genders were recruited from 6 urban and 4 rural primary health care centers in Al Hassa, Saudi Arabia. Participants were personally interviewed to gather information about their sociodemographic characteristics, searching activity about PA and cancer, and the time spent in leisure time PA (moderate and vigorous)/week using the Global Physical Activity Questionnaire with show cards. Finally, items about the role of PA in cancer risk reduction were inquired. Results: Of the included participants, 11.6% met the recommendations for cancer prevention (≥45 minutes of moderate-vigorous PA activity/≥5 days/week or 225 minutes/week). Multivariate regression showed that being male (AOR=1.49, CI=1.09-2.06), <20 years of age (AOR=3.11, CI=2.03-4.76), and unemployed (AOR=2.22, CI=1.57-3.18) were significant predictors for meeting PA recommendations for cancer prevention. Only 11.4% of the sample indicated correctly the frequency and duration of PA required for an average adult to be physically active and while >70% of them indicated the role of PA in prevention of hypertension, coronary heart disease and lowering elevated blood cholesterol, only 18.6% and 21.7% correctly mentioned the role of PA in reducing colon and breast cancer risk, respectively. Poor knowledge was found among those with less than college education and aged ≥50 years. The level of knowledge was significantly positively correlated with total leisure time PA of the participants. Conclusions: A minority of adult Saudis in Al Hassa was aware about the role of PA in cancer prevention and engaged in sufficient LTPA for cancer risk reduction benefits, highlighting the need for public health actions to include policies and programs that address factors deterring their participation in LTPA and increasing their awareness with remedies to manage the prevalent misconceptions.

Keywords: Physical activity - cancer prevention - recommendations guidelines - adults - knowledge - Saudi Arabia

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Introduction

Cancer prevention by modifying environmental and lifestyle risk factors remains the most viable long-term strategy for substantially reducing the burden of cancer worldwide (Colditz et al., 2005). Physical activity (PA) and its role as a modifiable risk factor in cancer has been recently attracted the attention with accumulation of evidence that PA is a key modifiable lifestyle risk factor that may reduce the risk of several cancers. The risk of colon, breast and endometrial cancers is reduced by 25% to 30% in physically active individuals, and evidence for a beneficial effect of PA in reducing prostate, ovarian, lung and other gastrointestinal cancers is emerging. (Wolin et al., 2009; Cust 2011; Leitzmann 2011). The evidence for a role of PA in cancer etiology is now considered to be fairly strong, consistent and biologically plausible. The evidence of causal link between PA and cancer risk is found to be strong for colon cancer-convincing; weaker for postmenopausal breast and endometrium cancersl-

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probable; and limited suggestive for premenopausal breast, lung, prostate, ovary, gastric and pancreatic cancers (Kurk and Czerniak, 2013). PA may reduce the cancer risk with an average of 20-30%, and the protective effects of PA on cancer risk are hypothesized to be through multiple interrelated pathways: decrease in adiposity, decrease in sexual and metabolic hormones, changes in biomarkers and insulin resistance, improvement of immune function, and reduction of inflammation (Kurk and Czerniak, 2013). Such evidences have driven the evolution of PA recommendations by different organizations in the developed world entailed the amount and duration of PA that reduce cancer risk (Byers et al., 2003). Although the specific dose of PA necessary for cancer prevention is not yet clear (Friedenreich et al., 2010), research to date suggests that the greatest gains in cancer risk reduction are made when PA exceeds the minimum 150 minutes per week recommended for general health benefits. In 2006, the American Cancer Society (ACS) recommended at least 225 minutes per week of moderate and preferably vigorous PA for colon and breast cancer risk reduction (Kushi et al., 2006). The World Cancer Research Fund with the American Institute for Cancer Research (WCRF/AICR) has recommended that adults participate in at least 60 minutes of moderate daily PA or 420 minutes per week, for cancer risk reduction (World Cancer Research Fund and the American Institute for Cancer Research, 2007). The purpose of these guidelines is to encourage inactive populations to engage in PA and to provide a target to set personal PA goals and measure progress (Sharratt and Hearst, 2007). While occupational, household and transportation activities can contribute to overall health; leisure activity is the most modifiable type of activity and has been the main target of public health promotion of PA (Sharratt and Hearst, 2007). LTPA is also more likely to be intentional and at moderate and vigorous intensity than the majority of daily household and occupational activities (Kushi et al., 2006). LTPA is a logical target for population health interventions aimed at cancer prevention (Friedenreich et al., 2010; Gao et al., 2013; Sangrajrang et al., 2013). Awareness about the protective role that PA exerts against cancer is important, greater knowledge may promote more individuals to engage in regular PA. Studies (Jalleh et al., 2005; Graham et al., 2006) have shown that informing people about the link between PA and colon cancer increases the motivation to be more physically active and may also increase the actual engagement in physical activities. In Saudi Arabia the total number of cancer incident cases reported to the Saudi Cancer Registry between January 1st and December 31th, 2007 was 11,437. Overall cancer was slightly more in females (52.1%) than in males (47.9%). The common cancer for men is colorectal cancer (CRC) and among females is breast cancer. The third highest incident rate for the geographic regions was in the Eastern Province 104.4cases per 100,000 (Al-Eid et al., 2007). This rise is attributed to increase in predisposing factors including physical inactivity (Al-Otaibi, 2013). Furthermore, published reports on PA profile of Saudi adults indicated that the majority are not physically active enough to achieve health benefits. (Amin et al., 2011; 2012; Al-Otaibi, 2013). No previous studies from the Middle East have explored the proportion of a population that met the recommended PA level for cancer prevention or assessed the population awareness about the role of PA in cancer prevention. This study aimed at estimating the proportion of adult Saudis meeting the PA guidelines specifically those recommended by ACS for cancer prevention, and to assess the public awareness about the role of PA in cancer prevention.

Materials and Methods

Settings and design

This cross-sectional descriptive study was carried out in Al-Hassa Governorate located in the eastern province of KSA, with a total population of around one and half million. Al-Hassa is composed of three regions; urban, populated by about 60% of the total population, rural consisting of 23 villages (35% of the population) and "Hegar" Bedouin scattered communities making up the remaining 5%. The Ministry of Health provides primary care through 58 PHCs in Al Hassa.

Sample size and selection

Assuming leisure time PA level among adult Saudis in Al Hassa (total population of about 1,300,000) of 25% (Amin et al., 2011), with a precision of±3%, employing a 95% confidence, 80% power, and deign effect of 3, the total sample size would be 1350 adults. Adding a 30% increment to compensate for potential non-response, the final total sample size estimated to be 1800. An updated list of all PHCs was used for sample selection. Ten PHCs were randomly selected (6 urban and 4 rural, those in "Hegar" areas were excluded for logistical reasons). In the second stage, considering a female to male ratio of attendees of 1.5:1 (Taha and Bella 1998), an appropriate sampling fraction was used to estimate the required sample according to gender and urban-rural distribution. All adult Saudis of both genders aged ≥18 years attended the selected PHCs during the period from March 1st to May 30th 2013 were invited to participate through personal approach after receiving proper orientation. Of 2791 (1513 women and 1278 men) PHCs attendees approached, 1271 women and 1008 men agreed to participate. Those who refused to participate were not significantly different from the rest of the sample regarding their socio-demographic characteristics.

Inclusion criteria

Both genders, aged ≥18 years, Saudi Nationals, with no apparent physical-neurological disabilities or any handicapping conditions.

Exclusion criteria

Those with physiological "e.g. pregnancy" or pathological conditions "e.g. wounds" deterring them from their routine LTPA during the week preceding their interview.

Data collection instruments

Participants were invited to a personal interview to gather information on the followings: *i)* Socio-

demographics and cancer-related information searching: Age in years, current residence, years of education, occupational status, previous history of cancer among his close relatives (if any), ever diagnosed with cancer, last year search for information about cancer and the sources (if any), and last year search for the role of PA in cancer prevention and its sources (if any). *ii)* Assessment of Intentional Leisure Time Physical Activity 'ILTPA': The Global Physical Activity Questionnaire (GPAQ) version 2.0 was used for data collection and accompanied with a modified show card derived from World Health Organization STEP wise approach to Chronic Disease Risk Factor Surveillance instrument (WHO STEPs) http://www.who.int/chp/steps/GPAQ/en/index.htm) which provides examples of types and intensity of PA, modifications were carried out to suit the local Saudi community (Amin et al., 2011; 2012). We employed the GPAQ to assess the frequency (days) and time (minutes/hours) spent in doing moderate-and-vigorous-intensity PA during a typical week in the leisure-related. GPAQ is derived from International Physical Activity Questionnaire (IPAQ) (www.ipaq. ki. se). GPAQ is validated and widely employed to assess PA pattern. Previous studies have shown that GPAQ has good test-retest repeatability and relative validity (Bull et al., 2009; Trinh et al., 2009). Translation of the original content of GPAQ into Arabic, followed by back translation into English to ensure reliability was carried out with no changes to the original contents and wording of the questionnaire. LTPA covered the following activities: walking (light and intense), running, biking (light and intense), swimming (light and intense), tennis, football, basketball, handball, martial arts, aerobics-gym, weightlifting, workout with apparatus, and others. From each PHC two nurses; one male and one female were recruited for data collection; they received training on: a) Conducting an interview. b) How to use the show card. c) Checking for quality of the collected data under supervision of investigators. *iii)* Knowledge about the role of PA in cancer prevention: Several items were adopted from the available literature (Keighley et al., 2004; Coups et al., 2008; Bennet et al., 2009; Tylor et al., 2013), the primary form contained seventeen items inquiring about: the duration, frequency of LTPA for an average adult to become physically active (two items were in multiple options format), correct responses of these two times were summed for each participant as a correct answer), this was followed by inquires about role of PA in chronic diseases prevention namely elevated blood pressure, coronary heart disease and lowering of blood cholesterol (three items in true-false-I do not know format). Two questions were included to inquire about the role of PA in preventing cancers namely colon and breast in multiple options format Further inquires then followed about the role of home chores in cancer prevention, the beneficial role of PA in cancer prevention through being lifelong-long term, intensity required for cancer prevention, and its value in cancer cases (five items in true-false-do not know format). The duration, frequency and intensity of PA recommended for cancer prevention were added (three items with multiple options format). Finally two open ended questions were added to probe the participants' knowledge about the prevention of common cancer namely colon and breast for which mentioning of PA was considered to be a correct knowledge.

Pilot study

Pilot testing was carried out through interviewing a sample of 87 subjects attending a nearby primary care center, aimed at training the data collectors, and assess to validity and reliability of data collection instrument. (Inter-rater reliability coefficient=0.86). Data collection and processing followed the GPAQ version 2.0 analysis protocol. For the knowledge: Items of the used data collection tool were translated to Arabic by a panel of qualified professional followed by back translation into English by another independent expert. The tool was piloted to clarify terms and assess any potential difficulty in administration. During the pilot phase, the 17 items form, yielded an internal consistency reliability coefficient (Cronbach' alpha) of 0.476, deletion of items that compromise reliability namely those about the recommended duration, frequency and intensity of PA to prevent cancer (three items) and the open ended questions as there were rarely mentioned during the pilot testing (two items). The final form was composed of 12 items (nine were cancer relevant) displayed a reliability coefficient (Chronbach's alpha of 0.689).

Definitions and analysis procedures

Data collection and processing followed the GPAQ version 2.0 analysis protocol. According to the GPAQ analysis framework, LTPA is classified into the following levels: *i*) Sufficiently active: Participants who met the LTPA recommendations meeting the minimum recommendations of 30 minutes of moderate-vigorous-intensity LTPA or a total of 150 minutes/week of moderate-vigorous intensity/week (International Physical Activity Questionnaire. www. ipaq. ki. se). *i*) Insufficiently active: Those ranged from 1-149 minutes of moderate-vigorous intensity LTPA/week. *i*) Meeting the American Cancer Society (ASC) recommendations for cancer prevention: ≥225 minutes/week or ≥45 minutes of moderate-vigorous LTPA/week (Byers et al., 2003).

Statistical analysis

Data entry and analysis were carried out using SPSS 17.0 (SPSS Inc. Chicago, ILL.) and Epi-Info version 7.0 (Centers for Disease Control and Prevention, Atlanta GA.). Data cleaning and analysis were performed according to GPAQ protocol. Elimination was done in response to:
a) Missing information on one or more items (292 records). b) Over-reporting of total minutes spent in LTPA /day ">1440 minutes/day" (102 records). The total eligible records for final analysis were 2127. For LTPA, Kolmogorov-Smirnov test for normality revealed a statistic of 0.300 (p=0.001) for minutes of LTPA/week which rejects normality. LTPA was expressed using median and interquartile range (IQR), mean was also reported. Non-parametric tests of significance namely Kruskal Wallis (one way) and Mann Whitney were used for comparison of continuous variables. Categorical variables were reported as proportions with 95% confidence intervals

(CI); Chi-square test for trend was used when appropriate. Univariate analysis was generated to determine the correlates of meeting the recommendations for being physically active and active enough to cancer prevention, significant variables at the univariate analysis were used to generate adjusted logistic regression analysis to define the positive predictors for being physically active and meeting the recommended level for cancer prevention. For the knowledge section, for the first two questions correct responses at both were considered as a single correct choice, for the other items correct response was assigned one point while incorrect and do not response received nil. Items relevant to physical activity and its role in cancer prevention were considered for analysis (total of 8 items) with a total score of 8 points. The knowledge score was expressed using median, interquartile range and mean, using Mann Whitney and Kruskal Wallis tests for comparison. p value of <0.05 was considered significant.

Ethical considerations

Permissions were obtained from the Health Authorities and our institution after approval of the proposal and data collection tools. Participants were provided with full explanation of the study with the emphasis on the right of the subject not to participate.

Results

Socio-demographic characteristics: Total participants accounted for 2127; women represented 56.1%, 56.8% were urban residents, the age ranged from 18 to 78, median of 37.0 (mean 36.4±10.4) years. Women in the age category of <20 years were proportionately more than men. Illiteracy was 15.2%, significantly more among men. Of the included women, 27.7% were employed either in governmental jobs or self employed, students and retirees were significantly more among men and 15.0% were unemployed but able to work with no significant difference in relation to genders. (Table 1) Of the included participants 13.1% reported the occurrence of cancer among close family members and 2.5% (n=54) had previously diagnosed with cancers (among women breast in 17, endometrial 2, ovary 1, thyroid 1, 4 colorectal, and 1 skin while among men, colon 14, lung 3, bone1, testicular 1, lymphoma 3, stomach 1, prostate1, brain tumors in 2 cases). Thirty two percent mentioned last year search for cancer information. Thirty nine percent mentioned searching for information about PA and cancer in the last year (Table 1).

Intentional leisure time physical activity (ILTPA): Table 2 displays leisure-related PA in minutes during the last seven days distributed by genders and age groups. Of the included participants, 50.1% and 43.4% of men and women respectively stated leisure-related PA in the last seven days. The median minutes per week for the total leisure-related PA was 72 (interquartile range IQR=190, mean=178.4, standard deviation=±211.6), significantly more among men (median of 110 minutes, 199.3±180.7 compared to median of 51 minutes (IQR=126) and mean of 155.2±191.8 among women, p=0.001). Table 2 also depicts the decline of leisure-related PA in relation to age irrespective of the genders. Moderate intensity PA was in the form of brisk walking, recreational swimming, gymnastics, weight training, table tennis, basketball, and boxing among men, while for women, brisk walking, gymnastics, stationary bicycling, and recreational swimming were the main activities. For vigorous activity, running, competitive games and martial arts were the chief activities among men while among women, aerobics and stationary bicycling were the main activities. The median total minutes spent in moderate intensity PA/week was 78 minutes (IQR=170, mean=186.4±201.6), while for vigorous intensity PA the median minutes/week a median of 41 minutes (IQR=146, mean of 138.3.1±188.5). Those aged ≥50 years did not report any form of vigorous PA. Both moderate and vigorous PA declined in relation to age and with significant difference between men and women in intensity and duration.

Correlates of being physically active and meeting the recommendations for cancer prevention: Of the included participants, 426(20.0%) were categorized as being physically active (≥30 minutes /≥5 days/week of moderate and vigorous intensity), while only 246 (11.6%) met the ACS recommendations for cancer prevention (≥45 minutes of moderate-vigorous PA activity /≥5 days/ week or 225 minutes/week). Table 3 demonstrates the socio-demographic correlates for both being physically active and meeting the cancer prevention levels. For being physically active, men in the age range of 18-<30 years, rural, with college or higher education and those unemployed but able to work/students/retired persons were significantly physically more active. Multivariate logistic regression analysis with adjustment for possible confounding variables showed that only those <20 years (adjusted Odds ratio, AOR=2.71, confidence intervals, CI=1.98-3.73) and being unemployed but able to work (AOR=2.66, CI=1.88-3.76) were the significant predictors for being physically active. For meeting the recommended level of PA for cancer prevention: univariate analysis in table 3 showed that men, being aged <30 years, rural residents, students/retired or unemployed but able to work and with college or higher educational level (OR=1.41, CI=1.07-1.84, p=0.012) were the significant positive predictors for meeting the preventive level of PA. Multivariate regression model with adjustment showed that being male (AOR=1.49, CI=1.09-2.06), <20 years of age (AOR=3.11, CI=2.03-4.76), and unemployed (AOR=2.22, CI=1.57-3.18) were the significant predictors for meeting the recommendation for cancer prevention, the effect of residence and educational status was attenuated in the multivariate model. Neither the participant's last year search for cancer information nor searching for information about PA and cancer had significant association with being physically active (only 14.3% "98/683" and 5.7% "39/683" of those searched for cancer information were physically active and meeting the recommendation for cancer prevention respectively) Those searched for PA and cancer prevention, showed that 148/829 (17.9%) were physically active and only 63/829 (7.6%) the recommendation respectively.

Knowledge about physical activity and cancer prevention: Table 4 displays the correct responses to

Table 1. Socio-Demographic and Information Seeking Behavior of the Included Participants, Al Hassa, Saudi Arabia

Characteristics	Gender No. (%) Women (N=1193)	Men (N=934)	Total (N=2127)	p value*
Age in years: Median (mean±SD)	37.0(36.9±10.3)	38.5(37.6±10.7)	37.0(36.4±10.4)	0.126**
Age groups (years):				
<20	188(15.8)	65(6.9)	253(11.9)	
20-<30	238(19.9)	218(23.3)	456(21.4)	0.001
30-<40	319(26.7)	268(28.7)	587(27.6)	
40-<50	254(21.3)	201(21.5)	455(21.4)	
≥50	194(16.3)	182(19.5)	376(17.7)	
Residence:Urban	679(56.9)	530(56.7)	1209(56.8)	
Rural	514(43.1)	404(43.3)	918(43.2)	0.932
Educational status:				
Illiterate/read and write	153(12.8)	171(18.3)	324(15.2)	
Primary/intermediate	182(15.3)	146(15.6)	328(15.4)	0.009
Secondary	401(33.6)	319(34.2)	720(33.9)	
College or higher	457(38.3)	298(31.9)	755(35.5)	
Occupational status:				
Employed (government/self)	331(27.7)	510(54.6)	841(39.5	0.001
Students and retired	171(14.3)	283(30.3)	454(21.3)	
Unemployed but able to work	178(14.9)	141(15.1)	319(15.0)	
House makers	513(43.0)	--	513(24.1)	
History of cancer among close family	169(14.2)	109(11.6)	278(13.1)	0.09
Ever diagnosed as having cancer	26(2.2)	28(3.0)	54(2.5)	0.233
Last year search for cancer information	381(31.9)	302(32.3)	683(32.1)	0.854
Last year search for informationabout physical				
Sources of information about PA and cancer	463(38.8)	366(39.2)	829(38.9)	0.559
Website	205(44.3)	209(57.1)	414(49.9)	0.001
Television 89(19.2)	54(14.8)	143(17.2)	0.091	
Flayers, posters, at haelth facilties	64(5.4)	29(7.9)	93(11.2)	0.007
Family, friends, and workmates	55(11.9)	27(7.4)	82(9.9)	0.031
Health care providrs	32(6.9)	21(5.7)	53(6.4)	0.497
More than one source	18(3.9)	26(7.1)	44(5.3)	0.04

*Chi square for independence; **t-test; SD=standard deviation

Table 2. Leisure-Related Physical Activity (Mean, Median in Minutes/Week) Reported by the Surveyed Population and Distributed by Gender and Age Groups

Gender and leisure time physical activity	Age groups (years) <20 (n=253)	20-<30 (n=456)	30-<40 (n=587)	40-<50 (n=455)	≥50 (n=376)	p value
Men (N=473): No. (%)	59(86.2)	152(69.7)	133(49.6)	83(41.3)	64(35.2)	0.001*
Total leisure*	273.0[120.0(271)]	210.8[60.0(233)]	171.7[30.0(90.0)]	160.3[0.0(90.0)]	138.4[0.0(30.0)]	0.003**
Leisure-related moderate*	170.1[90.0(135)]	162.2[43.6(120.0)]	127.1[21.0(90.0)]	144.9[0.0(90.0)]	138.4[0.0(30.0)	0.001**
Leisure-related vigorous*	109.8[60.0(180.0)]	90.5[20.8(127.0)]	61.5[10.0(40.0)]	39.0[0.0(0.0)]	---	0.091**
Women (N=518): No. (%)	123(65.5)	122(51.2)	121(37.9)	89(35.0)	63(24.8)	0.001*
Total leisure*	195.8[70.0(140.0)]	156.5[30.0(100.0)]	151.7[30.0(60.0)]	138.2[0.0(60.0)]	121.6[0.0(30.0)]	0.001**
Leisure-related moderate*	153.3[41.0(90.0)]	145.1[18.00(90.0)]	137.8[18.0(39.0)]	138.2[0.0(60.0)	121.6[0.0(22.0)	0.002**
Leisure-related vigorous*	95.1[10.5(30.0)]	55.6[10.0(31.8)]	38.7[0.0(15.0)]	---	---	0.041**
Both (N=991): No. (%)	182(71.9)	274(60.1)	254(43.3)	172(37.8)	127(33.8)	0.001*
Total leisure	260.4[70.0(173.0)]	215.9[40.0(157.0)]	164.8[20.0(60.0)]	149.9[0.0(63.4)]	129.8[0.0(30.0)]	0.001**
Leisure-related moderate*	179.1[152.0(126.0)	150.8[30.0(111.7)]	109.5[15.8(78.0)]	138.4[0.0(60.0)]	129.8[0.0(0.0)]	0.121**
Leisure-related vigorous*	91.3[60.0(85.7)]	69.7[0.0(80.0)]	58.3[0.0(30.0)]	20.8[0.0(0.0)]	---	0.043**

* Chi square for trend; Mean [Median (IQR)]; IQR=interquartile range, ** Kruskal Wallis test

knowledge items about the role of physical activity in chronic diseases prevention with especial reference to cancer distributed by genders. Overall, only 11.4% indicated the right responses for the two questions about the number of days and duration of time of PA for an average adult to be physically active. More than 70% of the sampled population indicated correctly the role of PA in preventing hypertension, coronary heart disease and over 50% responded correctly about its role of PA in lowering elevated blood cholesterol, slightly more among men. Out of the options provided for a question about the type of cancer prevented through of PA, only 18.6% mentioned colon cancer, 21.7% brain cancer, bone cancer by 30.6% and 29.1% did not know. The type of cancer among women that can prevented by PA: Women were significantly more knowledgeable about the type of cancer that could be prevented through PA compared to men, where more than one third of the included women picked the correct response (breast cancer) compared to men (only 11.6%), among women, other options selected were thyroid cancer 18.2, bone cancer 22.7, and 26.9% do not know response. Over 65% of the participants agreed with the false statement that PA in the form home or domestic chores can reduce cancer risk. Only 13.7% gave the correct answer about the role of PA activity in cancer prevention provided it is lifelong and/or for long term, while only one in ten gave the correct response about the false statement that PA should be too strenuous to reduce cancer risk. About 15% mentioned correctly that PA to be protective against cancer it should increase the heart rate and cause

Table 3. Correlates of Being Physically Active and Meeting the Recommended Protective Level Against Cancer in Relation to Socio-Demographics

Variables		Physically active[a]; No. (%)		Odds ratio (95% C.I)	Meeting recommendations for cancer prevention[b]; No. (%)		Odds ratio (95% CI)
		Active (n=426)	Inactive (n=1701)		Yes (n=246)	None (n=1881)	
Gender:	Men	228(53.5)	706(41.5)	1.60(1.3-2.00)**	149(60.6)	785(41.7)	2.14(1.63-2.81)**
	Women	198(46.5)	995(58.5)	Reference	97(39.4)	1096(58.3)	Reference
Age groups (years)							
	<20	107(25.1)	146(8.6)	3.57(2.71-4.70)*	73(29.7)	180(9.6)	3.98(2.91-5.45)**
	20-<30	111(26.1)	345(20.3)	1.38(1.08-1.77)*	68(27.6)	388(20.6)	1.47(1.08-1.98)*
	30-<40	90(21.1)	497(29.2)	0.65(0.51-0.84)*	60(24.4)	527(28.0)	0.82(0.0.61-1.13)
	40-<50	87(20.4)	368(21.6)	0.93(0.72-1.21)	37(15.0)	418(22.2)	0.62(0.43-0.88)*
	≥50	31(7.3)	345(20.3)	Reference	8(3.3)	368(19.6)	Reference
Residence							
	Urban	199(46.7)	1013(59.6)	0.59(0.48-0.73)**	105(42.7)	1107(58.9)	0.52(0.39-0.68)**
	Rural	227(53.3)	688(40.4)	Reference	141(57.3)	774(41.1)	Reference
Educational status:							
	Illiterate/read and write	38(8.9)	286(16.8)	0.48(0.34-0.69)**	16(6.5)	308(16.4)	0.35(0.22-0.56)**
	Primary/intermediate	52(12.2)	276(16.3)	0.72(0.52-0.98)*	30(12.2)	298(15.8)	0.74(0.52-1.06)
	Secondary	148(34.7)	572(33.6)	1.02(0.82-1.28)	95(38.6)	625(33.2)	1.23(0.93-1.62)
	College or higher	188(44.1)	567(33.3)	Reference	105(42.7)	650(34.6)	Reference
Occupational status							
	Employed (government/self)	131(30.8)	710(41.7)	0.62(0.49-0.78)**	78(32.0)	763(40.6)	0.68(0.51-0.90)**
	Students and retired	121(28.4)	333(19.6)	1.63(1.28-2.10)**	76(30.9)	378(20.1)	1.77(1.32-2.38)**
	Unemployed but able to work	121(28.4)	198(11.6)	3.01(2.32-3.89)**	69(28.2)	250(13.3)	2.54(1.87-3.46)**
	House makers	53(12.4)	460(27.1)	Reference	23(9.3)	490(26.0)	Reference

*CI= confidence intervals, * p value <0.05, ** p value <0.001. [a] 30 minutes or more/≥ 5 days/week [b] ≥45 minutes/≥5 days /week or 225 minutes/week of moderate and vigorous intensity activities

Table 4. Knowledge Regarding Role of Physical Activity in Cancer Prevention Distributed in Relation to the Gender of Participants, Al Hassa, Saudi Arabia

Items	Correct responses			
	Men (N=934) No. (%)	Women (N=1193) No. (%)	Total No. (%)	p value*
Days per week an average adult should perform PA (exercise) to stay healthy. (options) (5 or more days/week).	178(19.1)	181(15.2)	359(16.9)	0.017
On these days duration an average adult should be physically active to stay healthy. (options) (30 or more minutes/day).	201(21.5)	192(16.1)	393(18.5)	0.001
LCombined correct answer for 1 and 2	109(11.7)	133(11.1)	242(11.4)	0.706
Regular PA (exercise) can prevent increase in blood pressure (True).	711(76.1)	878(73.6)	1589(74.7)	0.43
Regular PA (exercise) can prevent coronary heart disease (True).	693(74.2)	811(68.0)	1504(70.7)	0.03
Regular PA (exercise) can reduce high blood cholesterol (True).	519(55.6)	684(57.3)	1203(56.6)	0.338
PA (exercise) can reduce the risk for-cancer (options) Colon.	191(20.4)	205(21.0)	396(18.6)	0.054
PA (exercise) can reduce the risk for-cancer among women. (options) Breast.	108(11.6)	384(32.2)	492(23.1)	0.001
For women, routine home chores can reduce breast cancer risk (False)	88 (9.4)	114 (9.6)	202 (9.5)	0.916
PA (exercise) can reduce the risk of cancer if it is lifelong or for long term (True).	139(14.9)	152(12.7)	291(13.7)	0.153
PA (exercise) should be too strenuous to reduce cancer risk (False).	97 (10.4)	114 (9.6)	211 (9.9)	0.525
PA (exercise) that causes sweating, increase in heart rate is more protective against cancer (True)	136(14.6)	147(12.3)	283(13.3)	0.131
PA (exercise) is of no value in patients already affected with cancer (False).	106(11.3)	105(8.8)	211(9.9)	0.051
Knowledge score: Median (interquartile range)Mean±SD	3.0(2-3)	3.0(1-3)	3.0(1-3)	
Mean and SD	2.64±1.33	2.48±1.133	2.53±1.34	0.069**

*PA=Physical activity IQR= interquartile range; SD=Standard deviation; * Chi square test for independence; ** Mann Whitney test; Scores were calculated to cancer relevant items (n=8)

sweating. PA is of no value for patients already affected with cancer, only 11.3% answered correctly, 66.3% gave incorrect response and 22.4 did not know. Our participants successfully identified the role of PA in preventing chronic diseases conditions like hypertension and coronary heart disease but failed to do the same about the role of PA and cancer prevention. The total knowledge score ranged from 0 to 6 (out of eight points), median of 3.0 and IQR (1-3). There was no significant difference in the knowledge score in relation to genders. Table 5 demonstrates the correct responses of the participants distributed by age groups. As for the frequency and duration of PA to be physically active, those aged 20 to <30 years were more likely to pick up the correct options compared to other age groups. Older age groups (40 or more) were more knowledgeable about the protective role of PA and chronic diseases like hypertension, coronary heart disease and elevated blood cholesterol compared to the younger age. Apart from those <20 years of age, there was a downward significant decline in knowledge regarding the role of PA in preventing

Table 5. Knowledge About Role of Physical Activity in Cancer Prevention Distributed In Relation to Age Groups of Participants, Al Hassa, Saudi Arabia

Items	Correct responses No. (%)					
	<20 years (n=253)	20-<30 (n=456)	30-<40 (n=587)	40-<50 (n=455)	≥50 years (n=376)	p value*
Days per week an average adult should perform PA (exercise) to stay healthy. (options) (5 or more days/week).	51 (20.2)	86(18.9)	103(17.5)	68(14.9)	51(13.6)	0.006
On these days duration an average adult should be physically active to stay healthy. (options) (30 or more minutes/day).	66 (26.1)	89(19.5)	99(16.9)	73(16.0)	66(17.6)	0.006
Combined correct answer for 1 and 2.	28 (11.1)	61(13.4)	63(10.7)	49(10.8)	31(8.2)	0.115
Regular PA (exercise) can prevent increase in blood pressure (True).	188 (74.3)	352(77.2)	431(73.4)	339(74.5)	279(74.2)	0.52
Regular PA (exercise) can prevent coronary heart disease (True).	173 (68.4)	339(74.3)	419(71.4)	329(72.3)	244(64.9)	0.104
Regular PA (exercise) can reduce high blood cholesterol (True).	128 (50.6)	265(58.1)	372(63.4)	239(52.5)	199(52.9)	0.032
PA (exercise) can reduce the risk for-cancer (options) Colon.	21 (8.3)	127(27.9)	117(19.9)	78(17.1)	53(14.1)	0.027
PA (exercise) can reduce the risk for-cancer among women (options) Breast.	32 (12.6)	118(25.9)	160(27.3)	109(23.9)	73(19.4)	0.047
For women, routine home chores can reduce breast cancer risk (False)	28 (11.1)	49(10.8)	48 (8.2)	45 (9.9)	32 (8.5)	0.248
PA (exercise) can reduce the risk of cancer if it is lifelong or for long term (True).	31 (16.2)	84(18.4)	73(12.4)	57(12.5)	42(11.2)	0.021
PA (exercise) should be too strenuous to.reduce cancer risk (False).	15 (5.9)	69(15.1)	68(11.6)	37 (8.1)	22 (5.9)	0.03
PA (exercise) that causes sweating, increase in heart rate is more protective against cancer (True).	26 (10.3)	102(22.4)	106(18.1)	38 (8.4)	11 (2.9)	0.011
PA (exercise) is of no value in patients already affected with cancer (False).	23 (9.1)	54 (11.8)	57 (9.7)	37 (8.1)	30 (8.0)	0.118
Knowledge score: Median (Interquartile range).	2.0(2)	3.0(3)	3.0(2)	3.0(1)	2.0(1)	
mean ±SD	2.14±1.43	2.68±1.31	2.51±1.15	2.08±1.18	1.92±1.01	0.022**

*PA=Physical activity, IQR=interquartile range, SD=Standard deviation. * Chi square for trend. ** Kruskal Wallis test; Scores were calculated to cancer relevant items (n=8)

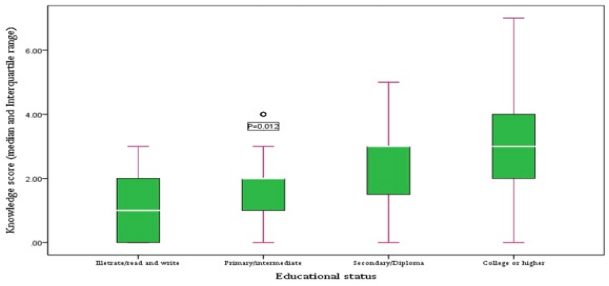

Figure 1. Physical Activity and Its Role in Cancer Prevention, knowledge scores in realtion to the Educational Status of Participnts-Al Hassa, Saudi Arabia

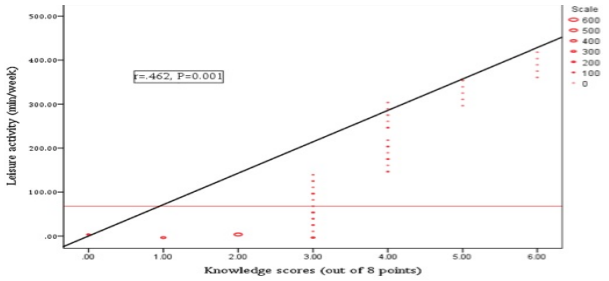

Figure 2. Lelsure Time (minutes/week) and its Relation to Knowledge Scores About Physical Activity and Cancer Prevention, Al Hassa, Saudi Arabia

colon and breast cancers. The highest knowledge score was found among those aged 20-<30 years and followed by those of 30 to <40 years with significant decline in relation to age. Figure 1 displays the knowledge scores distributed by the educational status of the participants. Those in the illiterate/read and write categories scored 1.88±0.95 (median of 1.5, IQR=0-3), lower than those with < primary/preparatory education of 2.19±1.15 (median=2, IQR=1-3), while whose with secondary education scored 2.26±1.16 (median=3, IQR=0-4), while college or higher education scored the highest 2.75±1.44 (median=3, IQR=0-6, Kurskall Wallis p value=0.011). The knowledge score showed no significant differences in relation to residence (2.62±1.37 for urban *vs* 2.69±1.39 for rural, Mann Whitney p=0.201), last year search for cancer information (yes, 2.48±1.38 *vs* no=2.57±1.29, p=0.091), last year search for PA and cancer (yes=2.59±1.37 *vs* no=2.48±1.31, p=0.421), or having a relative diagnosed with cancer (no=2.55±1.32 *vs* yes=2.44±1.37, p=0.085). Figure 2 shows the correlation between leisure time PA in minutes/week and the knowledge scores. Positive correlation was found between the total time spent in leisure time PA and knowledge score (Spearmen correlation r=.462, p=0.001).

Discussion

This study revealed that only 426 (20.0%) were considered physically active in LTPA with ≥30 minutes/≥5 days/week of moderate and vigorous activities and only 11.6% met ACS recommendations for cancer prevention. Our findings suggest that few adult Saudis are participating in sufficient leisure activity to reduce cancer risk, probably because of the higher levels of activity required to meet ACS. Our results are far lower than those reported from the developed countries like Canada where 39% of Canadians were found to comply with ACS recommendations of PA (Aparicio-Ting et al., 2013), an Australian study found that 26% of adults participated in at least 420 minutes of moderate PA/week (Cerin et al., 2005). Very few studies have attempted to estimate the prevalence of sufficient PA for cancer prevention (Cerin et al., 2005; Aparicio-Ting et al., 2012). Furthermore, an important point to consider while comparing our figures with those reported from the developed countries is the differences in LTPA measurement used. The short time frame of GPAQ may be more influenced by seasonal variation and the presence of acute illnesses (Pereira et al., 1997) in comparison with long term LTPA estimates which are more likely to reflect usual activity patterns (pas year total physical activity questionnaire, PYTPAQ) (Aparicio-Ting et al.,

2012). Another important component is the data collection as this self-reported LTPA could be accompanied with over-reporting due to social desirability bias. Even with presence of previous points the results of this study shed the lights on the low population proportion that would be benefit from PA in cancer risk reduction and the need for policy and programs that encourage the Saudi and other Middle Eastern populations to engage in PA and reduction of the overall cancer risk especially colon and breast cancer, the most common encountered cancers in the region. Several studies in Asia have found physical inactivity as a major risk factor for several types of cancers. In Thailand Sangrajrang et al. (2013) conducted a case control study where 1,130 cases of newly diagnosed breast cancer and 1,142 controls were included. They found that regular exercise was associated with a decreased risk of breast cancer (OR=0.78, 95%CI 0.68-0.98). Interestingly, analysis by type of activity revealed significant protective effects for women who reported the highest levels of walking for shopping (OR=0.58, 95%CI 0.38-0.88) (Sangrajrang et al., 2013), the authors concluded that recreational PA has protective effects and the primary prevention of breast cancer should be promoted in an integrated manner including engagement of women in PA. Also Gao et al. (2013) confirmed the previous findings regarding PA and breast cancer risk reduction, they have found an inverse association between regular PA and breast cancer risk, physical activities are significantly associated with a decreased risk of breast cancer in Chinese females (Gao et al., 2013). Tyyem et al. (2013) included 232 Jordanian patients diagnosed with CRC with matched 271 population controls. They found a significant negative association between CRC and PA levels expressed as both METs (Metabolic Equivalents for Task) and MET-hours/week. Among females, a significant trend of reduction in CRC by 62% was observed with increasing the level of PA expressed in MET. They have concluded that being physically active could reduce the risk of developing CRC, especially in women (Tayyem et al., 2013). Similar findings were reported by Arafa et al. (2011), where a sedentary lifestyle and a diet low in fruits and vegetables, and high in animal red meat and saturated fat, appeared to be associated with CRC among the studied Jordanian subjects (Arafa et al., 2011).

Finally, in Malaysia, Shahar et al. (2011) found that past history of not engaging with any PA at the age of 45 to 54 years old increased risk of prostate cancer by approximately three folds (Shahar et al., 2011). In this study, women were less likely than men to be physically active or to meet the ACS guidelines even after adjustment for the other socio-demographics, a finding consistent with other reports (Aparicio-Ting et al., 2012; 2013). The previous difference should be considered in the presence of cultural, social barriers and motivating factors may shape the differences in PA behavior between men and women (Amin et al., 2011; Al-Otaibi, 2013), a point to be taken in promoting PA for cancer prevention for the Saudi population. Al Otaibi found that among adult Saudis who were in prime age, highly educated, employed and physically inactive, the majority of them were at pre-contemplation stage for PA with more external barriers and less self efficacy especially among females. Strategies aiming at deranged self efficacy and the several perceived barriers including psychosocial should be tailored to increase PA engagement and practice among Saudis to prevent the many chronic diseases including certain types of cancers in Saudi Arabia (Al-Otaibi, 2013). This study showed that those who were able to work but unemployed significantly more likely to be more physically active and complied with the ACS recommendations. The previous finding is consistent with previous reports (Aparicio-Ting et al., 2012; 2013) where retirees were found more likely to be active with more leisure time and more likely to be active at levels recommended for cancer prevention. Sufficient leisure activity to reduce cancer risk is likely associated with greater barriers related to time, competing commitments and motivation than participating in the lower levels required for general health benefits (Amin et al., 2011; Al-Otaibi, 2013). Perceived benefits are another important component to encourage PA behavior, increasing public awareness of the PA guidelines relevant to cancer prevention may encourage individuals to comply with these guidelines for being physically active. In this study only 11.4% of the sampled population indicated correctly the required frequency (days) and duration (minutes) of PA for an average adult to be physically active. Our results are far lower than those reported from developed countries, Bennet et al. (2009) reported that out of U.S probability sample (n=2381), 33% were able to identify the correct national physical activity recommendations. To date there is no clear strategy to promote physical activity among natives of the Arab countries including Saudi Arabia despite the overwhelming current and expected burden of non-communicable diseases including cancers (Musaiger et al., 2011). Accurate knowledge of PA recommendations may be an important first step in raising awareness about its importance in cancer reduction and motivating people to adopt a more physically active lifestyle. The responses of our population about the role of PA in preventing hypertension, lowering blood cholesterol and preventing heart diseases were comparable to those found elsewhere in many developed nations. Taylor et al. (2012) reported that among U.S Asians, three quarters of their sample knew that PA can prevent high blood pressure, high blood cholesterol, heart disease and diabetes but only 56% and 47% knew that PA can prevent colon and breast cancer respectively (Taylor et al., 2012). Another survey among Americans reported that 62% knew that PA can decrease the likelihood of getting certain types of cancers (OA et al., 2010). Inconsistent to our findings, the previous reports stated a higher level of knowledge compared to Saudi population, where only 18.6% and 23.1% correctly picked up the cancer types prevented by PA namely colon and breast cancers respectively. Coups et al. (2008) found that only 15% of the included U.S sample knew about the role of PA in colon cancer prevention, a close figure to ours (Coups et al., 2008).Women in this study were more aware about the role of PA in preventing breast cancer this could be explained by the frequent campaigns held in the last several years about breast cancer prevention in the Eastern Province of Saudi Arabia and the higher perceived risk of breast cancer among them (Amin et al., 2012b),

otherwise the overall knowledge showed no significant difference in relation to gender. On the other hand, some studies have found a significant awareness about the women's awareness regarding the recommended level of PA required (Bennet et al., 2008) while others found no difference in indicating the role of PA in cancer prevention (Coups et al., 2008; Taylor et al., 2012). In this study the knowledge levels were significantly more among those aged 20 to <30 years and less among those aged ≥50 years, this finding is conflicting what was reported by Coups et al., where they found that those aged 40 to 49 years were more knowledgeable about the role of PA in colon cancer prevention (Coups et al., 2008). Educational status found to be significantly influence the responses of our sample where the knowledge scores were higher among those with college or higher educational status, this is consistent with similar studies where higher educational status was coupled with better awareness about the role of PA in cancer prevention (Taylor et al., 2012) and colon cancer in specific (Coups et al., 2008), while it did not differ regarding the recommendations guidelines (Bennet et al., 2008; Coups et al., 2008). Another important finding was the significant relationship between the amount of LTPA and awareness; those with higher level of LTPA were more knowledgeable about the role of PA and cancer prevention, Chen and colleagues have reported that LTPA is positively associated with greater knowledge about the health benefits of exercise in Taiwan (Chen et al., 2011), while Taylor et al. (2012) found that individuals with low level of PA were less aware about the role of PA in chronic disease prevention including cancer (Taylor et al., 2012). In this study cancer seeking information behavior was not associated with either the level of PA nor the knowledge score, which contradicting the report of similar study, where cancer seeking behavior was positively associated with the role of PA in colon cancer prevention (Coups et al., 2008). This study delineated several prevalent misconceptions relevant to the role of PA in cancer prevention, about two thirds agreed that domestic chores are protective against breast cancer, only 13.7% indicated that PA should be for life or long term to be protective, only one in ten correctly indicated that PA should not be too strenuous to be protective, and 88.7% believed that PA has no effect among cancer patients. The previous findings may provide the foundations for proper health education messages by health care providers including the importance of LTPA in cancer prevention, recommended level of PA, corrections of the prevalent misconceptions and the role of PA in particular in colon and breast cancer risk reduction (Coups et al., 2008).

Study limitations

This study should be viewed in the lights of its several limitations. First this study only focused on the PA during a seven days period prior the interview rather estimating the whole year activity and this may result in imprecise estimation of the total PA recommended to prevent cancer. Second, social desirability bias is another potential problem owing to the self reported PA. Third, we emphasized our inquiry about the intentional LTPA rather than all domains of PA as may contribute in cancer risk reduction mechanisms. Fourth, we employed the ACS recommended level of PA for cancer prevention as there are no available local-regional recommendations for Saudi Arabia or any other population in the region. Fifth, this study did not consider the presence of other factors including smoking, obesity and overweight and chronic disease conditions, all of which may impede the PA. Finally, the knowledge items about the role of PA in cancer prevention were primary based in the form of multiple options which may yield a high probability of guessing.

In conclusion, a minority of adults Saudis in Al Hassa is aware about the role of PA in cancer prevention and engaged in sufficient LTPA for cancer risk reduction benefits highlighting the need for the public health actions to include policies and programs that address factors deter participation in LTPA and increase their awareness and manage the prevalent misconceptions.

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