

Review Article

Physical Activity and Colorectal Cancer Risk: An Evaluation Based on a Systematic Review of Epidemiologic Evidence Among the Japanese Population

Ngoc Minh Pham¹, Tetsuya Mizoue^{1,*}, Keitaro Tanaka², Ichiro Tsuji³, Akiko Tamakoshi⁴, Keitaro Matsuo⁵, Hidemi Ito⁵, Kenji Wakai⁶, Chisato Nagata⁷, Shizuka Sasazuki⁸, Manami Inoue⁸ and Shoichiro Tsugane⁸ for the Research Group for the Development and Evaluation of Cancer Prevention Strategies in Japan

¹Department of Epidemiology and Prevention, International Clinical Research Center, National Center for Global Health and Medicine, Tokyo, ²Department of Preventive Medicine, Faculty of Medicine, Saga University, Saga, ³Division of Epidemiology, Department of Public Health and Forensic Medicine, Tohoku University Graduate School of Medicine, Sendai, ⁴Department of Public Health, Aichi Medical University School of Medicine, Nagakute, ⁵Division of Epidemiology and Prevention, Aichi Cancer Center Research Institute, ⁶Department of Preventive Medicine, Nagoya University Graduate School of Medicine, Nagoya, ⁷Department of Epidemiology and Preventive Medicine, Gifu University Graduate School of Medicine, Gifu and ⁸Epidemiology and Prevention Division, Research Center for Cancer Prevention and Screening, National Cancer Center, Tokyo, Japan

*For reprints and all correspondence: Tetsuya Mizoue, Department of Epidemiology and Prevention, International Clinical Research Center, National Center for Global Health and Medicine, Tokyo 162-8655, Japan.
E-mail: mizoue@ri.ncgm.go.jp

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Objective: Higher levels of physical activity have been consistently associated with a decreased risk of colon cancer, but not rectal cancer, in Western populations. The present study systematically evaluated epidemiologic evidence on the association between physical activity and colorectal cancer risk among the Japanese population.

Methods: Original data were obtained from MEDLINE searched using PubMed or from searches of the *Ichushi* database, complemented by manual searches. The associations were evaluated based on the strength of evidence, the magnitude of association and biologic plausibility.

Results: Two cohort studies and six case–control studies were identified. A weak to strong protective association between physical activity and colon cancer risk was observed in both cohort studies, showing a graded relationship, and among the majority of case–control studies, with some showing a dose–response relationship. The association observed in cohort studies was more consistent and stronger in men than in women and for proximal colon cancer than for distal colon cancer. A protective association with rectal cancer was found only in case–control studies, but the evidence was less consistent and weaker than that observed for colon cancer.

Conclusions: Physical activity probably decreases the risk of colorectal cancer among the Japanese population. More specifically, the evidence for the colon is probable, whereas that for the rectum is insufficient.

Key words: systematic review – epidemiology – physical activity – colorectal cancer – Japanese

INTRODUCTION

Colorectal cancer is a common form of malignancy in developed countries, being the second and third leading cause of

cancer death in men and women, respectively (1). In Japan, colorectal cancer mortality has risen remarkably over the past three decades (1970–2000) (2) and its incidence is

among the highest levels worldwide (3). The increasing trend has been attributed to the changes in lifestyles, especially diet featured by a high intake of animal fats and meat and a low intake of fibers and cereals (4,5). Less attention has been paid to decreased physical activity in modern life as a causal factor that could account for the increased colorectal cancer among Japanese.

Physical activity in relation to colorectal cancer has been extensively investigated (6–10). On the basis of a comprehensive review of epidemiologic studies, the World Cancer Research Fund and American Institute for Cancer Research (WCRF/AIR) (7) concluded that physical activity convincingly reduces colorectal cancer risk; more specifically, the evidence is stronger for the colon than for the rectum. An earlier systematic review and meta-analysis (6) reported a consistent association between physical activity and a decreased risk of colon cancer; however, no association with rectal cancer was observed. Likewise, several recent systematic reviews and meta-analyses (8–10) consistently reported an inverse association of physical activity with colon cancer risk, but not with rectal cancer (8,9). Briefly, there is ample evidence that physical activity is convincingly associated with a reduced risk of colon cancer, but weaker or absent for rectal cancer. However, such evidence has been mainly derived from studies in Western countries and less is known in Asian countries, including Japan.

To assess the strength and consistency of the association between physical activity and colorectal cancer risk among the Japanese population, we conducted a systematic review of epidemiologic studies on this issue in Japan. This is one in a series of articles that summarized epidemiologic evidence on the relationship of lifestyles to total cancers and major forms of cancer in Japan (11,12).

PATIENTS AND METHODS

This review was based on a MEDLINE search of all published epidemiological studies on the association between physical activity and colorectal cancer incidence or mortality among Japanese published through May 2011. A search of the *Ichushi* (*Japana Centra Revuo Medicina*) database was also done to identify the studies written in Japanese. These methods of literature identification were complemented by manual searches of references from relevant articles where necessary. We employed the terms ‘physical activity’, ‘sports’, ‘colorectal cancer’, ‘colon cancer’, ‘rectal cancer’, ‘case–control studies’, ‘cohort studies’, ‘Japan’ and ‘Japanese’. Articles written in either English or Japanese were reviewed. Only studies on Japanese populations living in Japan were included. Individual results were summarized in tables separately according to study design as cohort or case–control studies.

The studies were evaluated on the basis of the magnitude of association and the strength of evidence. First, relative risks or odds ratios in each epidemiologic study were grouped by the magnitude of association, considering statistical significance (SS) or no statistical significance (NS), into: strong

(symbol $\uparrow\uparrow\uparrow$ or $\downarrow\downarrow\downarrow$), <0.5 or >2.0 (SS); moderate (symbol $\uparrow\uparrow$ or $\downarrow\downarrow$), either (a) <0.5 or >2.0 (NS), (b) >1.5 – 2.0 (SS) or (c) 0.5 to <0.67 (SS); weak (symbol \uparrow or \downarrow), either (a) >1.5 – 2.0 (NS), (b) 0.5 to <0.67 (NS) or (c) 0.67 – 1.5 (SS) or no association (symbol $-$), 0.67 – 1.5 (NS). We thus defined, for individual study, the magnitude of association by its strength, i.e. the size of relative risks or odds ratios for the highest physical activity group compared with the lowest, and its SS. Two-sided P values <0.05 were considered statistically significant. In case of multiple publications of analyses of the same or overlapping datasets, only data from the largest or most recent results were included and the incidence was preferable as the measure of outcome to mortality. After this process, the strength of evidence was evaluated in a similar manner to that used in the WHO/FAO Expert Consultation Report (13), where evidence was classified as ‘convincing’, ‘probable’, ‘possible’ and ‘insufficient’. We assumed that biological plausibility based on evidence in experimental models, human studies and other relevant data. Despite the use of this quantitative assessment rule, an arbitrary assessment cannot be avoided when considerable variation exists in the magnitude of association between the results of each study. The final judgment was made based on a consensus of the research group members, and it was therefore not necessarily objective.

MAIN FEATURES AND COMMENTS

A total of two cohort studies (14,15) and six case–control studies (16–21) were identified (Tables 1 and 2, respectively). Both cohort studies presented results separately for men and women. Among the case–control studies, two studies presented results by sex (19,21), one for men only (16) and the remaining three studies for men and women combined (17,18,20). The magnitude of association of physical activity with colorectal cancer is summarized in Tables 3 and 4 for cohort studies and case–control studies, respectively.

The two identified cohort studies showed relative risk for each the colon and the rectum. In men, the Japan Public Health Center-based Prospective study (JPHC) (14) found a strong inverse association of physical activity with proximal colon cancer and the other, the Miyagi cohort study (15), reported a strong inverse association with colon cancer. In women, however, physical activity was only weakly related to decreased risk of proximal colon cancer in the JPHC study or was not associated with colon cancer risk in the Miyagi cohort study. For rectal cancer, a moderate positive association was observed in women in the JPHC study, whereas no association was found in women of the Miyagi cohort study or in men of each study. When colon and rectal cancer combined, a weak (14) or moderate (15) inverse association was observed in men, while no association existed in women.

Of the six case–control studies evaluated, five (16–19,21) measured odds ratios for the colon and rectum separately, and one study (20) showed values for the combined colon and rectum only. Of these, two (16,17) found a moderate protective

Table 1. Physical activity and colorectal cancer risk, cohort study among Japanese populations

Reference	Study period	Study population				Category	No. among cases or deaths	Relative risk (95% CI or <i>P</i>)	<i>P</i> for trend	Confounding variables considered
		No. of subjects for analysis	Source of subjects	Event followed	No. of incident cases or deaths					
Lee et al. (14)	1995–02	65 022 (29 842 men, 35 180 women)	JPHC study (Cohort I: five prefectures, Cohort II: six prefectures), residential registry	Incidence	Colorectum	MET hours per day ^a				Age, study area, family history of colorectal cancer, smoking, alcohol intake, body mass index, intake of red meat, dietary fiber and folate
					290 men	Lowest	84	1.00		
						Second	81	0.99 (0.72–1.35)		
						Third	64	0.85 (0.61–1.20)		
						Highest	61	0.69 (0.49–0.97)	0.02	
					196 women	Lowest	53	1.00		
						Second	53	1.17 (0.79–1.75)		
						Third	45	0.97 (0.63–1.47)		
						Highest	45	1.16 (0.76–1.77)	0.57	
					Colon					
					197 men	Lowest	64	1.00		
						Second	55	0.87 (0.61–1.26)		
						Third	38	0.62 (0.41–0.95)		
						Highest	40	0.58 (0.39–0.87)	0.006	
					140 women	Lowest	41	1.00		
						Second	37	1.03 (0.65–1.64)		
						Third	35	0.91 (0.57–1.47)		
						Highest	27	0.89 (0.24–1.26)	0.61	
					Proximal colon					
					82 men	Lowest	29	1.00		
						Second	27	0.89 (0.52–1.51)		
						Third	15	0.44 (0.22–0.86)		
						Highest	11	0.29 (0.14–0.60)	<0.001	
					72 women	Lowest	21	1.00		
						Second	21	1.14 (0.61–2.12)		
						Third	21	1.01 (0.53–1.89)		
						Highest	9	0.55 (0.24–1.26)	0.15	
					Distal colon					

Continued

Table 1. Continued

Reference	Study period	Study population		Category	No. among cases or deaths	Relative risk (95% CI or <i>P</i>)	<i>P</i> for trend	Confounding variables considered
		No. of subjects for analysis	Source of subjects					
			Event followed	No. of incident cases or deaths				
				65 men	<0.5	1.00		
					0.5–1	1.75 (0.88–3.50)		
					>1	1.07 (0.55–2.06)	0.94	
				44 women	<0.5	1.00		
					0.5–1	1.18 (0.54–2.58)		
					>1	0.82 (0.39–1.71)	0.55	

^aEstimated from four levels of physical activity: heavy physical work or strenuous exercise, walking and standing, sedentary and sleep or others.^bEstimated from time spent on walking.

association of physical activity against colon cancer, one (19) showed a weak protective association with proximal colon cancer and another (21) exhibited a moderate to strong protective association with distal colon cancer. A protective association was also observed for rectal cancer, although the association was generally less evident than for colon cancer (16–18,21). The remaining study examining the combined colon and rectal cancer only showed no association (20).

We should discuss several methodological issues regarding the evidence of the relationship between physical activity and colorectal cancer in general and in particular for Japanese studies. First, we did not conduct a meta-analysis to calculate summary effect size of the association between physical activity and risk of colorectal cancer. This is because we found a large discrepancy among the studies reviewed here regarding methods used in the ascertainment of physical activity and categories created to group study participants. Secondly, attention should be focused when interpreting the findings of case-control studies. Case-control studies are prone to recall bias, leading to a difference in reported levels of physical activity between cases and controls. Specifically, a protective association between physical activity and colorectal cancer is overestimated if patients with colorectal cancer tend to underreport physical activity in the past, due to the influence of their disease status on recall, compared with healthy control individuals. Thirdly, most of the case-control studies reviewed in the present paper selected controls from among patients or participants of health checkups or screening, which might have resulted in various extents of selection bias among studies. Fourthly, few case-control studies have controlled for factors including intakes of dietary fiber, folate and vegetables, which have been favorably associated with colorectal cancer risk (22,23). Failure to account for these factors may result in a spurious association between physical activity and the risk of colorectal cancer. However, both cohort studies in the present review showed a strong, inverse association between physical activity and colon cancer in men even after adjustment of potentially important risk or protective factors of colorectal cancer. Fifthly, cohort studies possess their constitutional drawbacks. For one, physical activity level assessed in a prospective cohort design would be non-differentially misclassified, leading to a dilution of association. Furthermore, only baseline measurement of physical activity was used as an exposure variable in the two Japanese cohort studies, but physical activity level may change over the life course. Finally, as with any review based on published articles, we cannot rule out a possibility of publication bias, which would work to produce spurious association even in the case of no association. However, the effect of such bias may not largely distort our conclusion because most case-control studies in this review reported results not only for physical activity but also for other lifestyle factors within the same paper or in other independent ones.

A protective association between physical activity and colorectal cancer is supported by a number of biologic mechanisms. Main hypothesized mechanisms include

Table 2. Physical activity and colorectal cancer risk, case–control study among Japanese populations

Reference	Study period	Study subjects				Category	Odds ratio (95% CI or <i>P</i>)	<i>P</i> for trend	Confounding variables considered	Comments
		Type and source	Definition	No. of cases	No. of controls					
Kato et al. (16)	1979–87	Registry based (Aichi Cancer Registry)	Cases: histologically confirmed (90%); controls: patients with other sites of cancer excluding known alcohol-related cancers (mouth, pharynx, esophagus, liver and unknown sites)	Colon		Occupational activity			Adjusted for age	Each occupation was classified according to the proportion of physically active time on the job
				1716 men	16 600 men	High	1.00			
						Moderate	1.79 (1.50–2.15)			
						Low	1.87 (1.58–2.23)	NA		
				Proximal colon						
				445 men	16 600 men	High	1.00			
						Moderate	1.76 (1.24–2.48)			
						Low	1.92 (1.38–2.67)	NA		
				Distal colon						
				756 men	16 600 men	High	1.00			
						Moderate	1.70 (1.33–2.19)			
						Low	1.52 (1.19–1.94)	NA		
Kato et al. (17)	1986–90	Hospital based (Aichi Cancer Center Hospital)	Cases: histologically confirmed cases among examinees of colonoscopy at the hospital; controls: population controls selected through the telephone directories	Colon		Sports activity			Adjusted for residence, sex and age (5-year age group)	*Common controls for cases of cancer of the colon and rectum
				132 (M: 79, F: 53)	578 (M: 377, F: 201)*	Almost no activity	1.00			
						< 1/week	0.72 (0.44–1.19)			
						≥ 1/week	0.55 (0.33–0.89)			
						Occupational activity				
						Sedentary	1.00			
						Moderate	0.58 (0.37–0.90)			
						High	0.51 (0.30–0.87)			
				Rectum		Sports activity				

Continued

Table 2. Continued

Reference	Study period	Study subjects				Category	Odds ratio (95% CI or <i>P</i>)	<i>P</i> for trend	Confounding variables considered	Comments
		Type and source	Definition	No. of cases	No. of controls					
Kotake et al. (18)	1992–94	Hospital based (10 hospitals in Kanto region)	Cases: histologically confirmed cases; controls: screening controls and hospital controls, including cancer patients	Colon	91 (M: 60, F: 31) 578 (M: 377, F: 201)*	Almost no activity	1.00		Matched for sex, age (5-year age group)	Risk estimates for intermediate categories are not shown.
						<1/week	0.86 (0.50–1.50)			
						≥1/week	0.54 (0.30–0.97)			
						Occupational activity				
						Sedentary	1.00			
						Moderate	1.24 (0.72–2.15)			
						High	0.70 (0.36–1.38)			
						Occupational physical activity				
						Very active	1.0			
						Sedentary	1.1 (0.30–2.84)			
						Physical exercise				
						Often	1.0			
						Seldom	0.9 (0.17–1.89)			
						Rectum				
						Occupational physical activity				
Inoue et al. (19)	1988–92	Hospital based (Aichi Cancer Center Hospital)	Cases: histologically confirmed cases; controls: first-visit outpatients free from cancer	Proximal colon	176 (M: 103, F: 73) 176 (M: 103, F: 73)	Very active	1.0		Adjusted for age	*Common controls for cases of cancer of the colon and rectum
						Sedentary	1.9 (0.66–5.54)			
						Physical exercise				
						Often	1.0			
						Seldom	1.0 (0.25–8.01)			
				Distal colon	51 men 43 women	Physical exercise				
						≤4/month	1.0			
						>4/month	0.7 (0.4–1.5)			
						≤4/month	1.0			
						>4/month	0.5 (0.2–1.5)			
						≤4/month	1.0			
						>4/month	0.7 (0.4–1.3)			
				Rectum	62 women 131 men	≤4/month	1.0			
						>4/month	0.7 (0.4–1.3)			
						≤4/month	1.0			
						>4/month	1.0 (0.5–2.0)			
						≤4/month	1.0			
						>4/month	0.8 (0.5–1.3)			
				70 women	23 161 women*	≤4/month	1.0			
						>4/month	0.7 (0.3–1.4)			

Ping et al. (20)	1986–94	Health checkup based (Tokai University Hospital: health checkup examinees)	Cases: histologically confirmed cases; controls: cancer-free examinees	Colorectum	100 (M: 77, F: 23)	265 (NA)	Exercise		Matched (1:3) for sex, age (± 2 years), data of health checking (± 3 months) and residence; 35 controls were excluded due to a lack of lifestyle data	The definition of 'lack of exercise' is not stated.
							Not lacking	1.00		
							Lacking	1.39 (0.87–2.20)		
Isomura et al. (21)	2000–03	Hospital based (two university hospitals and six affiliated hospitals)	Cases: patients undergoing surgery for a first diagnosis of colorectal cancer; controls: population controls selected using two-stage random sampling method	Colon			Job-related physical activity		The number of control candidates by sex and 10-year age class were determined a priori in accordance with sex and age-specific numbers of incident cases of colorectal cancer in the Osaka Cancer Registry; Adjusted for age, smoking, alcohol use, residence, BMI and non-job physical activities or job-related physical activities	
					248 men	470 men	Sedentary	1.0		
							Moderate	0.9 (0.6–1.4)		
							Hard	0.7 (0.4–1.0)	0.06	
							Non-job physical activity			
							0	1.0		
							0.1–15.9	0.9 (0.6–1.4)		
							16.0+	0.8 (0.5–1.2)	0.22	
					190 women	297 women	Job-related physical activity			
							Sedentary	1.0		
							Active	0.7 (0.4–1.2)	0.18	
							Non-job physical activity			
							0	1.0		
							0.1–15.9	0.9 (0.5–1.5)		
							16.0+	0.8 (0.5–1.4)	0.45	
				Proximal colon			Job-related physical activity			
					88 men	470 men	Sedentary	1.0		
							Moderate	1.2 (0.6–2.2)		
							Hard	0.7 (0.4–1.4)	0.45	
							Non-job physical activity			
							0	1.0		
							0.1–15.9	1.2 (0.6–2.1)		
							16.0+	0.9 (0.5–1.7)	0.69	

Continued

Table 2. *Continued*

Reference	Study period	Study subjects				Category	Odds ratio (95% CI or <i>P</i>)	<i>P</i> for trend	Confounding variables considered	Comments
		Type and source	Definition	No. of cases	No. of controls					
				87 women	297 women	Job-related physical activity				
						Sedentary	1.0			
						Active	1.2 (0.6–2.3)	0.65		
						Non-job physical activity				
						0	1.0			
						0.1–15.9	1.5 (0.7–3.3)			
						16.0+	1.6 (0.7–3.6)	0.41		
		Distal colon				Job-related physical activity				
				159 men	470 men	Sedentary	1.0			
						Moderate	0.8 (0.4–1.4)			
						Hard	0.6 (0.4–1.0)	0.047		
						Non-job physical activity				
						0	1.0			
						0.1–15.9	0.8 (0.5–1.3)			
						16.0+	0.7 (0.4–1.1)	0.19		
		103 women		297 women		Job-related physical activity				
						Sedentary	1.0			
						Active	0.4 (0.2–0.8)	0.02		
						Non-job physical activity				
						0	1.0			
						0.1–15.9	0.7 (0.4–1.3)			
						16.0+	0.6 (0.3–1.1)	0.12		
		Rectum				Job-related physical activity				
				208 men	470 men	Sedentary	1.0			
						Moderate	0.9 (0.5–1.4)			
						Hard	0.6 (0.4–0.9)	0.02		
						Non-job physical activity				
						0	1.0			
						0.1–15.9	0.6 (0.4–0.9)			
						16.0+	0.5 (0.3–0.8)	0.01		

	132 women	297 women	Job-related physical activity	
			Sedentary	1.0
			Active	1.1 (0.6–1.9)
			Non-job physical activity	0.81
			0	1.0
			0.1–15.9	1.2 (0.7–2.3)
			16.0+	0.9 (0.5–1.8)
				0.47

NA, not available; NS, not significant; M, men; F, women.

prevention of obesity, a strong predictor of colorectal cancer, decreased inflammation, reduced levels of insulin and insulin-like growth factor 1 and modulated immune response (7,24,25). In addition, physical activity has been associated with an increased level of circulating vitamin D (26), which has an anti-carcinogenic effect on colonic epithelial cells (27) and has been related to lower risk of colon cancer (28). Other possible mechanisms include decreased bowel transit time (29), thereby resulting in less exposure of the colon to colonic contents, bile acids and other potential carcinogens. Physical activity was also related to increased prostaglandin F₂α (30) and reduced prostaglandin E₂ (31); the former prevents tumor development in the colon and increases gut motility (32,33), whereas the latter reduces colonic motility and promotes the proliferation of colonic cells (32,34). Moreover, physical activity has been shown to be associated with decreased prevalence of colon adenoma (35), a precursor of colorectal cancer.

The association between physical activity and colorectal cancer in Japanese studies reviewed here is generally in agreement with that of previous reviews (6–10). A consistent dose–response relationship of physical activity to a decreased risk of colon cancer was observed in both cohort and case–control studies. Moreover, agreement exists between Japanese cohort studies (14,15) and previous reviews (6–9) on the lack of association between physical activity and risk of rectal cancer. Results of the present review support a protective role of physical activity in the prevention of colon cancer.

Unlike the protective association of physical activity with colon cancer risk consistently observed here and in previous reviews (6–10), the association with rectal cancer was mixed in our review. Consistent with previous reports (6–9), cohort studies reviewed here did not show any association between physical activity and rectal cancer, while the majority of case–control studies reported weak to moderate protective association (16–18,21) and some of the case–control studies exhibited a dose–response relationship (16,17,21). The possible disagreement regarding the association of physical activity with rectal cancer observed in cohort and case–control studies in the present review may be attributed to the difference of study design, as discussed in the methodological section above.

A point of note in the present review is that men showed a stronger protective association of physical activity with colon cancer than women in cohort studies. This observation is in line with numerous studies in other countries on this topic (6–10). We had no clear reason for such sex difference in association. One possible explanation is that men and women differ in terms of the amount, intensity and duration of physical activity engaged. It is conceivable that men tend to be engaged in more strenuous physical activity when compared with women. In addition, women are more likely to participate in housework and childcare, which are difficult to assess precisely. As a result, men may provide more accurate information about their physical activity than women. Epidemiologic evidence suggests that 30–60 min per day of moderate to vigorous intensity physical activity are necessary to reduce colon cancer risk (36).

Table 3. Summary of the association between physical activity and colorectal cancer risk, cohort study

References	Study period	Study population					Magnitude of association ^a		
		Sex	Number of subjects	Ranged age (years)	Event	Number of incident cases or deaths	Colon	Rectum	Colorectum
Lee et al. (14)	1995–02	Men	29 842	40–69	Incidence	290	↓↓↓ ^{b,c,d}	—	↓
		Women	35 180	40–69	Incidence	196	↓ ^b	↑↑	—
Takahashi et al. (15)	1990–97	Men	25 279	40–64	Incidence	166	↓↓↓ ^d	—	↓↓
		Women	26 642	40–64	Incidence	94	—	—	—

^a↑↑↑ or ↓↓↓, strong; ↑↑ or ↓↓, moderate; ↑ or ↓, weak; —, no association (see text for more detailed definition); if the magnitude of association differs between occupational and non-occupational activities or between proximal and distal colon, strongest association is reported.
^bProximal colon.
^cOccupational physical activity.
^dNon-occupational physical activity.

Table 4. Summary of the association between physical activity and colorectal cancer risk, case–control study

Reference	Study period	Study subjects						Magnitude of association ^a		
		Sex	Age range	No. of cases			No. of controls	Colon	Rectum	Colorectum
				Colon	Rectum	Colorectum				
Kato et al. (16)	1979–87	Men	≥20 year	1716	1611	NP	16 600	↓↓ ^d	↓ ^d	NA
Kato et al. (17)	1986–90	Men and women	Not specified	132	91	NP	578	↓↓ ^{d,e}	↓↓ ^d	NA
Kotake et al. (18)	1992–94	Men and women	Not specified	187	176	NP	363	—	↓ ^d	NA
Inoue et al. (19)	1988–92	Men	24–86 year	126	131	NP	8621	— ^c	— ^c	NA
		Women	24–88 year	105	70	NP	23 161	↓ ^{b,c}	— ^c	NA
Ping et al. (20)	1986–94	Men and women	40–84 year	NP	NP	100	265	NA	NA	—
Isomura et al. (21)	2000–03	Men	20–74 year	248	208	NP	470	↓↓ ^{c,d}	↓↓ ^{d,e}	NA
		Women	20–74 year	190	132	NP	297	↓↓↓ ^{c,d}	—	NA

NP, not provided; NA, not available; M, men; F, women.
^a↑↑↑ or ↓↓↓, strong; ↑↑ or ↓↓, moderate; ↑ or ↓, weak; —, no association (see text for more detailed definition); if the magnitude of association differs between occupational and non-occupational activities or between proximal and distal colon, strongest association is reported.
^bProximal colon.
^cDistal colon.
^dOccupational physical activity.
^eNon-occupational physical activity.

In conclusion, epidemiological evidence for a protective association of physical activity with colorectal cancer among the Japanese population is more consistent and stronger for colon cancer than for rectal cancer. A protective association with rectal cancer was observed in some case–control studies, but not in cohort studies.

EVALUATION OF EVIDENCE ON PHYSICAL ACTIVITY AND COLORECTAL CANCER IN JAPANESE

From the results of the present review and based on the hypothesized biological plausibility, we conclude that physical activity probably reduces the risk of colorectal cancer

among the Japanese population. More specifically, the evidence for the colon is probable, whereas that for the rectum is insufficient.

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Conflict of interest statement

None declared.

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Appendix

Research group members: Shoichiro Tsugane (principal investigator), Manami Inoue, Shizuka Sasazuki, Motoki Iwasaki, Tetsuya Otani (until 2006), Norie Sawada (since 2007), Taichi Shimazu (since 2007) (National Cancer Center, Tokyo); Ichiro Tsuji (since 2004), Yoshitaka Tsubono (in 2003) (Tohoku University, Sendai); Yoshikazu Nishino (until 2006) (Miyagi Cancer Research Institute, Natori, Miyagi); Akiko Tamakoshi (since 2010) (Aichi Medical University, Aichi); Keitaro Matsuo (until 2010), Hidemi Ito (since 2010) (Aichi Cancer Center, Nagoya); Kenji Wakai (Nagoya University, Nagoya); Chisato Nagata (Gifu University, Gifu); Tetsuya Mizoue (National Center for Global Health and Medicine, Tokyo); Keitaro Tanaka (Saga University, Saga).