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The prevalence and influencing factors of physical activity and sedentary behaviour in the rural population in China: the Henan Rural Cohort Study

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ABSTRACT

Objectives To estimate the prevalence and influencing factors of physical activity (PA) and sedentary behaviour (SB) in rural areas of China.

Design Cross-sectional study.

Setting A multistage, stratified cluster sampling method was used to obtain samples in the general population of Henan province in China.

Participants 38 515 participants aged 18–79 years were enrolled from the Henan Rural Cohort Study for the cross-sectional study.

Main outcome measures The International Physical Activity Questionnaire was used to assess the levels of PA and SB. Multiple logistic regression analysis was used to calculate ORs and 95% CIs of potential influencing factors with physical inactivity.

Results The age-standardised prevalence of light PA and sitting >7.5 hours per day were 32.74% and 26.88% in the general Chinese rural adults, respectively. Gender differences were: 34.91%, 29.76% for men and 31.75%, 25.16% for women, respectively. The prevalence of participants with both light PA and sitting >7.5 hours per day was 13.95%. Education at least junior middle school, divorced/widowed/unmarried, RMB1000> per capita monthly income ≥RMB500, sitting >7.5 hours per day were negatively associated with light PA. For sitting >7.5 hours per day, the negative factors were being men, divorced/ widowed/unmarried, heavy smoking, Fishery products, vegetable and fruits intake .

Conclusion Physical inactivity and SB were high in rural China. There is an increased need to promote a healthy lifestyle to the rural population.

Clinical trial registration The Henan Rural Cohort Study has been registered with the Chinese Clinical Trial Register. Registration number: ChiCTR-OOC-15006699. http://www. chictr.org.cn/showproj.aspx?proj=11375

INTRODUCTION

Over the past few decades, epidemiological studies have suggested that physical inactivity or sedentary behaviour (SB) were risk factors for non-communicable diseases, such as breast cancer,[1] prostate cancer,[2] cardio-vascular diseases,[3] stroke,[4] type 2 diabetes mellitus[5] and metabolic syndrome.[6] More-over, a study ranging from the eastern Mediterranean to the western Pacific region showed that more than 5.3 million deaths could be avoided each year, if inactive people became active.[7] In addition to the burden of disease, physical inactivity and SB also result in substantial economic burden to patients and society, especially in rural areas with limited resources.[8]

The prevalence of physical inactivity was about 31.1% all over the world, and varied by region. For instance, the prevalence of physical inactivity was 43.3% in USA, while it was just 17.0% in south-east Asia.[9] Even within a country, the prevalence of physical inactivity varies from region to region. In China, the prevalence of physical inactivity was 63.1% in Shenzhen,[10] and another study in Shanghai showed that only 18.4% of participants showed physical activity (PA).[11] Although previous studies had explored the prevalence of PA and SB among inhabitants of urban China, there is little evidence of these in rural areas of China that have undergone rapid socioeconomic development.[12] Therefore, it is necessary to update the prevalence and risk factors of PA and SB and then evaluate the levels of PA and SB in rural areas of China, to gather important evidence to generate strategy and promote PA in the population.

Strengths and limitations of this study

► The study was focused on the rural population.
► The study was based on a large sample.
► Enough potential confounding variables were includ-ed in this study.
► The study was based on a cross-sectional study.
► The questionnaire was a standard version.

Table 1 Demographic characteristics of the participants

Variable	Overall (n=38515)	Physical activity			P values	Sitting time per day		P values
		Vigorous (n=11510)	Moderate (n=14672)	Light (n=12333)		≤7.5hours (n=28270)	>7.5 hours (n=10245)	
Age (years), mean±SD	55.65±12.14	55.48±10.81	54.62±12.05	57.02±13.25	<0.001	55.46±11.93	56.17±12.68	<0.001
Gender*, % (95% CI)					<0.001			<0.001
Women	60.52 (60.03 to 61.01)	51.81 (50.89 to 52.72)	70.90 (70.16 to 71.63)	56.31 (55.44 to 57.19)		62.21 (61.65 to 62.78)	55.85 (54.89 to 56.81)	
Men	39.48 (38.99 to 39.97)	48.19 (47.28 to 49.11)	29.10 (28.37 to 29.84)	43.69 (42.81 to 44.56)		37.79 (37.22 to 38.35)	44.15 (43.19 to 45.11)	
Marital status*, % (95% CI)					<0.001			<0.001
Married/cohabiting	89.76 (89.46 to 90.06)	91.81 (91.31 to 92.31)	90.18 (89.7 to 90.66)	87.35 (86.76 to 87.94)		90.21 (89.86 to 90.56)	88.52 (87.9 to 89.14)	
Widowed/single/divorced/ separated	10.24 (9.94 to 10.54)	8.19 (7.69 to 8.69)	9.82 (9.34 to 10.30)	12.65 (12.06 to 13.24)		9.79 (9.44 to 10.14)	11.48 (10.86 to 12.10)	
Education*, % (95% CI)					0.234			0.001
≤ Primary school	44.86 (44.36 to 45.35)	44.74 (43.83 to 45.64)	44.45 (43.64 to 45.25)	45.46 (44.58 to 46.34)		44.33 (43.75 to 44.91)	46.31 (45.34 to 47.27)	
≥ Junior school	55.14 (54.65 to 55.64)	55.26 (54.36 to 56.17)	55.55 (54.75 to 56.36)	54.54 (53.66 to 55.42)		55.67 (55.09 to 56.25)	53.69 (52.73 to 54.66)	
Per capita monthly income*, % (95% CI)					<0.001			<0.001
<RMB500	35.69 (35.21 to 36.17)	36.22 (35.34 to 37.10)	32.99 (32.23 to 33.76)	38.40 (37.54 to 39.26)		34.71 (34.15 to 35.26)	38.40 (37.46 to 39.34)	
RMB500~	32.86 (32.39 to 33.33)	32.35 (31.50 to 33.21)	33.80 (33.03 to 34.56)	32.22 (31.40 to 33.05)		34.38 (33.83 to 34.94)	28.67 (27.79 to 29.54)	
≥RMB1000	31.45 (30.98 to 31.91)	31.42 (30.58 to 32.27)	33.21 (32.44 to 33.97)	29.38 (28.57 to 30.18)		30.91 (30.37 to 31.45)	32.93 (32.02 to 33.84)	
Smoking*, % (95% CI)					<0.001			<0.001
Never	72.76 (72.31 to 73.20)	66.48 (65.62 to 67.34)	80.21 (79.56 to 80.85)	69.76 (68.95 to 70.57)		74.03 (73.52 to 74.54)	69.24 (68.35 to 70.14)	
Light	5.59 (5.36 to 5.82)	6.83 (6.37 to 7.29)	4.26 (3.93 to 4.59)	6.01 (5.59 to 6.43)		5.66 (5.39 to 5.93)	5.40 (4.96 to 5.84)	
Moderate	4.54 (4.34 to 4.75)	5.49 (5.07 to 5.91)	3.44 (3.15 to 3.74)	4.97 (4.59 to 5.35)		4.43 (4.19 to 4.67)	4.86 (4.44 to 5.28)	
Heavy	17.11 (16.73 to 17.49)	21.20 (20.45 to 21.95)	12.09 (11.56 to 12.62)	19.27 (18.57 to 19.96)		15.88 (15.46 to 16.31)	20.50 (19.72 to 21.28)	
Drinking*, % (95% CI)					<0.001			<0.001
Never	77.46 (77.04 to 77.88)	71.74 (70.92 to 72.56)	83.31 (82.70 to 83.91)	75.84 (75.08 to 76.59)		78.06 (77.58 to 78.54)	75.79 (74.96 to 76.62)	
Light	13.92 (13.57 to 14.26)	17.94 (17.24 to 18.64)	10.39 (9.90 to 10.89)	14.35 (13.73 to 14.97)		13.58 (13.18 to 13.98)	14.84 (14.15 to 15.52)	

Continued

Table 1 Continued

Variable	Overall (n=38515)	Physical activity			P values	Sitting time per day		P values
		Vigorous (n=11510)	Moderate (n=14672)	Light (n=12333)		≤7.5 hours (n=28270)	>7.5 hours (n=10245)	
Moderate	4.73 (4.51 to 4.94)	5.80 (5.38 to 6.23)	3.64 (3.34 to 3.94)	5.01 (4.63 to 5.40)		4.78 (4.53 to 5.03)	4.58 (4.17 to 4.98)	
Heavy	3.90 (3.71 to 4.09)	4.52 (4.14 to 4.90)	2.66 (2.40 to 2.92)	4.80 (4.42 to 5.18)		3.58 (3.36 to 3.79)	4.79 (4.38 to 5.21)	
Dietary habits (kg/month), (mean±SD)								
Meat and poultry	1.32±1.32	1.21±1.28	1.40±1.35	1.33±1.33	<0.001	1.31±1.33	1.34±1.31	0.410
Fishery products	0.11±0.16	0.10±0.15	0.12±0.16	0.11±0.16	<0.001	0.11±0.16	0.13±0.17	<0.001
Vegetables and fruits	13.8±7.47	12.49±7.43	14.68±7.37	14.07±7.44	<0.001	13.27±7.23	15.24±7.91	<0.001
Soy products	0.48±0.64	0.41±0.60	0.49±0.65	0.53±0.67	<0.001	0.49±0.65	0.46±0.63	<0.001
Height (cm), mean±SD	159.69±8.20	160.65±8.24	158.62±7.84	160.07±8.43	<0.001	159.59±8.17	159.98±8.28	<0.001
Weight (kg), mean±SD	63.48±11.14	63.92±10.86	62.44±10.76	64.30±11.72	<0.001	63.60±11.09	63.15±11.27	<0.001
BMI (kg/m²), mean±SD	24.84±3.57	24.72±3.46	24.77±3.50	25.03±3.73	<0.001	24.92±3.56	24.61±3.59	<0.001
WC (cm), mean±SD	84.07±10.41	83.65±10.03	83.44±10.19	85.22±10.90	<0.001	84.42±10.35	83.10±10.50	<0.001

*Was presented as % and 95% CIs.
BMI, body mass index; WC, waist circumference.

The objectives of the current study were: (1) To explore the prevalence of PA and SB. (2) To investigate potential influencing factors of PA and SB.

METHODS
Settings and participants
This cross-sectional study was conducted from 2015 to 2017 in five rural regions (Suiping, Yuzhou, Xinxiang, Tongxu and Yima counties) of Henan province. The participants were permanent residents aged 18–79 years. Seven hundred and forty-four participants with insufficient information about their PA and sitting time were excluded. Ultimately, 38 515 participants with completed questionnaires, anthropometric measurements and blood tests were included in our analysis.

Data collection
The details of the sampling process were previously reported.[13] Briefly, a multistage, stratified cluster sampling method was used. In the first stage, five rural counties were selected in central, south, north, east and west Henan province. In the second stage, one to three rural communities (referred to as 'townships') in each county were selected. In the last stage, all permanent residents who were 18–79 years old and who signed informed consent were selected as the study sample. The information was collected by face-to-face interview. The data about general demographic characteristics and lifestyles were included in a standard questionnaire. Educational level was classified into primary school or below and junior middle school or above, and marital status into married/cohabitation and unmarried/divorced/widowed categories. In accordance with the smoking index of WHO,[14] the smoking status was divided into never smoking, light smoking, moderate smoking and heavy smoking. According to daily alcohol intake of WHO,[14] drinking was categorised into never drinking, light drinking, moderate drinking and heavy drinking. According to Chinese dietary guidelines,[15] four aspects were considered while evaluating dietary habits: meat and poultry, fishery products, vegetables and fruits, and soy products. The waist circumference was measured to the nearest 0.1 cm at 1 cm above the navel in a horizontal plane, by a non-elastic tape. Height was measured twice to the nearest 0.1 cm, without shoes, using a wall-mounted ruler tape with an insertion buckle at one end. Body weight, using a mechanical scale on a level surface to the nearest 0.1 kg, was measured once with the subjects in light clothing and barefoot.[16] Body mass index was calculated as weight in kilograms divided by the square of height in metres.

Patient and public involvement
Neither patients nor the public were involved in developing this project.

Definitions
The International Physical Activity Questionnaire (IPAQ) was used to assess the levels of PA and SB.[17] All the weekly
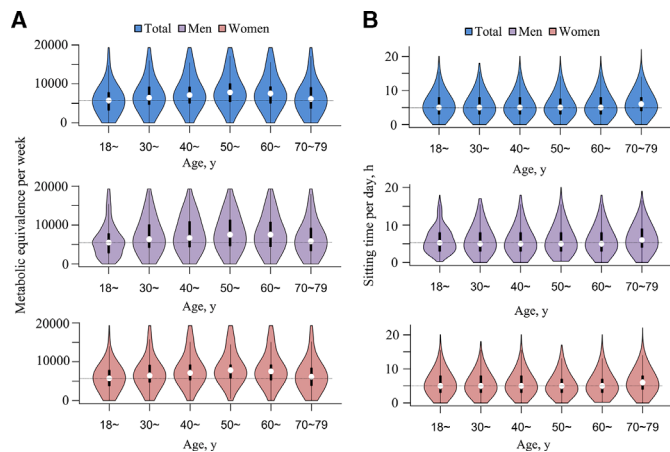
Figure 1 The violin chart of metabolic equivalence per week and sitting time per day according to gender and age. (A) Metabolic equivalence per week. (B) Sitting time per day. h, hours; y, years.

time of vigorous activity, moderate activity and walking was calculated with the number of Mets (multiples of the basal metabolic rate) in each category and the daily average estimated. Mets reflected the energy expenditure specific for vigorous activity, moderate activity and walking. In this study, 1 MET was defined as the energy spent when an individual sits quietly. The Mets of vigorous activity was 8; the Mets of moderate activity was 4; the Mets of walking was 3.3. The value of Mets was estimated by the sum of the three PAs in 1 week. The PAs categorised into three levels were light (physically inactive), moderate and vigorous.[9 18] These categories were based on the standard scoring criteria of IPAQ. Vigorous activity should meet either of the following two criteria: (1) Vigorous activity was at least 3 days/week and the week of accumulating Mets was at least 1500 MET-min/week. (2) Any combination of vigorous activity, moderate activity or walking at least 5 days/week and the accumulating Mets was at least 3000 MET-min/week. Moderate activity should meet either of the following four criteria: (1) Moderate activity was at least 30 min in 5 days a week. (2) Vigorous activity was at least 20 min in 3 days a week. (3) Walking at least 30 min a day for five or more days a week. (4) The accumulating Mets, of any combination of moderate activity, vigorous activity or walking, was at least 600 MET-min/week in five or more days a week. The light activity category was for individuals who met neither vigorous activity nor moderate activity criteria. In addition, the cut-off point for SB was set at 7.5 hours.[19 20] At the same time, according WHO, PA was classified into insufficiently active, active and highly active. Some moderate-intensity or vigorous-intensity PA but less than 150 min of moderate-intensity PA a week or 75 min of vigorous-intensity PA or the equivalent combination was considered insufficiently active. The equivalent of 150–300 min of moderate-intensity PA a week was considered active. The equivalent of more than 300 min of moderate-intensity PA a week was considered highly active.[21 22]

Statistical analysis

Continuous variables were presented as mean±SD. Differences between two groups were tested using t-test and more than two groups were tested using analysis of variance. Categorical variables, presented as numbers and percentages, were compared using the χ^2 test. Based on the Chinese population data from the 2010 census, direct standardisation was used to calculate the age-standardised prevalence of Mets. Multinomial logistic regression models were used to calculate ORs and 95% CIs between the potential factors and Mets. All statistical tests were two-tailed, and p<0.05 was considered statistically significant. Data were analysed using SAS V.9.1 (SAS Institute, USA) and R V.3.5.1.

RESULTS

Demographic characteristics

Table 1 shows the demographic characteristics of the 38 515 participants aged 18–79 years old. The mean (SD) age was 55.65 (12.14) years. Overall, a total of 11 510, 14 672 and 12 333 subjects were engaged in vigorous, moderate and light PA, respectively. Being male, married/cohabiting, light, moderate and heavy levels of smoking, and light and moderate drinking were more common among vigorous activity participants, while older age, widowed/single/divorced/separated, at least primary school education, per capita monthly income <RMB500, heavy drinking were more prevalent among moderate PA participants. Among the 38 515 participants, 28 270 were sitting ≤7.5 hours per day. Being female, married/cohabiting, at least junior school education, RMB500≤ per capita monthly income <RMB1000, never smoking and never drinking were more prevalent in the subjects sitting ≤7.5 hours per day than those sitting >7.5 hours per day (p<0.001). Online supplementary table 1 shows the demographic characteristics according to WHO.

The gender-specific distributions of PA and sitting time according to age

Figure 1 describes the gender-specific distribution of the Mets of PA and sitting time according to age. The median of Mets for PA and sitting time were 7092 MET-min/week and 5 hours, respectively. The median of Mets for PA were 6558 MET-min/week and 7119 MET-min/week for men and women, respectively. The median of sitting time were 5 hours for both men and women. The mean±SD of Mets for PA was 7626.02±4229.32 MET-min/week and sitting time was 5.70±3.23 hours. The mean±SD of Mets for PA and sitting time were 7506.15±4524.75 MET-min/week, 7704.20±4023.12 MET-min/week and 5.97±3.39 hours, 5.53±3.12 hours for men and women (p < 0.001), respectively. Notably, the sitting time of men was higher than that of women. The 50–59 years age group had the highest Mets. The 70–79 years age group had the highest sitting time.
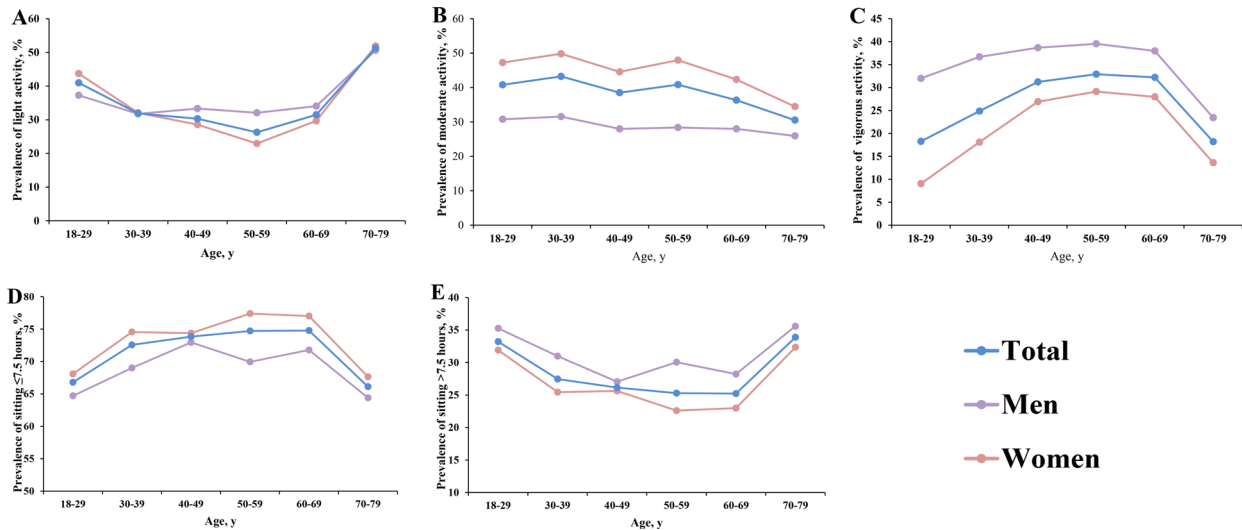
Figure 2 Changes in the age-standardised prevalence of physical activity and sitting time with age in different genders. (A) Light physical activity. (B) Moderate physical activity. (C) Vigorous physical activity. (D) Sitting time ≤7.5 hours per day. (E) Sitting time >7.5 hours per day. y, years.
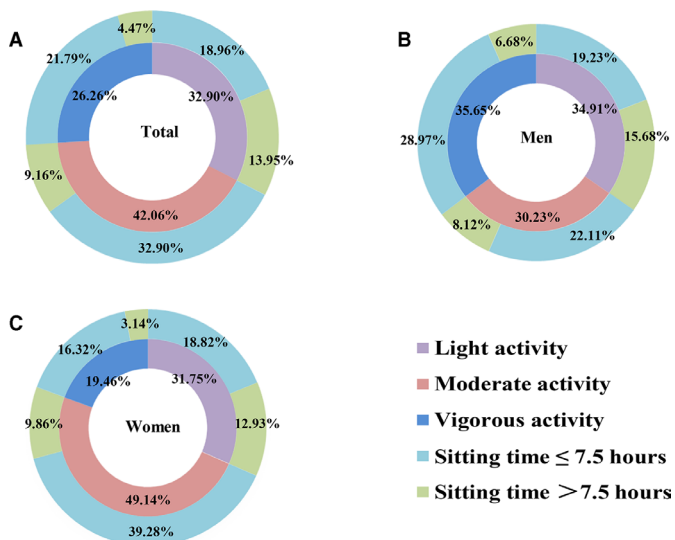
Prevalence of light PA and sitting >7.5 hours per day

Online supplementary table 2 displays the prevalence of light PA and sitting >7.5 hours per day among various characteristics. The prevalence of light PA and sitting >7.5 hours per day were 32.02% and 26.60%, and the age-standardised prevalence of light PA and sitting >7.5 hours per day were 32.74% and 26.88% in the general Chinese rural adults, respectively. Gender differences were: 34.91%, 29.76% for men and 31.75%, 25.16% for women, respectively. Subgroup study showed that the prevalence of low PA and sitting >7.5 hours per day were higher in those who were younger or older, male, widowed/single/divorced/separated with lower per capita monthly income, heavy smoking and drinking.

Figure 3 The age-standardised percentage according to the cut-off points of physical activity and sitting time in different genders. (A) Total. (B) Men. (C) Women.

Changes of light PA and sitting >7.5 hours per day in different subgroups

Figure 2 shows that the age-standardised prevalence of light PA and sitting >7.5 hours per day changed with age in both sexes. The prevalence of light PA and sitting >7.5 hours per day decreased with age first and then increased. Men had higher probability of having high PA and sitting >7.5 hours per day than women in all the age groups. Online supplementary figure 1 shows the age-standardised prevalence according to WHO.

The percentage according to the cut-off points of PA and sitting time in different sexes

Figure 3 shows the age-standardised percentage according to the cut-off points of PA and sitting time in different sexes. Seventeen thousand three hundred and forty-six subjects (7434 men and 9912 women) had light PA or sitting >7.5 hours per day, and the corresponding age-standardised prevalence was 46.53% (49.71% in men and 44.75% in women). The age-standardised prevalence of participants with both light PA and single sitting >7.5 hours per day was 13.95% (15.68% in men and 12.93% in women). Online supplementary figure 2 shows the age-standardised percentage according to WHO cut-off points and sitting time.

Analysis of influencing determinants

Table 2 describes the ORs of the association of potential influencing determinants with light PA and sitting time >7.5 hours per day. Being female, in the 18–29 years age group, level of education at least junior middle school, divorced/widowed/unmarried, RMB1000 >per capita monthly income ≥RMB500, never smoking and drinking, and sitting time per day were significantly negatively associated with light PA; while being male, level of education upto primary school, per capita monthly income <RMB500, heavy smoking and

Table 2 Association of potential risk factors for physical activity and sitting time

	OR (95% CI)					
	Physical activity				Sitting time per day	
Factors	Moderate*	Moderate†	Light*	Light†	>7.5 hours*	>7.5 hours†
Age (years)						
18-	1.00	1.00	1.00	1.00	1.00	1.00
30-	0.67 (0.56 to 0.81)	0.70 (0.58 to 0.85)	0.58 (0.48 to 0.70)	0.63 (0.51 to 0.76)	0.99 (0.85 to 1.14)	1.04 (0.89 to 1.22)
40-	0.49 (0.41 to 0.57)	0.52 (0.44 to 0.62)	0.42 (0.36 to 0.50)	0.47 (0.39 to 0.56)	0.91 (0.79 to 1.04)	0.98 (0.85 to 1.13)
50-	0.48 (0.41 to 0.57)	0.52 (0.44 to 0.61)	0.36 (0.30 to 0.42)	0.39 (0.33 to 0.47)	0.87 (0.76 to 0.99)	0.94 (0.82 to 1.09)
60-	0.45 (0.38 to 0.52)	0.51 (0.43 to 0.61)	0.46 (0.39 to 0.54)	0.51 (0.43 to 0.62)	0.89 (0.78 to 1.02)	0.89 (0.77 to 1.02)
70–79	0.62 (0.52 to 0.74)	0.72 (0.60 to 0.87)	1.13 (0.95 to 1.35)	1.17 (0.97 to 1.42)	1.34 (1.17 to 1.54)	1.08 (0.93 to 1.26)
Gender						
Female	1.00	1.00	1.00	1.00	1.00	1.00
Male	0.44 (0.42 to 0.46)	0.46 (0.43 to 0.50)	0.83 (0.79 to 0.88)	0.76 (0.70 to 0.83)	1.30 (1.24 to 1.36)	1.25 (1.16 to 1.35)
Education						
≤ Primary school	1.00	1.00	1.00	1.00	1.00	1.00
≥ Junior middle school	1.01 (0.96 to 1.06)	1.07 (1.01 to 1.14)	0.97 (0.92 to 1.02)	1.27 (1.20 to 1.35)	0.92 (0.88 to 0.97)	0.85 (0.81 to 0.90)
Marital status						
Married/cohabiting	1.00	1.00	1.00	1.00	1.00	1.00
Divorced/widowed/unmarried	1.22 (1.12 to 1.33)	1.15 (1.05 to 1.26)	1.62 (1.49 to 1.77)	1.19 (1.09 to 1.31)	1.20 (1.11 to 1.28)	1.08 (1.00 to 1.17)
Per capita monthly income						
<RMB500	1.00	1.00	1.00	1.00	1.00	1.00
RMB500-	1.15 (1.08 to 1.22)	1.16 (1.09 to 1.23)	0.94 (0.88 to 1.00)	1.08 (1.01 to 1.15)	0.75 (0.71 to 0.80)	0.79 (0.75 to 0.84)
≥RMB1000	1.16 (1.09 to 1.23)	1.13 (1.06 to 1.21)	0.88 (0.83 to 0.94)	1.00 (0.93 to 1.07)	0.96 (0.91 to 1.02)	1.01 (0.95 to 1.07)
Smoking						
Never	1.00	1.00	1.00	1.00	1.00	1.00
Light	0.52 (0.46 to 0.58)	0.57 (0.51 to 0.64)	0.84 (0.75 to 0.93)	0.79 (0.70 to 0.89)	1.04 (0.93 to 1.16)	0.88 (0.78 to 0.99)
Moderate	0.52 (0.46 to 0.59)	0.61 (0.54 to 0.69)	0.86 (0.77 to 0.97)	0.85 (0.75 to 0.97)	1.21 (1.07 to 1.36)	1.02 (0.90 to 1.16)
Heavy	0.47 (0.44 to 0.51)	0.57 (0.52 to 0.61)	0.87 (0.81 to 0.92)	0.83 (0.77 to 0.90)	1.41 (1.33 to 1.51)	1.20 (1.10 to 1.31)
Drinking,						
Never	1.00	1.00	1.00	1.00	1.00	1.00
Light	0.50 (0.46 to 0.54)	0.64 (0.59 to 0.69)	0.76 (0.71 to 0.81)	0.80 (0.74 to 0.87)	1.19 (1.10 to 1.28)	0.98 (0.90 to 1.06)
Moderate	0.54 (0.48 to 0.61)	0.71 (0.63 to 0.81)	0.82 (0.73 to 0.91)	0.93 (0.82 to 1.05)	1.08 (0.96 to 1.22)	0.82 (0.72 to 0.92)
Heavy	0.51 (0.44 to 0.58)	0.70 (0.61 to 0.81)	1.01 (0.89 to 1.13)	1.10 (0.96 to 1.27)	1.31 (1.16 to 1.48)	1.06 (0.93 to 1.21)
Dietary habits						
Meat and poultry	1.04 (1.02 to 1.06)	1.08 (1.06 to 1.10)	0.93 (0.91 to 0.95)	1.01 (0.99 to 1.04)	1.01 (0.99 to 1.03)	0.95 (0.93 to 0.97)
Fishery products	1.16 (0.99 to 1.34)	0.97 (0.82 to 1.16)	0.61 (0.52 to 0.72)	0.76 (0.63 to 0.93)	2.16 (1.86 to 2.52)	2.21 (1.87 to 2.60)

Continued

Table 2 Continued

Factors	OR (95% CI)					
	Physical activity				Sitting time per day	
	Moderate*	Moderate†	Light*	Light†	>7.5 hours*	>7.5 hours†
Vegetables and fruits	1.01 (1.01 to 1.01)	1.01 (1.00 to 1.01)	0.97 (0.97 to 0.97)	0.96 (0.96 to 0.97)	1.04 (1.03 to 1.04)	1.05 (1.04 to 1.05)
Soy products	0.91 (0.88 to 0.94)	0.88 (0.85 to 0.92)	0.74 (0.71 to 0.77)	0.81 (0.78 to 0.85)	0.91 (0.87 to 0.95)	0.91 (0.88 to 0.95)
Sitting time per day						
≤7.5 hours	1.00	1.00	1.00	1.00	–	–
>7.5 hours	1.34 (1.25 to 1.42)	1.35 (1.27 to 1.44)	3.68 (3.47 to 3.91)	4.09 (3.84 to 4.36)	–	–
Physical activity						
Vigorous	–	–	–	–	1.00	1.00
Moderate	–	–	–	–	1.34 (1.25 to 1.42)	1.37 (1.28 to 1.46)
Light	–	–	–	–	3.68 (3.47 to 3.91)	4.08 (3.83 to 4.34)

*Was a crude model;.
†Was a full model: adjusted for age, gender, education, marital status, per capita monthly income, smoking, drinking and dietary habits.

drinking, fishery products, vegetables and fruits, were significantly negatively associated with sitting >7.5 hours per day. Online supplementary table 3 shows the potential influencing determinants according to WHO.

DISCUSSION

Results of this large survey provided new insights on PA and SB among the rural population in the Henan province of China. Overall, the median levels of sitting time were higher in adults in rural China compared with a previous study of a 20-country comparison of sitting,[23] and the percentage levels of physical inactivity were higher in Chinese rural adults than in the previous study of global PA levels.[9] At first PA decreased with age; then there was an increase in the prevalence of light PA and sitting >7.5 hours per day. The percentage of men, women and total individuals that had both light PA and sitting >7.5 hours per day were 15.68%, 12.93% and 13.95%, respectively. Further multiple logistic regression analysis found gender, age, level of education, marital status, smoking, drinking and vegetables intake were influencing factors for light PA and sitting >7.5 hours.

Previous studies had shown that the levels of physical inactivity and SB were high in urban China.[10] [11] Compared with urban areas, rural areas are at a relatively low level. The difference might be explained by the level of development. The mean of Mets increased with age initially and then decreased in the 50–59 years age group, while the sitting time was highest in the 70–79 years age group. It is likely that the decline in physical ability with age limits PA and increases the sedentary nature of the elderly.[24] Furthermore, the aged might fear injuries, which was another reason leading to their physical inactivity.[25] Subgroup analysis of PA showed that under the

various categories, the prevalence of vigorous PA was about 30%, moderate PA was about 40% and light PA was about 30%, whereas sitting time, under the various categories, ≤7.5 hours per day was about 70%. These results were similar to that from a Chilean study.[23]

The results of coexistence of PA and SB showed that light PA and sitting time >7.5 hours per day were 15.68%, 12.93% and 13.95 in men, women and totally, respectively. These results were similar to that from a study from Japan.[26] Participants with light PA and sitting time >7.5 hours per day, should adopt measures to promote their PA.

Evidence showed that there were negative relationships between junior middle school education level or above, divorced/widowed/unmarried, per capita monthly income ≥RMB500, and meat and poultry consumption, and moderate PA. Having a junior middle school education level or above, divorced/widowed/unmarried, RMB1000> per capita monthly income ≥RMB500, and sitting time per day >7.5 hours were negatively associated with light PA. For sitting >7.5 hours per day, the negative factors were being male, divorced/widowed/unmarried, heavy smoking, fishery products and vegetable and fruits intake.

The current study focused on the epidemiological characteristics of PA and SB based on a relatively large sample size of the rural population in the Henan province of China. Although a series of measures, such as standardised tools and training implementation, had been adopted to guarantee the authenticity, there were several limitations. First, these results were based on a cross-sectional study, so the causal relationships between factors and PA or SB could not be confirmed. Second, the responses were from self-reported data, which could distort real facts. Third, according to the actual rural circumstances, the residents who studied or worked in cities were not included in this

study, so the prevalence of Mets in the rural population might be overestimated or underestimated. Fourth, the subjects included in the present study had an asymmetrical age structure, which might lead to potential bias of IPAQ. Fifth, according to the actual rural circumstances, the residents who studied or worked in the city were not included in this study, so the prevalence of PA and SB in the rural population could be overestimated. Although these limitations exist, the relatively large sample size of this epidemiological study could reflect the prevalence of PA and SB in rural areas of China.

CONCLUSION

This study suggests a relatively higher prevalence of physical inactivity and SB among Chinese rural adults as a result of economic and social transition. More attention should be given to the aged population and to individuals who drink who are at high risk of physical inactivity.

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