

# Association between pet ownership and coronary artery disease in a Chinese population

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## Abstract

A number of studies have suggested the benefits of pet ownership to human health, including cardiovascular disease (CVD). However, there are few findings regarding pet ownership and coronary artery disease (CAD). The objective of this study is to investigate the association between pet ownership and CAD in a Chinese population. From October 2015 to May 2016, a survey consisting of 561 consecutive patients was done in Nanjing, China. Based on the results of coronary arteriography for the first time, participants were divided into 2 groups (non-CAD and CAD groups). Pet ownership information was collected by using a questionnaire. After multivariate adjustments, pet ownership was associated with a decreased CAD risk (odds ratios [OR]: 0.504, 95% confidence intervals [CIs]: 0.310–0.819). There was a reduced CAD risk among dog owners (OR: 0.420, 95% CI: 0.242–0.728) when compared with the cat group (OR: 0.738, 95% CI: 0.240–2.266) and the cat and dog group (OR: 1.052, 95% CI: 0.330–3.355). With the increase of pet ownership duration, there was a decreased tendency of CAD risk, including years of keeping pets ( $P$  for trend=0.008) and time of playing with pets per day ( $P$  for trend=0.001). In addition, similar dose–response relationship was observed for starting age of keeping pets ( $P$  for trend=0.002). Pet ownership, especially dog ownership, can be a protective factor for CAD in Chinese patients.

**Abbreviations:** BMI = body mass index, CAD = coronary artery disease, CI = confidence interval, CVD = cardiovascular disease, LDL-C = low-density lipoprotein cholesterol, OR = odds ratio, OT = oxytocin, TC = total cholesterol, TG = triglyceride.

**Keywords:** Chinese, coronary artery disease, pet ownership

## 1. Introduction

Coronary artery disease (CAD) is becoming more prevalent throughout the world.<sup>[1]</sup> There are many risk factors for CAD, such as smoking, hypertension, hyperlipidemia, physical activity, obesity, and diabetes. In our previous epidemiological studies, other modifiable factors had been found, including green tea<sup>[2]</sup> and different times of day for walking.<sup>[3]</sup>

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Keeping pets is an increasingly popular lifestyle. The relationship between human and pets has changed, and dogs and cats are no longer playing a simple role of gatekeeper or mouse catcher. In 2012, 36.5% of American families kept dogs, 30.4% kept cats, and 3.1% kept birds.<sup>[4]</sup> According to the report in 2015,<sup>[5]</sup> global pet consumption had increased by 24.0%, whereas the consumption increased by 10.90% and 54.2% in America and China, respectively, since 2009. The pet industry is still at its early stage, but develops rapidly in China.

A massive amount of evidence has proven the existing relationship between pet ownership and human health, such as asthma,<sup>[6]</sup> depression,<sup>[7]</sup> autism,<sup>[8]</sup> and cancer.<sup>[9]</sup> Besides, there are also some findings regarding CVD.<sup>[10–12]</sup> A scientific statement on pet ownership and cardiovascular risk was published by the American Heart Association, and pet ownership, particularly dog ownership, was reported to benefit CVD.<sup>[13]</sup> However, the conclusion remains controversial. Some researchers found no beneficial effects of pet ownership on CVD.<sup>[14]</sup> In addition, there are few studies exploring the relationship between pet ownership and CAD. Therefore, the objective of this study was to assess the association between pet ownership (dog or cat) and CAD patients in a Chinese population.

## 2. Materials and methods

### 2.1. Patient selection

From October 2015 to May 2016, 647 consecutive patients (aged 30–89 years) were investigated at The First Affiliated Hospital of Nanjing Medical University in Nanjing, China. All patients suffered from typical or atypical chest pain or abnormal ST-T changes, and they were admitted to this hospital for coronary arteriography. Exclusion criteria included patients underwent

coronary angiography or took postcoronary revascularization previously ( $n=42$ ) and patients with cardiomyopathy or myocarditis ( $n=15$ ) and valvular disease ( $n=15$ ). Two participants were excluded because their pets were not dogs or cats. Moreover, 12 patients were also excluded as they refused to participate in this survey. Finally, 376 males and 185 females were enrolled in this study. The participants were divided into CAD group and non-CAD group according to their coronary arteriography results. The study was assessed and approved by the institutional Ethics Committees of The First Affiliated Hospital of Nanjing Medical University.

## 2.2. Definition of coronary artery disease

All patients underwent coronary arteriography by 2 experienced angiographers using the standard Judkins technique, a selective coronary arteriography technique that was performed via femoral artery puncture.<sup>[15]</sup> All the assessments were in accordance with the American Heart Association method.<sup>[16]</sup> The evaluators were blind to pet ownership information. CAD was defined if there was stenosis  $\geq 50\%$  in any of major coronary arteries (including left main, left anterior descending, left circumflex, and right coronary artery).<sup>[17]</sup>

## 2.3. Pet ownership

Before coronary arteriography, pet ownership information was obtained with the help of a quantitative questionnaire. Pet owners were defined if their current pets were a dog ( $n=77$ ), cat ( $n=17$ ), or both dog and cat ( $n=16$ ) at baseline. Non-pet owners ( $n=451$ ) were participants who did not report to own any pet at baseline. Since few researches included the duration of pet ownership, we designed this quantitative questionnaire for the first time. Pet owners answered the following questions: How long have you kept pets? How long do you stay with your pets per day? When did you start to keep pets? And we set pet ownership variables into several levels according to some questionnaires used in CAD,<sup>[18–20]</sup> in which way we could explore the association between trend of pet ownership duration and CAD.

## 2.4. Data collection

A structured questionnaire, which was used in our previous epidemiological studies,<sup>[2,3]</sup> was adopted to collect information concerning demographic data, environmental exposure history (such as smoking and drinking), medical history, physical activity, family history of CAD, and education. Patients were investigated by trained interviewers before coronary arteriography.

Weight and height were measured after the patients wore their examination gowns and removed their shoes. Height was measured to the nearest 0.1 cm using a wall-mounted stadiometer. Weight was measured to the nearest 0.1 kg using a hospital balance beam scale. Besides, body mass index (BMI) was calculated as weight (kg) divided by the square of height ( $m^2$ ). Nonsmokers were defined as cigarettes consumption fewer than 100 in their lifetime, while current smokers were defined as ever smoking in the previous 1 year. Current drinkers were defined as alcohol use  $\geq 1$  time per week in the previous 1 year. Patients were physically active if they took exercises (walking, running, dancing, etc.) for more than 3 times per week and at least 30 minutes every time.

Fasting blood glucose, triglyceride (TG), total cholesterol (TC), and low-density lipoprotein cholesterol (LDL-C) were collected from their most recent medical records. Hyperlipidemia<sup>[21]</sup> was

defined as serum TG  $\geq 2.26$  mmol/L (200 mg/dL) or TC  $\geq 6.22$  mmol/L (240 mg/dL), or LDL-C  $\geq 4.14$  mmol/L (160 mg/dL) or taking lipid-lowering drugs. Diabetes mellitus was defined if fasting blood glucose was higher than 11.1 mmol/L (200 mg/dL) or if they were taking hypoglycemic drugs. Resting blood pressure was measured using an automated sphygmomanometer, and the average value of 3 times was taken as the final data. Hypertension was defined as systolic pressure  $\geq 140$  mm Hg or diastolic pressure  $\geq 90$  mm Hg or taking antihypertensive drugs.

## 2.5. Statistical analysis

Statistical analysis was carried out using Statistics Package for Social Sciences (ver. 16.0; SPSS Incorporated, Chicago, IL). Gender, hypertension, hyperlipidemia, physical activity, diabetes mellitus, smoking status, drinking status, family history of CAD, and education level were treated as categorical variables, while age and BMI were treated as continuous variables. Characteristics were compared between groups using chi-square tests for categorical variables. Independent-samples *t* test was used for continuous variables. Univariate and multiple logistic regression analyses were used to access and exclude various factors influencing the interference. In order to facilitate the analysis, pet ownership variables were set into several levels when compared to non-pet owners. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. Meanwhile, a linear trend test was adopted to analyze the duration of pet ownership. All *P* values were 2-sided and should be less than 0.05. Bonferroni correction was applied in multiple comparisons when using chi-square tests for categorical variables. To be exact, it was statistically significant only if the *P* value for multiple comparisons was lower than 0.017 in smoking and drinking status or 0.005 in education level.

## 3. Results

### 3.1. Baseline characteristics

Table 1 shows the characteristics between CAD and non-CAD patients. Among the 561 patients, 378 suffered from CAD. There were significant differences in age ( $P=0.001$ ), gender ( $P=0.015$ ), BMI ( $P=0.030$ ), hypertension ( $P=0.001$ ), diabetes ( $P<0.001$ ), hyperlipidemia ( $P=0.035$ ), smoking status ( $P=0.003$ ), physical activity ( $P<0.001$ ), and family history of CAD ( $P=0.003$ ) between CAD and non-CAD patients. Meanwhile, there was significant difference in pet ownership ( $P=0.039$ ).

Table 2 shows pet ownership characteristics. There were 110 pet owners among 561 participants. Men seemed to be more willing to keep pets than women ( $P=0.020$ ). A higher proportion of drinking status was distributed to the pet owner group, both former status ( $P=0.001$ ) and current status ( $P=0.005$ ). There was no significant difference in age, BMI, hypertension, diabetes mellitus, hyperlipidemia, smoking status, physical activity, and education.

### 3.2. Relationship between pet ownership and CAD

In Table 3, after adjusting for variables including age, gender, BMI, hypertension, diabetes mellitus, hyperlipidemia, smoking status, alcohol use, physical activity, and education, there were a significant differences in age (OR: 1.040, 95% CI: 1.018–1.061), diabetes (OR: 2.314, 95% CI: 1.337–4.006), current smoking status (OR: 2.491, 95% CI: 1.410–4.401), physical activity (OR: 0.505, 95% CI: 0.310–0.822), and family history of CAD (OR:

**Table 1**  
**Characteristics between CAD and non-CAD.**

Characteristics	CAD (n=378)	Non-CAD (n=183)	P
Age, y	63.07 ± 9.89	59.91 ± 10.78	0.001
Gender (M/F)	266/112	110/73	0.015
BMI, kg/m <sup>2</sup>	25.42 ± 3.35	24.81 ± 3.63	0.030
Hypertension	288 (76.2)	114 (62.3)	0.001
Diabetes	98 (25.9)	21 (11.5)	<0.001
Hyperlipidemia	82 (21.7)	26 (14.2)	0.035
Smoke			0.003
Never	175 (46.3)	113 (61.7)	
Former	58 (15.3)	22 (12.0)	
Current	145 (38.4)	48 (26.2)	
Drink			0.171
Never	199 (52.6)	111 (60.7)	
Former	87 (23.0)	32 (17.5)	
Current	92 (24.3)	40 (21.9)	
Physical activity	51 (13.5)	47 (25.7)	<0.001
Family history of CAD	85 (22.5)	22 (12.0)	0.003
Education			0.354
Illiteracy	40 (10.6)	23 (12.6)	
Primary	66 (17.5)	24 (13.1)	
Middle	98 (25.9)	59 (32.2)	
High	97 (25.7)	46 (25.1)	
College	77 (20.4)	31 (16.9)	
Pet owners	65 (17.2)	45 (24.6)	0.039

Values expressed as mean ± SD or n (%). BMI = body mass index, CAD = coronary artery disease.

2.382, 95% CI: 1.370–4.144). Furthermore, pet ownership could be a helpful factor for CAD (OR: 0.504, 95% CI: 0.310–0.819).

**3.3. Different kinds of pets**

Multiple logistic regression analysis was used to explore whether the pet type could influence the relationship between pet

**Table 2**  
**Characteristics of pet ownership.**

Characteristics	Pet owner (n=110)	Non-pet owner (n=451)	P
Age, y	62.10 ± 8.85	62.02 ± 10.63	0.937
Gender (M/F)	84/26	292/159	0.020
BMI, kg/m <sup>2</sup>	25.37 ± 3.26	25.19 ± 3.51	0.615
Hypertension	79 (71.8)	323 (71.6)	0.967
Diabetes	23 (20.9)	96 (21.3)	0.931
Hyperlipidemia	19 (17.3)	89 (19.7)	0.557
Smoke			0.043
Never	45 (40.9)	243 (53.9)	
Former	20 (18.2)	60 (13.3)	
Current	45 (40.9)	148 (32.8)	
Drink			0.001
Never	44 (40.0)	266 (59.0)	
Former	33 (30.0)	86 (19.1)	
Current	33 (30.0)	99 (22.0)	
Physical activity	18 (16.4)	80 (17.7)	0.734
Family history of CAD	19 (17.3)	88 (19.5)	0.592
Education			0.108
Illiteracy	13 (11.8)	50 (11.1)	
Primary	24 (21.8)	66 (14.6)	
Middle	27 (24.5)	130 (28.8)	
High	32 (29.1)	111 (24.6)	
College	14 (12.7)	94 (20.8)	

Values expressed as mean ± SD or n (%). BMI = body mass index, CAD = coronary artery disease.

**Table 3**  
**Multivariate logistic regression for CAD risk factors.**

Characteristic	OR	95% CI	P
Age, y	1.040	1.018, 1.061	<0.001
Gender (male=0/female=1)	0.630	0.353, 1.125	0.118
BMI, kg/m <sup>2</sup>	1.062	0.999, 1.130	0.055
Hypertension (N=0/Y=1)	1.489	0.970, 2.285	0.069
Diabetes (N=0/Y=1)	2.314	1.337, 4.006	0.003
Hyperlipidemia (N=0/Y=1)	1.709	1.002, 2.915	0.049
Smoke (N=0/Y=1)			
Never	1		
Former	1.480	0.718, 3.054	0.288
Current	2.491	1.410, 4.401	0.002
Drink (N=0/Y=1)			
Never	1		
Former	1.305	0.712, 2.392	0.389
Current	0.855	0.478, 1.528	0.596
Physical activity (N=0/Y=1)	0.505	0.310, 0.822	0.006
Family history of CAD (N=0/Y=1)	2.382	1.370, 4.144	0.002
Education (N=0/Y=1)			
Illiteracy	1		
Primary	1.089	0.507, 2.340	0.826
Middle	0.595	0.296, 1.198	0.146
High	0.766	0.370, 1.586	0.473
College	0.743	0.339, 1.628	0.457
Pet owners (N=0/Y=1)	0.491	0.303, 0.796	0.004

Adjustment for age, gender, body mass index, hypertension, diabetes mellitus, hyperlipidemia, smoking status, alcohol use, physical activity, and education in the analysis. BMI = body mass index, CAD = coronary artery disease, CI = confidence interval, OR = odds ratio.

ownership and CAD. In Table 4, the dog-only ownership had a reduced CAD risk, with a crude OR of 0.563 (95% CI: 0.345–0.918), a gender-adjusted OR of 0.518 (95% CI: 0.315–0.852), an age- and gender-adjusted OR of 0.526 (95% CI: 0.318–0.869), and a multivariate OR of 0.420 (95% CI: 0.242–0.728). Besides, it was found that cat ownership might help reduce CAD risk with a multivariate adjusted OR of 0.738, while the cat and dog group increased CAD risk with a multivariate adjusted OR of 1.052, but not statistically significant.

**Table 4**  
**Associations between different kinds of pet ownership and CAD.**

	CAD	Non-CAD	OR (95% CI)	P
Cat-only	11	6		
No adjusted			0.884 (0.322, 2.429)	0.811
Gender-adjusted			0.868 (0.314, 2.398)	0.785
Age- and gender-adjusted			0.719 (0.257, 2.017)	0.531
Multivariate adjusted			0.738 (0.240, 2.266)	0.596
Dog-only	43	34		
No adjusted			0.563 (0.345, 0.918)	0.021
Gender-adjusted			0.518 (0.315, 0.852)	0.009
Age- and gender-adjusted			0.526 (0.318, 0.869)	0.012
Multivariate adjusted			0.420 (0.242, 0.728)	0.002
Cat and dog	11	5		
No adjusted			1.067 (0.365, 3.118)	0.906
Gender-adjusted			1.059 (0.360, 3.111)	0.917
Age- and gender-adjusted			1.000 (0.337, 2.967)	>0.99
Multivariate adjusted			1.052 (0.330, 3.355)	0.931

Multivariate models adjusted for age, body mass index, hypertension, diabetes mellitus, hyperlipidemia, smoking status, alcohol use, physical activity, and education in the analysis. CAD = coronary artery disease, CI = confidence interval, OR = odds ratio.

**Table 5****Associations between duration of pet ownership and CAD risk.**

	Non-CAD (n=183)	CAD (n=378)	Crude OR (95% CI)	P	Multivariate OR (95% CI)	P
Years of keeping pets						
None	138	313	1		1	
0–10	14	24	0.756 (0.380, 1.505)	0.426	0.518 (0.240, 1.119)	0.094
11–20	17	23	0.597 (0.309, 1.152)	0.124	0.519 (0.250, 1.080)	0.079
>20	14	18	0.567 (0.274, 1.172)	0.126	0.431 (0.191, 0.972)	0.043
P for trend				0.041		0.008
Time of playing with pets						
Never	138	314	1		1	
0–2 h/d	33	55	0.732 (0.455, 1.179)	0.200	0.547 (0.321, 0.931)	0.026
>2 h/d	12	9	0.330 (0.136, 0.800)	0.014	0.253 (0.090, 0.709)	0.009
P for trend				0.010		0.001
Starting age of keeping pets						
None	138	313	1		1	
>50	18	36	0.882 (0.484, 1.607)	0.681	0.660 (0.335, 1.302)	0.231
31–50	11	11	0.441 (0.187, 1.041)	0.062	0.401 (0.148, 1.088)	0.079
<31	16	16	0.496 (0.249, 1.001)	0.050	0.359 (0.162, 0.796)	0.012
P for trend				0.016		0.002

Multivariate models adjusted for age, body mass index, hypertension, diabetes mellitus, hyperlipidemia, smoking status, alcohol use, physical activity, and education in the analysis. CAD = coronary artery disease, CI = confidence interval, OR = odds ratio.

### 3.4. Duration of pet ownership

Duration of pet ownership was measured to further evaluate the relationship between pet ownership and CAD, including years of keeping pets, time of playing with pets per day, and starting age of keeping pets. Results are shown in Table 5. When compared with non-pet owners, the adjusted ORs for years of keeping pets of 0–10 years, 11–20 years, and more than 20 years were 0.518 (95% CI: 0.240–1.119), 0.519 (95% CI: 0.250–1.080), and 0.431 (95% CI: 0.191–0.972), respectively. An obvious decreased tendency was observed in CAD risk (*P* for trend = 0.008). Similarly, those who spent more time staying with their pets had a lower risk. With the increase in time, the adjusted OR was reduced from 0.547 (95% CI: 0.321–0.931) to 0.253 (95% CI: 0.090–0.709) with the *P* value for trend at 0.001. In addition, there was a lower CAD risk in patients who began to keep pets at a younger age (*P* for trend = 0.002).

## 4. Discussion

To our knowledge, the study is the first to assess the relation of pet ownership and CAD in a Chinese population. First, pet ownership was found to have a protective effect on CAD patients. Second, dog owners had a significantly lower risk for CAD, while cat owners and those who owned both 2 pets did not have. Third, as the duration of pet ownership increased, there was a decreased tendency of CAD risk, including years of keeping pets and time of playing with pets per day. Besides, a lower risk was observed in those who kept pets at a younger age.

A number of studies have shown that pet ownership can decrease CVD risk, including hypertension, hyperlipidemia, physical activity, autonomic function, and cardiovascular reactivity. Since the 1980s, early evidence regarding the relationship between pet ownership and CVD was in hypertension.<sup>[22]</sup> There was a more recent survey consisting of 1179 elderly persons.<sup>[14]</sup> Pet owners were found with a lower hypertension risk (OR: 0.62, 95% CI: 0.49–0.80). Pet ownership can provide reduced stress, companion support, and physical exercise by walking a pet (usually a dog), which could be the reason for lower blood pressure. Pet owners seem to have lower lipids. A study at the Baker Medical Research Institute in

Melbourne showed that pet owners had lower TG (*P* = 0.01) and TC (*P* = 0.02) than those who did not own pets.<sup>[23]</sup> In addition, an online investigation (n = 916) with questionnaires showed that non-dog owners had significantly greater hypercholesterolemia risk (OR: 1.72, 95% CI: 1.06–2.81).<sup>[24]</sup> Physical activity affects CVD greatly. Dog walking is a very important and relatively consistent factor in those studies.<sup>[1]</sup> People may be encouraged to join physical activities. In a large survey<sup>[25]</sup> including ≥55,000 participants, it was found that dog owners walked more for leisure than those who did not own pet (OR: 1.6, 95% CI: 1.5–1.8). A Japanese survey of 5283 adults revealed that dog owners reached recommended levels of physical activity 1.54 times more than non-pet owners.<sup>[26]</sup> The INTERHEART study suggested that mental stress was attributed to more than 30% of acute myocardial infarction risk.<sup>[27]</sup> Pet ownership could contribute to improving autonomic function at psychological stress,<sup>[28,29]</sup> which was confirmed by a randomized trial designed by researchers.<sup>[30]</sup> In this study, pet dogs were assigned to 48 patients who were receiving antihypertensive treatment. The author found that there was a similar decrease in both groups after receiving treatment. However, when under stress, blood pressure changed more in the group without pets compared to the group with pets.

The precise mechanism remains to be elucidated. Nevertheless, some studies have suggested that the underlying mechanisms between pet ownership and CAD could be attributed to hormonal changes, such as cortisol and oxytocin (OT). After 18 adults interacted with 18 different dogs,<sup>[31]</sup> researchers found β-endorphin, OT, prolactin, phenyl acetic acid, and dopamine of these owners increased with the decrease of mean arterial blood pressure and cortisol. Besides, decreased cortisol was also observed in participants with an unfamiliar but friendly dog.<sup>[32,33]</sup> Another study showed that as the time of dogs gazing at their owners increased, OT concentration in the participants was found to be higher, which was measured via urinary OT.<sup>[34]</sup> It may provide a plausible explanation for the duration of pet ownership in our study. Elevated cortisol is associated with endothelial damage, visceral fat accumulation, and impaired lipid metabolism in individuals with subclinical hypercortisolism.<sup>[35]</sup> OT is found as a hormone of cardiovascular system with several

new functions in cardiovascular regulation, including lowering blood pressure, vasodilatation, parasympathetic neuromodulation, antioxidant activity, and anti-inflammatory activity.<sup>[36]</sup> A new study reported that in adult male albino rats, OT had antioxidant, anti-inflammatory, and antiapoptotic effects on myocardial infarction by nitric oxide.<sup>[37]</sup> Another experiment showed that OT-treated mice displayed significantly less atherosclerosis ( $P < 0.05$ ).<sup>[38]</sup> Moreover, OT-treated Watanabe Heritable Hyperlipidemic rabbits exhibited significantly lower plasma C-reactive protein levels at midpoint and endpoint and developed significantly less atherosclerosis in the thoracic aorta when compared to vehicle control animals at endpoint ( $P < 0.05$ ).<sup>[39]</sup> Hence, cortisol may worsen atherosclerosis by endothelial damage, while OT can play an antagonistic role in atherosclerosis. In general, pet ownership can offer less cortisol and more OT, which can decrease atherosclerosis in CAD.

There were few studies about pet ownership and CAD, while there were some studies concerning acute coronary syndrome patients. The results were inconsistent. Follow-ups consisting of 460 myocardial infarction survivors were done,<sup>[27]</sup> and the researchers found that patients without pets had a higher mortality risk ( $P = 0.036$ ). However, in another study including 412 patients after acute coronary syndrome, there was no significant difference in 1-year risk of readmission or cardiac death between dog group and non-pet group (OR: 1.59, 95% CI: 0.759–3.321), while cat owners had a higher risk than the other groups (OR: 3.22, 95% CI: 1.44–7.19).<sup>[40]</sup>

Some different results were found when comparing our study with others in pet ownership. In our study, there was no significant difference in physical activity between pet owners and non-pet owners, which could be due to the following reasons. First, China is still in the urbanization process. A large number of population moves to cities. In some city communities, pets are prohibited to facilitate management. Meanwhile, the concept of exercise and health is widely popular as social economy develops rapidly. Free gymnasium and park are constructed. There are many other motivations to take part in physical activity except pets. More precisely, it is not very clear whether pets motivate people to take more physical activities or people need a pet to company his physical activity. This means that some pet owners have a higher level of physical activity just because of their own personalities, which is irrelevant to pets. Small sample may be another explanation. In our study, physical activity was significantly different between CAD and non-CAD. After adjusting for multivariate variables, there remained to be significant difference in physical activity ( $P = 0.006$ ) as well as pet ownership ( $P = 0.004$ ).

#### 4.1. Limitations

An inverse association between pet ownership and CAD was found; however, some limitations should be considered in our study. First of all, all the patients underwent coronary arteriography and were all Chinese. Therefore, the patients in this study could not represent the general population. Second, our study was a small-sample and single-center observational research. Hence, the results need to be validated in a large-scale, multicenter prospective study. Third, as a retrospective design, some unavoidable limitations and potential recall bias existed. The inherent selection bias could not be eliminated completely. Finally, information on social financial condition, living areas, and other kind of pets should be gained. Social financial condition and living areas could influence CAD and pet

ownership. Dogs and cats were chosen because these 2 pets were in the majority of pets. More kinds of pets should be collected in later studies.

## 5. Conclusion

Pet ownership, especially dog ownership, is inversely associated with CAD in a Chinese population, which may provide a new way for CAD prevention. Furthermore, the benefits of pet ownership and individual CAD therapy should be considered in future research.

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