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Sociodemographic disparity in health-related behaviours and dietary habits among public workers in China: a cross-sectional study

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ABSTRACT

Objective We aimed to estimate the distribution of health-related behaviours and dietary habits by sociodemographics among public workers in China.

Design Cross-sectional study.

Setting A representative sample was obtained from 10 government-run institutions in Hunan province of China.

Participants A total of 5029 public workers were included in this study.

Primary and secondary outcome measures Prevalence on their sociodemographic characteristics, health-related behaviours and dietary habits. Socioeconomic status (SES) scores were calculated by multiplying ordinal numerical values assigned to consecutive categories of education level and annual household income. Multivariate logistic regression analysis and categorical principal component analysis were used to estimate differences in health-related behaviours and dietary habits by sociodemographics.

Results The distribution of health-related behaviours and dietary habits was varied by sociodemographic groups. Middle-aged groups (41–60 years) were more likely to smoke (for men, 34.5%), use alcohol (for men, 22.5%), and have short sleep duration (for men, 36.3%; for women, 39.6%). Young participants (≤30 years) were more likely to have multiple unhealthy behaviours and dietary habits. Those in low-SES have a significant higher rate of smoking (OR_{adj}=1.46, 95% CI: 1.15 to 1.85) and leisure-time physical inactivity (OR_{adj}=1.18, 95% CI: 1.02 to 1.37), but a lower rate of late sleeping (OR_{adj}=0.69, 95% CI: 0.57 to 0.83) than those in high-SES. Notably, older men (≥51 years) with low-SES preferred the 'smoked and pickled foods and dessert' and 'fish and nut' pattern. In high-SES groups, 41–50 year old people preferred the 'traditional foods' and 'cereals and dairy product' pattern. No difference in dietary patterns by sociodemographics was found among women (p<0.05).

Conclusions Our findings of the disparity distribution of health-related behaviours and dietary habits by specific gender, age and SES among Chinese public workers have important policy implications for developing targeted health interventions to facilitate health-related behaviours and dietary habits in this population.

INTRODUCTION

Globally, health-related behaviours and dietary habits play an essential role in shaping

Strengths and limitations of this study

► This is the first study using a large sample from a representative urban public worker population.

► This is also the first study to use the categorical principal components analysis method to study health-related behaviours and dietary habits by sociodemographic characteristics such as gender, age and socioeconomic status groups.

► Many variables were self-reported, and the findings may be subject to recall bias.

► Results and conclusions referred to dietary habits are based on a questionnaire that have not been validated in the population of interest so they cannot be made with confidence owing to the increased opportunity for measurement bias.

► Many variables were self-reported, and the findings may be subject to recall bias.

population health. Health-related behaviours can be defined as voluntary behaviours that relate to health or disease,[1] some of which may lead to negative outcomes from a health perspective, such as smoking, alcohol drinking, physical inactivity and sedentary lifestyle. Health-related behaviours have been recognised as major determinants of morbidity and mortality,[2 3] and their role extends to the development and progression of diseases, the effectiveness of treatments and quality of life.[4] The most common diseases can be prevented with the adoption of healthier behaviours.[5 6] Among various health-related behaviours, smoking is a chief contributor to morbidity and the leading cause of mortality.[6 7] Dietary habits are the habitual decisions of individuals or group of people regarding what foods they eat.[8] Some unhealthy dietary habits (eg, eating midnight snack and consuming pickled foods) have been shown to be associated with a higher risk of cancer.[9–11] The importance of healthy

behaviours and dietary habits is underscored by the US Affordable Health Care Act, which provides unprecedented universal coverage for preventive behavioural and dietary health services.[12]

The distributions of health-related behaviours and dietary habits usually differ by sociodemographic characteristics, such as gender, age and social class.[13–15] Men (including male adolescents), for instance, are more likely than women to smoke, binge drink;[16 17] women (including female adolescents), by contrast, are less likely to engage in physical activity.[18] Younger people were more likely to get involved in risk behaviours and unhealthy dietary habits than older people.[19 20] Those with high socioeconomic status (SES) were less likely to smoke, and have a low level of physical inactivity, but more likely to have high nutritional eating patterns.[21–25] These sociodemographic factors shape social context and day-to-day routines, which in turn influence health behaviours and dietary habits, as well as people's ability to change. Knowledge of sociodemographic-specific behavioural characteristics and their interrelationships can help pinpoint intervention targets and guide for the development of efficacious interventions.

Although health-related behaviours and dietary habits have been found to be associated with sociodemographics such as gender, age and SES, these factors are usually studied separately. There is a lack of comprehensive study on health-related behaviours and dietary habits by taking into account of all sociodemographic factors together, for instance, by combining age and gender. Also, most of the study were conducted in developed countries, it is also important to learn about the situation in developing countries such as China. The current study was conducted to understand the distribution of health-related behaviours and dietary habits by sociodemographics among public workers in urban area of China.

METHODS
Study design and setting
This cross-sectional study was conducted between January 2018 and December 2018 in Changsha city, Hunan province of China which has been described in our previous study.[26] Briefly, a multistage sampling design was carried out to obtain a representative sample. First, 10 institutions were randomly sampled from the government-run institutions that volunteered to participate in the study in Changsha city. Second, in each sampled institution, all the workers were selected to take part in our study using cluster sampling. In China, public workers are those working in the national legislative branch, judicial branch, administrative organs, the Party organs of the Communist Party of China and the democratic parties, people's organisations and public institutions, who perform public duties according to law, such as civil servants, regular employee at university or hospital. After obtaining informed consent, eligible participants were asked to complete a digital self-reported questionnaire.

The eligibility criteria for participants included: (1) being able to speak and understand Chinese, (2) being 18–60 years old, (3) working at the selected institution and (4) having no serious limb diseases. We invited 9149 public workers, and 7181 agreed to participate in, representing a response rate of 78.5%. Finally, a total of 5029 public workers that meet the criterion were include in this study.

Sociodemographic characteristics
The collected sociodemographic data included information on demographic (age, gender, marital status) and socioeconomic characteristics (education and annual household income). SES scores were calculated by multiplying ordinal numerical values assigned to consecutive categories of education level and annual household income.[27] Educational attainment was divided into six groups, and annual household income was divided into seven groups. The SES score ranged from 1 to 42. According to the tertile values of the SES score distribution, study participants were further divided into three groups: low-SES (L-SES, 1–12 points), medium-SES (M-SES, 13–18 points) and high-SES (H-SES, 19–42 points).

Health-related behaviours
Data on health-related behaviours were collected using standardised questionnaires (see in online supplemental appendix 1), which included smoking, alcohol drinking, leisure-time physical inactivity, sedentary behaviour, late sleeping and short sleep duration. Smoking was defined as smoking at least one cigarette a day for more than half a year, which can be further classified into three status: never, former or current smoking. Alcohol drinking was defined as drinking at least once a week for more than half a year, and can be further classified into three status: never, former or current smoking. Leisure-time physical inactivity was defined as 30 min/day of physical activity at a frequency of once per week or less. Sedentary behaviour was defined as >2 hours/day sitting (such as watching TV and surfing the internet) apart from work and study. Late sleeping was defined as sleeping after midnight, and short sleep duration was defined as sleeping time <7 hours per night.

Dietary habits
Dietary habits included four eating behaviour habits and 15 kinds of food consumption. Eating behaviour habits included irregular meals habit (yes or no), eating midnight snack habit (yes or no), eating gluttony habit (yes or no) and salty taste habit (yes or no). Food consumption was assessed by asking whether consuming each of the following food groups for more than three times/week: (1) rice, (2) wheat, (3) grains, (4) fish, (5) vegetables, (6) poultry meat, (7) livestock meat (pork, beef/lamb), (8) soybean and products, (9) fruits, (10) eggs, (11) dairy products, (12) nuts, (13) desserts, (14) pickle food and (15) smoked fish or meat.

Table 1 Discretisation criteria used in the principal components analysis of categorical data

Variable	Property	Criteria for classification	Assumable value
Gender	Dichotomous	Male, female	1, 2
Age	Ordinal	≤29, 30–40, 41–64, ≥65	1, 2, 3, 4
SES	Ordinal	SES score: ≤10; 11–16; 17–42	1, 2, 3
Rice consumption habit	Dichotomous	<3 days/week; >3 days/week	1, 2
Vegetable consumption habit	Dichotomous	<3 days/week; >3 days/week	1, 2
Wheat consumption habit	Dichotomous	<3 days/week; >3 days/week	1, 2
Grain consumption habit	Dichotomous	<3 days/week; >3 days/week	1, 2
Fish consumption habit	Dichotomous	<3 days/week; >3 days/week	1, 2
Livestock meat consumption habit	Dichotomous	<3 days/week; >3 days/week	1, 2
Poultry meat consumption habit	Dichotomous	<3 days/week; >3 days/week	1, 2
Soybean and products	Dichotomous	<3 days/week; >3 days/week	1, 2
Fruit consumption habit	Dichotomous	<3 days/week; >3 days/week	1, 2
Egg consumption habit	Dichotomous	<3 days/week; >3 days/week	1, 2
Dairy products consumption habit	Dichotomous	<3 days/week; >3 days/week	1, 2
Nut consumption habit	Dichotomous	<3 days/week; >3 days/week	1, 2
Dessert consumption habit	Dichotomous	<3 days/week; >3 days/week	1, 2

SES, socioeconomic status.

Data analysis

Crude frequencies and weighted percentages were calculated for the distribution of sociodemographic characteristics. Among these sociodemographic variables, gender, age and SES were considered as important factors for health-related behaviours and dietary habits. Thus, analyses of health-related behaviours and dietary habits were stratified by these three variables. Participants were grouped into eight categories based on gender (male/female) and four age subgroups (≤30, 31–40, 41–50 and ≥51), and three categories based on SES. Weighted percentage of the six health-related behaviours and four eating habits were calculated by these categories. Multivariate logistic regression analysis was used to determine frequencies (health-related behaviours and eating habits) in L-SES and H-SES.

Categorical principal components analysis (CATPCA) was used to examine the different consumption patterns for the 15 food groups mentioned previously (table 1). The analysis allowed for simultaneous evaluation of the relationships between various variables. The analysis was considered reliable for Cronbach's alpha coefficient >0.7. All the statistical analyses were performed using SPSS V.19.0 software. A two-sided p value <0.05 was considered as being of statistical significance.

Patient and public involvement

No patients were involved in the design of the study.

RESULTS
Sample characteristics

A total of 5029 participants were included in the study (3006 for women; 2023 for men), and their characteristics were shown in table 2. The age distribution of the sample was as follows: 19.6% of participants were ≤30 years, 40.1% were 31–40 years, 24.8% were 41–50 years and 15.6% were ≥51 years old. Most participants were married/cohabited (84.8%), with an education level of undergraduate/college or above (94.6%), and with a family income level of 1 10 000–200 000 (36.2%). According to the definition of SES for the current study, 35.3% were in L-SES group, 36.6% were in M-SES group and 28.1% were in H-SES group. The rate of current smoking, current alcohol drinking, leisure-time physical inactivity, sedentary behaviour, late sleeping and short sleep duration among the participants was 12.0%, 6.7%, 54.8%, 74.8%, 16.6% and 34.4%, respectively. Additionally, the rate of four eating behaviour habits was 38.3% for irregular meals habit, 26.1% for salty taste habit, 4.8% for eating gluttony and 2.0% for eating midnight snack, respectively (table 2).

Distribution of health-related behaviours and eating behaviour habits by gender and age

We further examined distribution of health-related behaviours and eating behaviour habits by age for men and women separately (table 3). Smoking and alcohol drinking behaviours were observed for men, but hardly for women. For men, the age of ≥51 years group had the highest rate of current smoking (36.2%, p<0.001), current alcohol drinking (25.7%, p<0.001) and short sleep duration (39.0%, p=0.001). Younger men (age ≤40 years, p<0.001) had a high rate of leisure-time physical inactivity (age ≤30 years: 52.8%; age 31–40 years: 59.6%). The youngest age group (age ≤30 years, p<0.001) had the highest rate of sedentary behaviour (80.4%) and

Table 2	Characteristics of study participants	
Variable	**Frequency**	**Weighted percentage**
Gender		
Male	2023	40.2
Female	3006	59.8
Age (years)		
≤30	981	19.6
31–40	2017	40.1
41–50	1245	24.8
≥51	786	15.6
Marital status		
Married/cohabited	4265	84.8
Unmarried	619	12.3
Divorced/widowed	145	2.9
Education		
Elementary school or below	8	0.2
Middle school	40	0.8
Vocational technical school	75	1.5
Senior school	149	3.0
Undergraduate and college	2677	53.2
Postgraduate and above	2080	41.4
Family income (CNY)		
<50 000	525	10.4
50 000–100 000	1186	23.6
110 000–200 000	1893	37.6
210 000–300 000	944	18.8
310 000–500 000	378	7.5
510 000–1 000 000	83	1.7
>1 000 000	20	0.4
SES*		
Low	1777	35.3
Medium	1838	36.6
High	1414	28.1
Smoking (current)	601	12.0
Drinking (current)	338	6.7
Leisure-time physical inactivity†	2756	54.8
Sedentary behaviour‡	3761	74.8
Late sleeping§	836	16.6
Short sleep duration¶	1723	34.4
Irregular meals habit**	1926	38.3
Eating midnight snack	98	2.0
Eating gluttony habit	242	4.8

Continued

Table 2	Continued	
Variable	**Frequency**	**Weighted percentage**
Salty taste habit	1404	26.1

*SES: socioeconomic status was calculated as education multiplied by family income.
†Leisure-time physical inactivity was defined as 30 min/day of physical activity at a frequency of once per week or less.
‡Sedentary behaviour was defined as the time spent sitting (such as watching TV and surfing the internet) >2 hours/day in addition to work and study.
§Late sleeping was defined as the time to fall asleep after midnight.
¶Short sleep duration was defined as sleep time <7 hours per night.
**Irregular meals habit was defined as not eating three meals on time per day.
SES, socioeconomic status.

late sleeping (30.1%). As for eating behaviour habits, the youngest age group (age ≤30 years, p<0.001) had the highest rate of irregular meals habit (50.4%), eating midnight snack habit (3.5%), eating gluttony habit (10.3%) and salty taste habit (35.8%).

For women, the youngest age group (age ≤30 years, p<0.001) had the highest rate of sedentary behaviour (81.7%), leisure-time physical inactivity (69.4%) and late sleeping (20.7%). The ≥51 years age group had the highest rate of short sleep duration (45.4%, p=0.001). As for eating behaviour habits, the youngest age group (age ≤30 years, p<0.001) had the highest rate of irregular meals habit (61.1%), eating midnight snack habit (3.9 %), eating gluttony habit (7.0%) and salty taste habit (25.6%). A negative dose–response trend increasing age was found in irregular meals habit, eating midnight snack habit and salty taste habit (p<0.001).

Distribution of health-related behaviours and eating behaviour habits by SES

Table 4 presented the distribution of health-related behaviours and eating behaviour habits among different SES groups after adjusting for age, gender and marital status. For health-related behaviours, compared with the H-SES group, the L-SES group demonstrated a significantly higher rate of current smoking (adjusted OR (OR_{adj})=1.46, 95% CI: 1.15 to 1.85) and leisure-time physical inactivity (OR_{adj}=1.18, 95% CI: 1.02 to 1.37), but a significantly lower rate of late sleeping (OR_{adj}=0.69, 95% CI: 0.57 to 0.83). No significant differences were found in the rate of current alcohol drinking, sedentary behaviour and short sleep duration (p>0.05). Additionally, the rate of the four dietary behaviours were similar in the three different SES groups (p>0.05).

Food consumption patterns by gender, age and SES

CATPCA was performed to identify the patterns of food consumption for 15 food groups by gender, age and SES (figure 1). The Cronbach's alpha was 0.887 and the total

Table 3 Distribution of health-related behaviours and eating behaviour habits by age and gender

Characteristics	Gender*	Age ≤30 years M (n=282) F (n=699)		Age 31–40 years M (n=705) F (n=1312)		Age 41–50 years M (n=577) F (n=668)		Age ≥51 years M (n=459) F (n=327)		P value
		n	%	n	%	n	%	n	%	
Health-related behaviours										
Smoking (current)										<0.001
	M	55	19.5	176	25.0	191	33.1	166	36.2	
	F	2	0.3	2	0.2	7	1.0	1	0.3	
Alcohol drinking (current)										<0.001
	M	18	6.4	81	11.5	115	19.9	118	25.7	
	F	0	0.0	2	0.2	3	0.4	1	0.3	
Leisure-time physical inactivity†										<0.001
	M	149	52.8	420	59.6	262	45.4	157	34.2	
	F	485	69.4	898	68.4	287	43.0	98	30.0	
Sedentary behaviour‡										<0.001
	M	227	80.4	521	73.9	442	76.6	351	76.5	
	F	571	81.7	921	70.2	491	73.5	237	72.5	
Late sleeping§										<0.001
	M	85	30.1	136	19.3	79	13.7	64	13.9	
	F	145	20.7	192	14.6	99	14.8	36	11.0	
Short sleep duration¶										0.001
	M	74	26.2	230	32.6	197	34.1	179	39.0	
	F	195	27.9	441	33.6	260	38.9	147	45.4	
Eating behaviour habits										
Irregular meals habit**										<0.001
	M	142	50.4	283	40.1	153	26.5	99	21.6	
	F	427	61.1	546	41.6	196	29.3	80	24.5	
Eating midnight snack										<0.001
	M	10	3.5	17	2.4	3	0.5	5	1.1	
	F	27	3.9	29	2.2	5	0.7	2	0.5	
Eating gluttony habit										<0.001
	M	29	10.3	37	5.2	25	4.3	22	4.8	
	F	49	7.0	58	4.4	12	1.8	10	3.1	
Salty taste habit										<0.001
	M	101	35.8	245	34.8	177	30.8	147	32.0	
	F	179	25.6	283	21.6	123	18.4	59	18.0	

*M: male; F: female.
†Leisure-time physical inactivity was defined as 30 min/day of physical activity at a frequency of once per week or less.
‡Sedentary behaviour was defined as the time spent sitting (such as watching TV and surfing the internet) >2 hours/day in addition to work and study.
§Late sleeping was defined as the time to fall asleep over 24 hours.
¶Short sleep duration was defined as sleeping time <7 hours per night.
**Irregular meals habit was defined as being not eating three meals on time per day.

eigenvalue was 5.812, indicating good reliability for assessment of simultaneous relationships among the selected variables. Among the 15 food groups, rice consumption habit was located at the centroid. Four food consumption patterns were identified. Pattern 1 named 'traditional foods' pattern was characterised by more consumption of vegetables, livestock and poultry meat, fruits and eggs. Pattern 2 named 'cereals and dairy product' pattern was characterised by more consumption of grain, wheat, soybean and products and dairy product. Pattern 3 named 'fish and nut' pattern was characterised by more consumption of fish and nut. Pattern 4 named 'smoked

Table 4 Distribution of health-related behaviours and eating behaviour habits by SES

Characteristics	L-SES n=1777		M-SES n=1838		H-SES n=1414		Adjusted OR*	95% CI	P value*
	n	%	n	%	n	%			
Health-related behaviours									
Smoking (current)	244	13.7	196	10.7	161	11.4	**1.46**	**1.15 to 1.85**	**0.006**
Drinking alcohol(current)	117	6.6	118	6.4	103	7.3	0.98	0.73 to 1.32	0.739
Leisure-time physical inactivity†	966	54.4	1056	57.5	734	51.9	**1.18**	**1.02 to 1.37**	**0.028**
Sedentary behaviour‡	1324	74.5	1374	74.8	1063	75.2	0.91	0.77 to 1.07	0.234
Late sleeping§	270	15.2	304	16.5	262	18.5	**0.69**	**0.57 to 0.83**	**<0.001**
Short sleep duration¶	623	35.1	634	34.5	466	33.0	1.08	0.93 to 1.26	0.290
Eating behaviour habit									
Irregular meals habit**	715	40.2	717	39.0	494	34.9	1.13	0.97 to 1.31	0.128
Eating midnight snack	34	1.9	40	2.2	24	1.7	1.01	0.59 to 1.74	0.934
Eating gluttony habit	85	4.8	98	5.3	59	4.2	1.04	0.74 to 1.48	0.803
Salty taste habit	464	26.1	472	25.7	378	26.7	0.99	0.84 to 1.17	0.722

Significant difference is highlighted by bold font (p < .05).
*Adjusted by age, gender and marital status; differences were assessed between L-SES and H-SES, with H-SES as a reference.
†Leisure-time physical inactivity was defined as 30 min/day of physical activity at a frequency of once per week or less.
‡Sedentary behaviour was defined as the time spent sitting (such as watching TV and surfing the internet) >2 hours/day in addition to work and study.
§Late sleeping was defined as the time to fall asleep over 24 hours.
¶Short sleep duration was defined as sleeping time <7 hours per night.
**Irregular meals habit was defined as being not eating three meals on time per day.
H-SES, high socioeconomic status; L-SES, low socioeconomic status; M-SES, medium socioeconomic status.

and pickled foods, and dessert' pattern was characterised by more consumption of smoked fish or meat, pickle food and dessert.CATPCA indicated the 'traditional foods' and 'cereals and dairy product' patterns were mainly observed in the 41–50 years age group with H-SES. 'Fish and nut' and 'smoked and pickled foods, and dessert' patterns were mainly observed among the ≥51 years old men in L-SES group. There is an absence of difference in four food consumption patterns among young women (aged ≤40 years old) in the M-SES group.

DISCUSSION

This cross-sectional study showed that the distributions of health-related behaviours and dietary habits varied by gender, age and SES among public workers in China. Men in the middle-aged group (41–60 years) were more likely to smoke, use alcohol and have short sleep duration, but men in the 31–40 years age group had the highest rate of leisure-time physical inactivity (59.6%). Young women (age ≤30 years) were more likely to have leisure-time physical inactivity, but women aged ≥51 years were more likely to have short sleep duration. Sedentary behaviour, late sleeping, as well as all four risk eating behaviour habits were more prevalent in the youngest age group (age ≤30 years), regardless of gender. In addition, we found that people in the H-SES group were less likely to be current smoker and have physical inactivity, but were more likely to have late sleeping. We also identified four

food consumption patterns, which varied by gender, age and SES.

We found gender and age differences in the occurrence of health-related behaviours. For instance, the rate of smoking and alcohol drinking were much lower in women than men, which may be explained by sociocultural factors. The social gender role in culture considers it acceptable, appropriate or even desirable to engage in certain behaviours such as smoking and drinking for men, but almost not for women.[28–30] In this study, a higher rate of smoking and alcohol drinking was found in middle-aged (41–60 years) men than that in younger men (≤40 years). In recent years, the Chinese government has been gradually strengthening the policies against tobacco use, and the group intervention on smoking cessation based on social cognitive theory could be effective to reduce smoking.[31 32] Male smokers in the high age group lacking health knowledge and ignoring the proper health behaviours cannot sufficiently understand the need for preventive measures,[33 34] even reduce the stress of social isolation, economic hardship, prior trauma and the loss of power and status by smoking.[35] In addition, we found young women and men had a high rate of leisure-time physical inactivity, late sleeping and sedentary behaviour, which was consistent with previous research.[36] With the rapid socioeconomic development in China and changes in urbanisation, work stress emerged in the urban population, especially among the working young population due
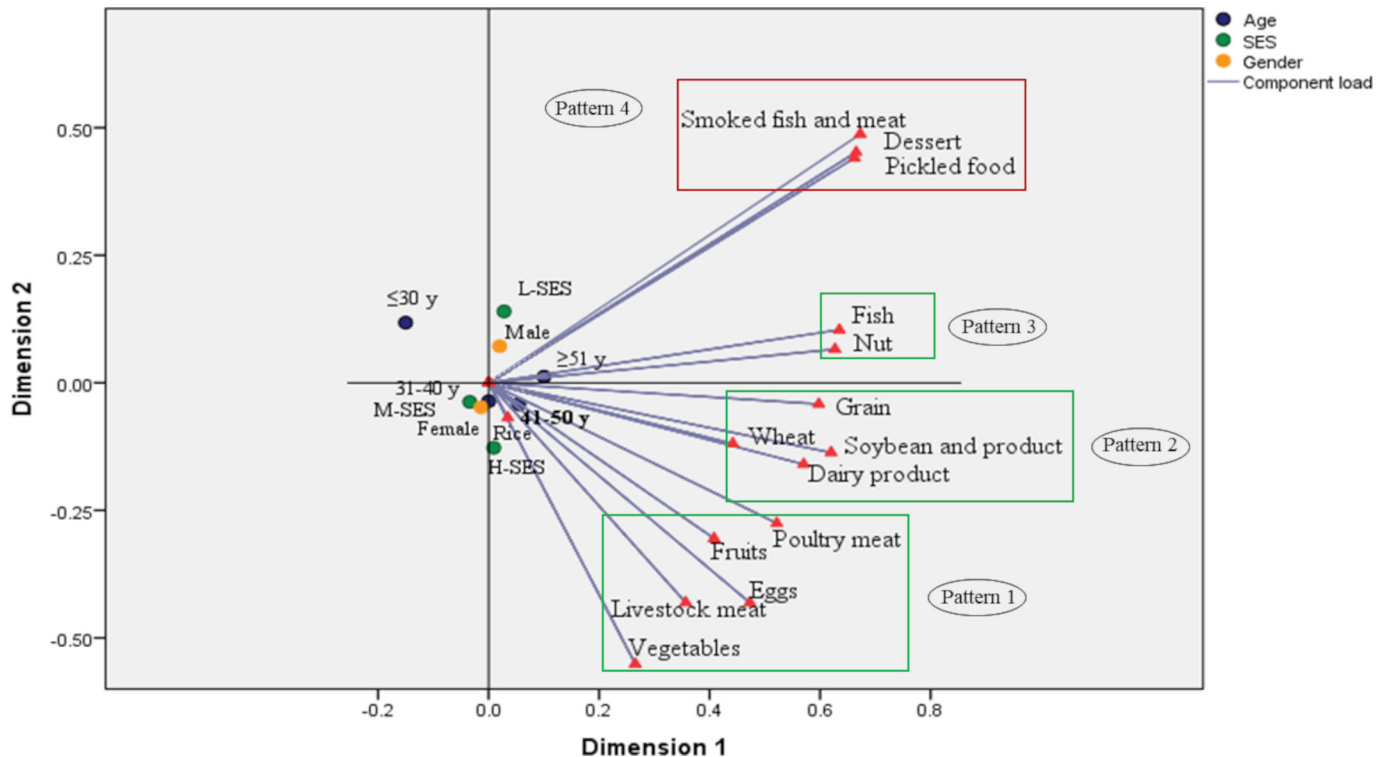
Figure 1 Principal components analysis of categorical data (Cronbach's alpha=0.887; eigenvalue=5.812). Variables in association: Pattern 1 named 'traditional foods' pattern was characterised by more consumption of vegetables, livestock and poultry meat, fruits and eggs. Pattern 2 named 'cereals and dairy product' pattern was characterised by more consumption of grain, wheat, soybean and products and dairy product. Pattern 3 named 'fish and nut' pattern was characterised by more consumption of fish and nut. Pattern 4 named 'smoked and pickled foods, and dessert' pattern was characterised by more consumption of smoked fish or meat, pickle food and dessert; H-SES, high-socioeconomic status; L-SES: low-socioeconomic status; M-SES, medium-socioeconomic status; SES, socioeconomic status.

to a rise in living costs, which may result in long working time and lacking leisure time to participate in physical activity. Modern media use has also become intricately connected with our bedtime routine and sleep.[37] Additionally, individuals in the ≥51 years age group were more likely to have a high level of short sleep duration. These findings strongly suggest that planning of effective health promotion programmes should target health-related behaviours that are modified by gender and age.

The association between SES and various health-related behaviours are multiple and complex.[38] Past studies have consistently shown SES as the strongest predictor of tobacco use.[39–41] In the current study, we found higher rate of smoking and leisure-time physical inactivity in the L-SES group than H-SES group, which was consistent with previous research.[42 43] Our study, for the first time, found a higher rate of late sleeping in H-SES group than L-SES group among public workers in China. Tobacco control policies, leisure-time physical inactivity and late sleeping interventions in China should be increasingly focused on populations with low-SES in order to break the link between socioeconomic disadvantage and these unhealthy behaviours. Education, one of the components of SES, remained the strongest predictor of these unhealthy behaviors,[39–41 43] suggesting future intervention programmes to take targeted measures to reduce

unhealthy behaviours, according to education attainment status. Although no significant differences in short sleep duration and sedentary behaviours were observed by SES in this study, we found much higher rate of short sleep duration and sedentary behaviours in our study population than the general population in southeast of China in other studies, [42 44] drawing our attention to the impact of short sleep duration and sedentary behaviours on health among this special population.[9]

We found differences in dietary habits including eating behaviour habits and food consumption patterns by gender, age and SES. For eating behaviour habits, both women and men in the younger age group (≤30 years) have the highest rate of these four unhealthy dietary habits. Younger individuals may get involved easily in unhealthy eating behaviours due to poor control awareness and health literacy.[19 20 45] Although there were no differences in four eating behaviours among three SES groups, combination of some other studies, SES remained an important factor to impact unhealthy eating behaviours.[46–48]

We also explored food consumption patterns by sociodemographics using CATPCAanalysis, which is the first study of its kind among public workers in China. We found the 'traditional foods' and 'cereals and dairy product' patterns were mainly observed in the 41–50

years age group with H-SES. In China, traditional foods such as vegetables, fruits, meats and eggs were considered as healthy food pattern in line with Chinese traditions. Research has consistently shown that high intake of vegetables and fruits, whole grains and eggs may decrease the risk of chronic diseases, even cancer.[49 50] In addition, we found 'fish and nut' and 'smoked and pickled foods, and dessert' patterns were mainly observed among the ≥51 years men in L-SES group. High intake of sugars, and pickled or smoked foods may increase such risk,[9 22 51 52] but fish consumption was associated with a reduced risk of all-cause mortality.[53] Available study has pointed out that men have a higher liking for sweets than women.[54] Younger age, low education and low family income were associated with a poor health literacy status, which may result in a low nutrient food consumption.[45] The findings have implications for future intervention programmes to take targeted measures to reduce unhealthy food consumption habits, according to specific sociodemographic characteristics.

Strengths and limitations

To the best of our knowledge, this is the first study using a large sample from a representative urban public worker population. This is also the first study to use the CATPCA method to study health-related behaviours and dietary habits by sociodemographic characteristics such as gender, age and SES groups. CATPCA was applied: a multivariate analysis for varying discrete systems which builds a mathematical space where the variables are projected. The sociodemographic factors, health-related behaviours and dietary habits were discrete values, so we had to discretise them for analysis by CATPCA. Additionally, CATPCA has standard provisions for the graphical representation of the non-linear principal component analysis output, including the biplots and triplots.[55] As can be seen in figure 1, such a biplot provides a clear and comprehensive view of the relationships between persons and variables. It is possible to enrich this view even further, as CATPCA can label persons by the categories of a particular variable to help determine how specific groups of persons can be distinguished on the basis of that particular variable. However, some limitations should be considered when interpreting our results. First, many variables were self-reported, and the findings may subject to recall bias. Meanwhile, results and conclusions referring to dietary habits were based on a questionnaire that have not been validated in the population of interest so they cannot be made with confidence owing to the increased opportunity for measurement bias. Second, the study participants came from Hunan province and China, and the generalisability of the study findings may not be able to generalise to other parts of China despite its large sample size. Future multiprovince or multinational surveillance studies are needed to further test findings in our study. Third, the cross-sectional study design may preclude any observation of behaviours and dietary habits changes over time. Future longitudinal studies may overcome such a limitation.

CONCLUSIONS

This study confirmed the various distribution of health-related behaviours and dietary habits by sociodemographic characteristics among public workers. Notably, this study found that middle-aged group (41–60 years) had the highest rate of smoking and alcohol drinking, and young-aged group (≤40 years) with L-SES were more likely to have multiple unhealthy behaviours and dietary habits. We also identified four food consumption patterns, which varied by gender, age and SES. Our findings of the disparity distribution of health-related behaviours and dietary habits by specific gender, age and SES among Chinese public workers have important policy implications for developing targeted health interventions to facilitate health-related behaviours and dietary habits in this population.

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REFERENCES

1 TZ Y. Health behavior theory and research 2007.

2 Khaw KT, Wareham N, Bingham S. Combined impact of health behaviours and mortality in men and women: the EPIC-Norfolk prospective population study 2008;5.

3 Mokdad AH, Marks JS, Stroup DF, et al. Actual causes of death in the United States, 2000. JAMA 2004;291:1238–45.

4 Fisher EB, Fitzgibbon ML, Glasgow RE, et al. Behavior matters. Am J Prev Med 2011;40:e15–30.

5 Alwan A, Maclean DR, Riley LM, et al. Monitoring and surveillance of chronic non-communicable diseases: progress and capacity in high-burden countries. Lancet 2010;376:1861–8.

6 Danaei G, Ding EL, Mozaffarian D, et al. The preventable causes of death in the United States: comparative risk assessment of dietary, lifestyle, and metabolic risk factors. PLoS Med 2009;6:e1000058.

7 Lee DH, Ha MH, Kim JR, et al. Effects of smoking cessation on changes in blood pressure and incidence of hypertension: a 4-year follow-up study. Hypertension 2001;37:194–8.

8 Preedy VR, Watson RR, Habits D. Handbook of disease burdens and quality of life measures 2010:4189–89.

9 Huang L, Chen L, Gui Z-X, et al. Preventable lifestyle and eating habits associated with gastric adenocarcinoma: a case-control study. J Cancer 2020;11:1231–9.

10 Bray F, Ferlay J, Soerjomataram I, et al. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2018;68:394–424.

11 Wang Z, Koh W-P, Jin A, et al. Composite protective lifestyle factors and risk of developing gastric adenocarcinoma: the Singapore Chinese Health study. Br J Cancer 2017;116:679–87.

12 Koh HK, Sebelius KG. Promoting prevention through the Affordable care act. N Engl J Med Overseas Ed 2010;363:1296–9.

13 Magnusson RS. Global health governance and the challenge of chronic, non-communicable disease. J Law Med Ethics 2010;38:8.

14 Kelishadi R, Ardalan G, Gheiratmand R, et al. Smoking behavior and its influencing factors in a national-representative sample of Iranian adolescents: Caspian study. Prev Med 2006;42:423–6.

15 Petrovic D, de Mestral C, Bochud M, et al. The contribution of health behaviors to socioeconomic inequalities in health: a systematic review. Prev Med 2018;113:15–31.

16 Heise L, Greene ME, Opper N, et al. Gender inequality and restrictive gender norms: framing the challenges to health. Lancet 2019;393:2440–54.

17 Weber AM, Cislaghi B, Meausoone V, et al. Gender norms and health: insights from global survey data. The Lancet 2019;393:2455–68.

18 Edwards ES, Sackett SC. Psychosocial variables related to why women are less active than men and related health implications. Clin Med Insights Womens Health 2016;9:CMWH.S34668–56.

19 Tseng T-S, Lin H-Y. Gender and age disparity in health-related behaviors and behavioral patterns based on a national survey of Taiwan. Int J Behav Med 2008;15:14–20.

20 Johansson L, Thelle DS, Solvoll K, et al. Healthy dietary habits in relation to social determinants and lifestyle factors. Br J Nutr 1999;81:211–20.

21 Claassen MA, Klein O, Bratanova B, et al. A systematic review of psychosocial explanations for the relationship between socioeconomic status and body mass index. Appetite 2019;132:208–21.

22 Hong X, Xu F, Wang Z, et al. Dietary patterns and the incidence of hyperglycemia in China. Public Health Nutr 2016;19:131–41.

23 Różańska D, Waśkiewicz A, Regulska-Ilow B, et al. Relationship between the dietary glycemic load of the adult Polish population and socio-demographic and lifestyle factors - results of the WOBASZ II study. Adv Clin Exp Med 2019;28:891–7.

24 Hosseinpoor AR, Bergen N, Kunst A, et al. Socioeconomic inequalities in risk factors for non communicable diseases in low-income and middle-income countries: results from the world health survey. BMC Public Health 2012;12:912.

25 Bonaccio M, Di Castelnuovo A, Bonanni A, et al. Socioeconomic status and impact of the economic crisis on dietary habits in Italy: results from the INHES study. J Public Health 2018;40:703–12.

26 He J, Ouyang F, Qiu D. Association of nap duration after lunch with prevalence of metabolic syndrome in a Chinese government employee population 2020;17.

27 Zujko ME, Waśkiewicz A, Drygas W, et al. Dietary habits and dietary antioxidant intake are related to socioeconomic status in Polish adults: a nationwide study. Nutrients 2020;12:518.

28 Schmitt DP, Long AE, McPhearson A, et al. Personality and gender differences in global perspective. Int J Psychol 2017;52 Suppl 1:45–56.

29 Andrews JO, Heath J. Women and the global tobacco epidemic: nurses call to action. Int Nurs Rev 2003;50:215–28.

30 Tang H, Cai W, Wang H, et al. The association between cultural orientation and drinking behaviors among university students in Wuhan, China. PLoS One 2013;8:e54796.

31 Zheng P, Zheng L, Guo F, et al. [Evaluation of two-year follow-up of group intervention on smoking cessation based on social cognitive theory]. Wei Sheng Yan Jiu 2008;37:53–6.

32 Hu T-W, Zhang X, Zheng R. China has raised the tax on cigarettes: what's next? Tob Control 2016;25:609–11.

33 He Z, Cheng Z, Shao T, et al. Factors influencing health knowledge and behaviors among the elderly in rural China. Int J Environ Res Public Health;13:975.

34 Maguire CP, Ryan J, Kelly A, et al. Do patient age and medical condition influence medical advice to stop smoking? Age Ageing 2000;29:264–6.

35 Burgess DJ, Mock J, Schillo BA, et al. Culture, acculturation and smoking use in Hmong, Khmer, Laotians, and Vietnamese communities in Minnesota. BMC Public Health 2014;14.

36 Hobbs M, Duncan MJ, Collins P, et al. Clusters of health behaviours in Queensland adults are associated with different socio-demographic characteristics. J Public Health 2019;41:268–77.

37 Exelmans L, Van den Bulck J. Bedtime mobile phone use and sleep in adults. Soc Sci Med 2016;148:93–101.

38 Organization WH. A conceptual framework for action on the social determinants of health 2010.

39 Samuel P, Antonisamy B, Raghupathy P, et al. Socio-Economic status and cardiovascular risk factors in rural and urban areas of Vellore, Tamilnadu, South India. Int J Epidemiol 2012;41:1315–27.

40 Hosseinpoor AR, Parker LA, Tursan d'Espaignet E, et al. Socioeconomic inequality in smoking in low-income and middle-income countries: results from the world health survey. PLoS One 2012;7:e42843.

41 Sanderson E, Davey Smith G, Bowden J. Mendelian randomisation analysis of the effect of educational attainment and cognitive ability on smoking behaviour. Nat Commun 2019;10:2949.

42 Chen M, Wu Y, Narimatsu H, et al. Socioeconomic status and physical activity in Chinese adults: a report from a community-based survey in Jiaxing, China. PLoS One 2015;10:e0132918.

43 Wang Q, Shen JJ, Sotero M. Income. occupation and education: Are they related to smoking behaviors in China? PLoS One 2018;13:e0192571.

44 HB W, Wang H, RY H. The association between sleep duration, snoring and prevalent type 2 diabetes mellitus with regard to gender and menopausal status: the CKB study in Zhejiang rural area, China. Acta Diabetol 2017;54:81–90.

45 Wang X, Guo H, Wang L, et al. Investigation of residents' health literacy status and its risk factors in Jiangsu Province of China. Asia Pac J Public Health 2015;27:NP2764–72.

46 Allen L, Williams J, Townsend N. Socioeconomic status and non-communicable disease behavioural risk factors in low-income and lower-middle-income countries: a systematic review. Lancet Glob Health 2017;5:e277–89.

47 Caldwell AE, Sayer RD. Evolutionary considerations on social status, eating behavior, and obesity. Appetite 2019;132:238–48.

48 Keski-Rahkonen A, Kaprio J, Rissanen A. Breakfast skipping and health-compromising behaviors in adolescents and adults. Eur J Clin Nutr 2003;57:842–53.

49 Guasch-Ferré M, Liu X, Malik VS. Nut Consumption and Risk of Cardiovascular Disease. J Am Coll Cardiol 2017;70:2519–32.

50 Tørris C, Småstuen MC, Molin M. Nutrients in fish and possible associations with cardiovascular disease risk factors in metabolic syndrome. Nutrients 2018;10:952.

51 Villegas R, Yang G, Gao YT. Dietary patterns are associated with lower incidence of type 2 diabetes in middle-aged women: the Shanghai Women's Health Study. Int J Epidemiol 2010;39:889–99.

52 Rouhani MH, Agh F, Azadbakht L. Pickle Consumption is Associated with Body Mass Index and Blood Pressure among Iranian Female College Students: a Cross-Sectional Study. Clin Nutr Res 2018;7:256–65.

53 Zhao LG, Sun JW, Yang Y. Fish consumption and all-cause mortality: a meta-analysis of cohort studies. Eur J Clin Nutr 2016;70:155–61.

54 Lampure A, Schlich P, Deglaire A. Sociodemographic, psychological, and lifestyle characteristics are associated with a liking of salty and sweet tastes in French adults. J Nutr 2015;145:587–94.

55 Linting M, Meulman JJ, Groenen PJ. Nonlinear principal components analysis: introduction and application. Psychol Methods 2007;12:336–58.