Gender differences in the relationships between housework and metabolic markers: a longitudinal cohort study in China

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Abstract

Background: Metabolic syndrome has become a major health threat of the world, there are few studies focused on the effects of housework on human metabolism. The aims of this study were to explore the associations between housework and metabolic markers, and to examine whether there are gender differences in the relationships of housework intensity on metabolic markers.

Methods: Using data of 2,624 participants were obtained from the China Health and Nutrition Survey. Binary logistic regression was used to analyze the associations between housework and metabolic markers (triglyceride, high- and low-density lipoprotein cholesterol, hemoglobin, blood glucose, cholesterol and blood pressure), with adjusting for the covariates.

Results: No associations were observed between housework and metabolic markers for men. Women who engaged housework had a higher risk of triglycerides than non-housework (OR=1.16, 95%CI:1.16-4.25). Compared with the low-intensity, women with moderate- and high-intensity had a higher risk of triglycerides (OR=1.78, 95%CI:1.14-2.78; OR=1.91, 95%CI: 1.22-2.98), MetS (OR=1.54, 95%CI: 0.98-2.43; OR=1.68, 95%CI: 1.07-2.66), pre-hypertension (OR=1.68, 95%CI: 1.08-2.62; OR=1.63, 95%CI: 1.04-2.55) and overweight (OR=1.65, 95%CI: 1.01-2.70; OR=1.66, 95%CI: 1.01-2.72).

Conclusion: Housework was associated with high levels of women's metabolic markers such as triglycerides, MetS and pre-hypertension, and there were gender differences between the associations of housework intensity and metabolism markers. This may be a mechanism through which housework was associated with metabolic diseases.

1. Background

Metabolic syndrome (MetS) is a common metabolic disorder, which is defined by WHO as a multifaceted continuum of metabolic disorders characterized by obesity, insulin resistance, hypertension and hyperlipidemia[1, 2]. The incidence of MetS globally was ranged from 12.2% to 43.7% and is anticipated to continuously increase. As reported, the prevalence of MetS among Chinese adults was about 21.3%[3, 4]. Previous evidence has shown that metabolic syndrome increases the risk of type 2 diabetes by 5 times and cardiovascular disease by 2 times[5]. Meanwhile, people with MetS spend 60% more on health care than others, which has brought a huge economic burden on the health care system[4].

Recently, some studies have demonstrated that housework was also an influential factor of individual mental and physical health[6, 7]. On the one hand, people with a high housework workload are at higher risks of experiencing mental illness, such as depression and suicide[7, 8]. On the other hand, people's physical health can be affected by housework, an increased risk of chronic lower back disease, upper limb strain, and functional somatic symptoms has been reported among people with more housework[9-11]. Housework may be affect health through physiological stress mechanism, it has been suggested that people who spend more time doing housework have higher salivary cortisol levels[12]. Cortisol might further affect the body's fat metabolism by binding to glucocorticoid receptors and activating fat cells[13]. Therefore, it is reasonable that housework may have an impact on metabolism, while the current research on the relationship between housework and metabolic markers is limited.

Existing research has suggested that housework has different health effects on men and women[6, 11]. On average, an overburden of housework was related to the self-reported poor health for women, while a large amount of housework was related to reduced risks of mortality and sickness among men [14]. Meanwhile, an increasing number of studies have shown that people who does housework has better physical health[6].

Housework is an indispensable part of daily life, and women do most of the housework in most countries and regions[15, 16]. Especially in China, influenced by the traditional Chinese culture of concepts and role expectations for women, women undertake more domestic work than men. It has been found that the burden of housework would increase with emergence of family members to care for[17]. On basis of rapid population aging and two-child policy, an increase of health problems are expected with more family members in need of care.

Although early studies have demonstrated the associations between housework and subjective health, the underlying mechanism remains unclear. It is hypothesized that housework can influence subjective health by metabolism, and there are gender differences between these associations. Accordingly, this study aims to examine the associations between housework and metabolic markers and to explore whether there are gender differences in these associations by a large longitudinal cohort study in China.

2. Methods

2.1 Study design and data source

This study used a nationally longitudinal data from CHNS, an ongoing large-scale, longitudinal survey (1989–2015). It was conducted by the Carolina Population Center at the University of North Carolina at Chapel Hill (UNC-CH) and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention (INFS-CCDC). The survey used a multistage, stratified, random cluster process to select sample in 15 provinces that varied in demography, geography, economic development, and medical resources[18]. The study used the individual Master-Time Allocation (TIMEA) survey, which provides an opportunity to assess the health and behavior of Chinese people participated in housework. Because the data format was different in early years, the sample only used three waves of data from 2009 to 2015. This study included the participants aged 18-80 who provided answers in three waves. Samples with any missing data would be excluded, and a total of 2642 participants were finally included. The research has been reviewed and approved by the institutional review committees of the UNC-CH and the INFS-CCDC. Written informed consents were obtained from each participant. And all methods of the study were performed in accordance with relevant guidelines and regulations.

2.2 Measures

2.2.1 Housework and housework intensity

Participants were asked 8 questions about their involvement in housework: 1) Do you buy food for your family? 2)How long does buying food take on average every day? 3) Do you cook for your family? 4)How long does cooking take on average every day? 5) Do you wash and iron clothes? 6) How long does it take on average every day? 7) Do you clean the room? 8) How long does it take on average every day? The time spent on each type of housework was summed up and divided into three categories: low-intensity housework (less than 50 minutes/day), moderate-intensity housework (50-180 minutes/day), and high-intensity housework (more than 180 minutes/day).

2.2.2 Metabolic markers

The health assessment measured 9 metabolic markers, including triglycerides, low- and high- density lipoprotein cholesterol (LDL and HDL), hemoglobin-A1c (HbA1C), fasting blood glucose, cholesterol, blood pressure, overweight and waist circumference.

Biomarker data blood was collected via venipuncture and detected immediately for glucose on empty stomach. Plasma and serum samples were then frozen and stored at -86 °C for laboratory analysis. All samples were analyzed at the national central laboratory in Beijing and strict quality control was carried out. Levels of biomarkers were categorized to represent using cut-off points recommended by the International Diabetes Federation, with separate cut-off points for men and women where appropriate (Table 1).

According to the American Heart Association, blood pressure should be correctly measured at least twice when sitting for a long time. After participants rested for 10 minutes, systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured three times by a professional using a mercury sphygmomanometer according to the standard procedures[19]. Hypertension is defined as SBP ³ 140 mmHg or DBP ³ 90 mmHg or taking antihypertensive drugs. Pre-hypertension is defined as SBP ³ 130 mmHg or DBP ³ 85 mmHg or taking antihypertensive drugs.

Height was measured without shoes to the nearest 0.1 cm using a portable SECA electronic multifunctional scale; weight was measured without shoes and in light clothing to the nearest 0.1 kg on a calibrated beam balance. Body mass index (BMI) was calculated as body weight divided by the square of height. Overweight is defined as BMI ³ 25 kg/m^2 according to Asian standard[20].

According to the latest National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATPIII) guidelines for Asian population, MetS is defined as the following three or more components: 1) men's waistline ³ 90 cm, women's waistline ³ 80 cm; 2) triglyceride 150 mg/dL; 3) HDL < 50 mg/dL; 4) pre-hypertension ³ 130/85 mmHg or currently used antihypertensive drugs; 5) fasting blood glucose ³ 100 mg/dL[21].

Table 1 Definitions of risk biomarker indicator.

Biomarker	Definition
High triglycerides	³150 mg/dL
High LDL	>130 mg/dL
Low HDL	Men: <40 mg/dL; women<50 mg/dL
High HbA1C	³6.5 %
High glucose	³ 100 mg/dL
High total cholesterol	³200 mg/dL
Hypertension	SBP ≥ 140 mmHg or DBP ≥ 90 mmHg or taking antihypertensive drugs
Pre-hypertension	SBP ≥ 130 mmHg or DBP ≥ 85 mmHg or taking antihypertensive drugs
Overweight	BMI ³ 25 kg/m^2
Waistline	Men's waist ³ 90 cm; women's waist ³ 80 cm
MetS	1) men's waist ³ 90 cm, women's waist ³ 80 cm; 2) triglyceride ³ 150 mg/dL; 3) HDL < 50 mg/dL; 4) blood pressure ³ 130/85 mmHg or currently used antihypertensive drugs; 5) fasting blood glucose ³100 mg/dL.

2.2.3 Covariates

The study covariates were guided by existing researches [22]. The covariables included gender and age, which were divided into three groups (18-40 years old, 41-65 and ³ 65). It also included socioeconomic indicators, including: education (primary/below, secondary school, tertiary school/above), employment status (yes/no), and residence (rural/urban), marital status (unmarried/divorced/ widowed, married/cohabiting with spouse), healthcare insurance (yes/no), drinking (yes/no), smoking (yes/no).

2.3 Statistical analysis

Descriptive statistics were performed by determining the mean value of continuous variables and ratio of categorical variables to describe the demographic characteristics of participants in the study. The distribution of demographic characteristics and biological metabolism differences between men and women

were analyzed by the Mann-Whitney test and Pearson's chi-squared test. The associations between household status and metabolic indicators were assessed by logistic regression analysis. Firstly, the participants were divided into two groups according to gender for age-related analysis. Secondly, all covariables were introduced to investigate the correlation between housework and metabolic markers. These potential regulators were selected based on previous literature[22]. All statistical analyses were performed using SPSS 22.0 software (Statistical Package for the Social Sciences for Windows, IBM Corp, Armonk, NY, USA). A two-tailed $P < 0.05$ was considered statistically significant.

3. Results

Table 2 showed the descriptive statistics provided by participants on metabolic outcomes and covariates (n=2624). Middle-aged women accounted for a larger proportion than men. This table showed that women provided more hours per-day of chore more than men, 41.7% of women who take part in housework provided 180 min/day compared to 6.4% of men. In general, the education level of men was higher than that of women, most men (59.4%) had secondary education, but nearly half of the women (54.1%) received primary education. Half of the men (49.9%) lived in cities, while most women (65.9%) lived in rural area. There were significant differences in the proportion of medical insurance between men (47.3%) and women (25.6%). Most people married and lived with their spouse. In addition, nearly two-thirds men reported current smoking and drinking and this greatly differ between men and women. Men's triglyceride (men: 171.3 mg/dL, women: 142.0 mg/dL), glucose (men: 98.9 mg/dL, women: 96.4 mg/dL), waistline (men: 83.4 mg/dL, women: 79.6 mg/dL) and blood pressure (SBP: 123.1 mmHg for men,12.1 mmHg for women; DBP: 79.8 mmHg for men,77.4 mmHg for women) were higher than that of women. However, women had higher cholesterol (men: 186.2 mg/dL, women: 190.6 mg/dL), HDL (men: 51.9 mg/dL, women: 56.7 mg/dL) and LDL (men: 113.5 mg/dL, women: 118.1 mg/dL).

Table 2 Characteristics of the study sample. (n=2624)

	Men (n=547)			Women(n=2077)			*P*
Age	n	%		n	%		<0.001*
18-40	261	47.7		650	31.3		
41-64	233	42.6		1290	62.1		
≥65	53	9.7		137	6.6		
Housework							<0.001**
0-50 min/day	364	66.5		137	6.6		
50-180min/day	148	27.1		1074	51.7		
³ 180 min/day	35	6.4		866	41.7		
Education							<0.001**
Primary school and below	132	24.1		1124	54.1		
Secondary school	325	59.4		833	40.1		
Tertiary school or above	90	16.5		120	5.8		
Employment status							<0.001**
No	223	40.8		1096	52.8		
Yes	324	59.2		981	47.2		
Residence							<0.001**
Rural	273	49.9		708	34.1		
Urban	274	50.1		1369	65.9		
Medical insurance							<0.001**
No	288	52.7		1545	74.4		
Yes	259	47.3		532	25.6		
Marital status							<0.001**
Single/Separated/divorced	90	16.5		174	8.4		
Married/living with partner	457	83.5		1903	91.6		
Smoking							<0.001**
non-smoking	220	40.2		2018	97.2		
current smoking	327	59.8		59	2.8		
Drinking							<0.001**
non-drinking	227	41.5		1915	92.2		
current drinking	320	58.5		162	7.8		
	mean	SD	IQR	mean	SD	IQR	
Housework time							
2009	44.0	65.9	60.0	165.7	88.4	115.0	<0.001**
2011	48.0	70.3	80.0	167.6	86.1	100.0	<0.001**
2015	61.8	67.9	100.0	176.6	114.7	100.0	<0.001**
Metabolic markers							
Triglycerides (mg/dL)	171.3	155.3	121.4	142.0	115.2	91.2	<0.001**
Cholesterol (mg/dL)	186.2	36.8	46.0	190.6	38.3	50.0	0.024*
HDL (mg/dL)	51.9	19.4	17.8	56.7	16.6	17.0	<0.001**
LDL (mg/dL)	113.5	41.3	47.6	118.1	37.1	46.0	0.010*

Glucose(mg/dL)	98.9	28.2	16.56	96.4	25.0	15.8	0.114
HbA1c (%)	5.7	1.0	0.6	5.6	1.0	0.6	0.480
Waistline	83.4	11.5	84.1	79.6	10.4	13.6	<0.001**
BMI	22.8	3.4	2.3	22.6	3.4	4.4	0.299
SBP mmHg	123.1	17.6	20.0	121.1	19.4	21.3	0.001*
DBP mmHg	79.8	10.3	14.0	77.4	10.6	12.7	<0.001**

SD: Standard Deviation; IQR: Inter Quartile Range

*P<0.05; **P<0.001.

3.1 Gender differences between housework intensity and metabolic markers.

In the study sample, in the low-, moderate-, and high-intensity groups, the proportion of men with abnormal metabolic indicators was significantly higher than that of women, especially with triglycerides, HDL, MetS, waistline (Table 3). There were significant differences in MetS, pre-hypertension among men in low-intensity, moderate-intensity and high-intensity groups. Men with high-intensity housework had a significantly higher prevalence of MetS (45.7%) compared to those with moderate-intensity (28.8%) and low-intensity (39.9%). The prevalence of women's triglycerides in the three groups were 20.4%, 30.1% and 32.8%, respectively. The risk of MetS was marginally different among the three caregiving groups of women. No significant differences among different housework intensity were observed for LDL, HbA1C, glucose, hypertension, and overweight.

Table 3 Gender differences between housework intensity and metabolic markers.

	Men				Women				P
	0-50 min/day	50-180min/day	³ 180 min/day	P	0-50 min/day	50-180min/day	³ 180 min/day	P	
Triglycerides				0.690				0.012*	<0.001**
Normal	224(61.5)	85(57.4)	21(60.0)		109(95.1)	751(69.9)	582(67.2)		
High	140(38.5)	63(42.6)	14(40.0)		28(20.4)	323(30.1)	284(32.8)		
LDL				0.169				0.234	0.109
Normal	267(73.4)	97(65.5)	23(65.7)		100(73.0)	708(65.9)	585(67.6)		
High	97(26.6)	51(34.5)	12(34.3)		37(27.0)	366(34.1)	281(32.4)		
HDL				0.160				0.846	<0.001**
Normal	176(48.4)	58(39.2)	15(42.9)		91(66.4)	711(66.2)	563(65.0)		
Low	188(51.6)	90(60.8)	20(57.1)		46(33.6)	363(33.8)	303(35.0)		
HbA1c				0.739				0.601	0.648
Normal	336(92.3)	136(91.9)	31(88.6)		129(94.2)	1010(94.0)	805(93.0)		
High	28(7.7)	12(8.1)	4(11.4)		8(5.8)	64(6.0)	61(7.0)		
Glucose				0.809				0.814	0.546
Normal	258(70.9)	105(70.9)	23(65.7)		105(76.6)	796(74.1)	643(74.2)		
High	106(29.1)	43(29.1)	12(34.3)		32(23.4)	278(25.9)	223(25.8)		
Cholesterol				0.083				0.374	0.080
Normal	259(71.2)	91(61.5)	22(62.9)		95(69.3)	678(63.1)	558(64.4)		
High	105(28.8)	57(38.5)	13(37.1)		42(30.7)	396(36.9)	308(3.56)		
MetS				0.014*				0.066	0.002*
No	259(71.2)	89(60.1)	19(54.3)		108(78.8)	779(72.5)	604(69.7)		
Yes	105(28.8)	59(39.9)	16(45.7)		29(21.2)	295(27.5)	262(30.3)		
Hypertension				0.618				0.673	0.488
No	286(78.6)	111(75.0)	26(75.3)		112(81.8)	870(81.0)	689(79.6)		
Yes	78(21.4)	37(25.0)	9(25.7)		25(18.2)	204(19.0)	177(20.4)		
Pre-hypertension				0.046*				0.115	0.018*
No	240(65.9)	90(60.8)	16(45.7)		103(75.2)	719(66.9)	574(66.3)		
Yes	124(34.1)	58(39.2)	19(54.3)		34(24.8)	355(33.1)	292(33.7)		
Overweight				0.991				0.103	0.214
No	271(74.5)	111(75.0)	26(74.3)		116(84.7)	838(78.0)	663(76.6)		
Yes	93(25.5)	37(25.0)	9(25.7)		21(15.3)	236(22.0)	203(23.4)		
Waistline				0.053				0.175	<0.001**
Normal	274(75.3)	100(67.6)	21(60.0)		77(56.2)	562(52.3)	425(49.1)		
High	90(24.7)	48(32.4)	14(40.0)		60(43.8)	512(47.7)	441(50.9)		

*P<0.05; **P<0.001.

3.2 Housework intensity of and metabolic markers.

3.3.1 Men's intensity of housework and metabolic markers.

Table 4 showed the associations between housework intensity and metabolic markers for men. In the age-adjusted model, housework was significantly associated with HDL, cholesterol and MetS (*P*<0.001). Compared with low-intensity housework, moderate-intensity housework workers were 49% more likely to have low HDL (OR = 1.49,95% CI: 1.01,2.21). Adjusted for all covariates, the associations among HDL, total cholesterol, MetS and housework became weak, among them, only the relationship between HDL and housework remained weak. No associations were observed between hours spent housework per day and metabolic markers for men.

3.3.2 Women's intensity of housework and metabolic markers.

Table 5 also showed the associations between housework intensity and the metabolic markers for women. In the age-adjusted model, women of engaged housework had a high risk of high triglycerides (OR = 2.07,95% CI: 1.07,4.02), women with high-intensity housework was more likely have high triglycerides, MetS, pre-hypertension and overweight (respectively, 190%, 169%, 165% and 166%) compared with women in low-intensity housework group. After adjusting for other covariates, these associations remained unchanged, and even strengthened, no matter in the moderate-intensity group or the high intensity group (high triglycerides: moderate-intensity: OR=1.78, 95%CI: 1.14,2.78, high-intensity: OR=1.91, 95%CI:1.22,2.98; MetS: moderate-intensity: OR=1.54, 95%CI: 0.98,2.43, high-intensity: OR=1.91, 95%CI:1.07,2.66; pre-hypertension: moderate-intensity: OR=1.68, 95%CI: 1.08,2.62, high-intensity: OR=1.63, 95%CI:1.04,2.55; overweight: moderate-intensity: OR=1.65, 95%CI:1.01,2.70, high-intensity: OR=1.66, 95%CI:1.01,2.72). There is significant correlation with high LDL, low HDL, high HbA1C, high glucose, hypertension and waistline.

4. Discussion

The study found that housework was associated with metabolic risk, and the risk of MetS increases with the intensity of housework, especially for women. Compared with low-intensity, women in the moderate- and high-intensity housework groups had a higher risk of high triglycerides, MetS, pre-hypertension and overweight in age-adjusted model. After adjusting for covariates, associations for women were strengthened. In this study, housework seems to have little impact on metabolic indicators for men, only a slight relationship between HDL and MetS and housework intensity. The findings were similar to with the results of previous studies[14, 23], people engaged in more hours of housework everyday reported poorer health than those in low-intensity. In additional, this study also found that more women undertook high-intensity housework in China, which is consistent with previous studies on the gender distribution of housework[16].

This study demonstrated that housework itself was not associated with metabolic risk for women but the intensity of housework was, which is consistent with prior research using the data of America National Health and Nutrition Examination Survey[24]. That study investigated relationship between physical activity intensity and MetS, suggested that high-intensity housework was negatively associated with MetS. However, Brooks and colleges found that housework can contribute to the 30 minutes per day of moderate-intensity activity required to confer health benefits[25]. Therefore, the intensity of housework may be an important factor affecting women’s metabolic function. There are several potential mechanisms that may affect metabolic risk through housework intensity.

First, Chronic stress may be a mechanism related to the housework intensity and metabolic risk. Svedberg et al. found that women with high-intensity housework often experienced stress and illness[26]. Chronic stress is a process of mutual induction and activation between the hypothalamic-pituitary-adrenal axis (HPA) and the reninangiotensin-aldosterone system (RAAS) [27, 28]. On the one hand, the high activation of HPA is associated with hyper-glucocorticoids and subclinical systemic inflammation. It will destroy the metabolism of muscle mass and affect skeletal muscle mitochondrial function and cause metabolic diseases. On the other hand, excessive activation of the HPA not only directly affects adipose tissue, but also causes changes in eating behavior[29]. When perceived stress or real chronic stressor existed, diet control will be lost as eating is a pleasure reward for the anti-adaptation of stress[30]. In addition, long-term chronic stress can lead to the hypertrophy and proliferation of adipocytes, change the secretion of adipokine and cause the attraction and activation of interstitial adipose immune cells[31]. The second mechanism may be sleep, Pepin found that women engaged in housework spend sleep less time, because they spent more time doing housework[32], the circadian rhythm disturbances caused by reduced sleep time can adversely affect their metabolic[33]. Third, household air pollution may be a potential mechanism. Studies have shown that free radicals produced by cooking can induced lipid peroxidation, leading to abnormal changes in regular blood lipids and affecting women's MetS and cholesterol[34].

Housework intensity has a little correlation with men's metabolic markers in this study, which is consistent with Saxbe’s study[35]. First of all, housework increases men's activity and thus has a beneficial effect. Most men may not have sufficient physical activity, while participating in housework provides an opportunity for them to achieve a certain amount of physical activity. Moderate physical activity can produce health benefits and reduce the risk of cardiovascular disease[22]. Secondly, housework can improve men's mental health. Some studies suggested that men were happier and lower levels of psychological stress when doing the housework such as cooking might make them find the meaning and purpose of life[14, 36]. In addition, most men's drinking and smoking behavior will affect the secretion and metabolism of hormone[37, 38], thus overshadowing the effect of housework on human metabolism. The underlying mechanism between male housework and metabolism remains to be explored.

There are several advantages in this study. The prominent one is that it uses a large nationally representative and regional sample, and thus the results can be generalized to more Chinese adults. Secondly, health information in this study was obtained under fasting and standard laboratory conditions. In most previous studies, the assessment of participants' health status was based on self-reported health outcomes, rather than objective data. Finally, this study provided evidence for the effects of housework on metabolism for men and women, which helped to understand the gender differences in the relationship between housework and metabolic risk. Nevertheless, this study has some limitations. Firstly, the data of time spent on housework is based on the self-reported, this may lead to recall bias. Secondly, some female participants in this study may be in menopause and produce changes in estrogen, which are related to the rise of HDL, blood sugar, triglycerides and others[39]. Thirdly, the relationship between housework and metabolism will be affected by the selection effect. The healthier the body is, the more housework it will take. And most of the missing samples tended to have higher blood pressure, cholesterol, lower education level.

5. Conclusion

This study showed that housework was associated with metabolic risk, especially among Chinese women. Women engaged in the moderate- and high-intensity housework groups had higher risk of high triglycerides, MetS, pre-hypertension and overweight compared with those in low-intensity housework.

Adjusted for covariables, all these associations for women were strengthened. Further research should explore the mechanisms of housework and metabolic risk. Appropriate interventions based on housework may reduce the metabolic risk among women with high-intensity housework.

6. Declarations

Ethics approval and consent to participate

The research has been reviewed and approved by the institutional review committees of the UNC-CH and the INFS-CCDC. Written informed consents were obtained from each participant.

Consent for publication

Not applicable.

Availability of data and materials

The datasets supporting the conclusions of this article are available in the China Health and Nutrition Survey repository, https://www.cpc.unc.edu/projects/china.

Competing interests

None of the authors have any competing interests.

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Authors' contributions

Wang XQ, Ren XH contributed to conception, design of the work, the acquisition and analysis of data, writing the original draft, and review and editing of the paper. Kou WJ, Li Y, Hui ZZ, Sun JR contributed to review and editing of the paper. Wang MX contributed to analysis and review and editing of the paper.

All authors read and approved the final manuscript.

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Tables

Table 4 Age adjusted and multiple logistic regression models of housework and metabolic markers for Chinese men.

	Age-adjusted OR (95%CI)							
	Triglycerides	LDL	HDL	HbA1c	Glucose	Cholesterol	MetS	Hyperten
Housework								
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	0.97(0.68,1.36)	1.02(0.71,1.49)	1.36(0.97,1.90)[a]	1.07(0.58,2.00)	1.03(0.71,1.49)	1.11(0.77,1.59)	1.26(0.87,1.82)	0.86(0.57
Housework hours								
0-50 min/day	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
50-180min/day	1.17(0.79,1.72)	1.32(0.87,2.00)	1.49(1.01,2.21)[b]	0.90(0.44,1.84)	0.89(0.58,1.37)	1.44(0.96,2.17)[a]	1.44(0.96,2.16)[a]	0.99(0.62
³ 180 min/day	1.08(0.52,2.22)	1.12(0.53,2.39)	1.32(0.64,2.68)	1.06(0.34,3.31)	0.97(0.45,2.06)	1.25(0.60,2.62)	1.53(0.74,3.16)	0.72(0.31
	Fully adjusted OR (95%CI)							
	Triglycerides	LDL	HDL	HbA1c	Glucose	Cholesterol	MetS	Hyperten
Housework								
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	0.89(0.63,1.27)	1.03(0.70,1.50)	1.36(0.96,1.93)[a]	0.98(0.52,1.88)	0.97(0.66,1.42)	1.05(0.73,1.53)	1.22(0.84,1.78)	0.83(0.54
Housework hours								
0-50 min/day	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
50-180min/day	1.10(0.74,1.64)	1.24(0.81,189)	1.43(0.96,2.14)[a]	0.86(0.41,1.79)	0.84(0.54,1.30)	1.36(0.90,2.04)	1.35(0.89,2.05)	1.01(0.63
³ 180 min/day	0.96(0.45,2.02)	1.02(0.48,2.22)	1.11(0.53,2.34)	0.94(0.29,3.07)	1.05(0.48,2.30)	1.08(0.50,2.32)	1.38(0.66,2.92)	0.76(0.32

OR: Odds Ratio; CI: Confidence Interval; Ref.: Reference.

a: $p<0.1$; b: $p<0.05$; c: $p<0.001$.

Table 5 Age adjusted and multiple logistic regression models of housework and metabolic markers for Chinese women.

	Age-adjusted OR (95%CI)							
	Triglycerides	LDL	HDL	HbA1c	Glucose	Cholesterol	MetS	Hyperte
Housework								
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	2.07(1.07,4.02)[b]	1.42(0.78,2.58)	1.18(0.69,2.05)	1.42(0.43,4.69)	0.97(0.54,1.76)	1.50(0.84,2.71)	1.33(0.71,2.51)	1.01(0.
Housework hours								
0-50 min/day	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
50-180min/day	1.69(1.09,2.64)[b]	1.43(0.94,2.17)[a]	1.01(0.70,1.47)	1.14(0.52,2.49)	1.15(0.75,1.77)	1.35(0.90,2.03)	1.47(0.93,2.31)[a]	1.11(0.
³ 180 min/day	1.90(1.22,2.98)[c]	1.31(0.86,1.99)	1.06(0.73,1.55)	1.36(0.62,2.97)	1.13(0.73,1.75)	1.25(0.83,1.83)	1.69(1.07,2.67)[b]	1.22(0.
	Fully-adjusted OR (95%CI)							
	Triglycerides	LDL	HDL	HbA1c	Glucose	Cholesterol	MetS	Hyperte
Housework								
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	2.18(1.16,4.25)[b]	1.44(0.80,2.62)	1.18(0.68,2.05)	1.40(0.42,4.65)	0.96(0.53,1.74)	1.53(0.84,2.77)	1.41(0.75,2.63)	0.98(0.
Housework hours								
0-50 min/day	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
50-180min/day	1.78(1.14,2.78)[b]	1.47(0.97,2.23)[a]	1.03(0.71,1.51)	1.19(0.55,2.60)	1.15(0.75,1.77)	1.38(0.92,2.07)	1.54(0.98,2.43)[a]	1.13(0.
³ 180 min/day	1.91(1.22,2.98)[c]	1.30(0.85,1.98)	1.05(0.71,1.54)	1.30(0.59,2.84)	1.13(0.73,1.75)	1.24(0.82,1.88)	1.68(1.07,2.66)[b]	1.20(0.

OR: Odds Ratio; CI: Confidence Interval; Ref.: Reference.

a: $p<0.1$; b: $p<0.05$; c: $p<0.001$.