Improvement to the subjective well-being of pet ownership may have positive psychological influence during COVID-19 epidemic

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Abstract
The COVID-19 epidemic and government intervention measures may have adverse effects on people’s mental health. To explore the influence of pets on the intervention of people’s psychological problems during the COVID-19 epidemic, an online survey was carried out between April 9 and April 29, 2020. A total of 756 participants replied to this questionnaire. Mental health variables were assessed, and the comparison of behavior changes among pet owners and pets on positive mental well-being during COVID-19 epidemic. Comparative analysis was performed; compared with individuals without pets (n = 575), pet owners (n = 181) had a higher prevalence of insomnia (p = 0.006). Living in Wuhan city was a risk factor for people with psychological stress (p < 0.05). Dog owners exhibited lower than average scores of insomnia and uncertainty of infection than cat owners (p = 0.004). People with more than one pet exhibited lower than average scores of depression than having one pet (p = 0.040). For analysis of psychological effects of pets on people, the role of pets in subjective feeling and positive psychological changes of pet owner was significantly different. Pet owners relieve that psychological pressure through behavioral changes towards their pets in early stage. Pets provided positive subjective well-being and psychological effects for their owners.

KEYWORDS
COVID-19 epidemic, individual without pet, pet owner, psychological interventions, psychological problem

1 INTRODUCTION

COVID-19 has been brought under control in China through a nationwide effort. But now, it has become a global pandemic, and the situation seems far from being over. As we all know, the Chinese government intervention measures have played important role in controlling the COVID-19 epidemic; however, these measures may have considerable psychological impact on people. For instance, quarantine was one of the public health measures enforced to prevent the spread of COVID-19, and several studies have shown that longer durations of quarantine were associated with poor mental health, which specifically include post-traumatic stress disorder (PTSD), avoidance behavior, and anger (Brooks et al., 2020). The Chinese government ordered an immediate school closure around the country, followed by prolonged school closure, and children found themselves confined in their homes without outdoor activities as well as interaction with same aged friends; such lifestyle changes might have negative impacts on children’s physical and mental health and development.
Pet ownership is associated with higher levels of physical activity and greater independent mobility (Oka & Shibata, 2009). From a psychological health perspective, pet ownership in adolescence and childhood has been shown to enhance self-esteem, decrease loneliness and trust, and increase resilience to depressive and anxious symptoms. Pets may also provide a “social buffer” for the owners in situations of increased stress or anxiety. The presence of pets in the household may teach children valuable life lessons, such as empathy towards others, the inevitability of death, and responsibility for other living things, as well as protect children from developing social-emotional problems especially for children without siblings (Christian et al., 2020; Purewal et al., 2019).

In this present study, online surveys were used to assess people’s mental health and the impact of pets on psychological pressures following interventions regarding the COVID-19 epidemic. For this purpose, the questionnaire was shared on the WeChat social media platform to understand the features of this psychological problem, such as insomnia, anxiety, depression, and so on. The psychological states of the pet owner and the role of pets in maintaining their mental health during and after the period of COVID-19 epidemic were also investigated.

2 | MATERIALS AND METHODS

2.1 | Ethics statement

All procedures performed in this study were in accordance with the Declaration of Helsinki and the ethical guidelines of the ethics committee of Tongji Medical College, Huazhong University of Science and Technology (No. 2020S132). All participants provided their online informed consent. As children are not capable of providing ethical consent to participate, the parents or legal guardians of participants provided online informed consent on their behalf.

2.2 | Study design

A cross-sectional study was carried out via an online survey from April 9 to 29, 2020. At that time, the existing, newly confirmed, and asymptomatic cases of COVID-19 were 1116, 733, and 1097, respectively. The total, cumulative cured, and cumulative dead cases of COVID-19 were 81,907, 77,455, and 3336 in mainland China on April 9 (Information from the official website of the National Health Commission of the People’s Republic of China). Most of the people have experienced psychological trauma during the COVID-19 epidemic and might suffer from PTSD in future (Jamie et al., 2020; Qiu et al., 2020). Individuals aged over 12 years were welcomed to join the online survey via the Wenjuanxing platform. All the participants can successfully and confidentially submit their responses, only if they have completely filled the survey questions on the online questionnaire.

2.3 | Definitions

Professional technical personnel refer to those who have specific professional skills (whether or not recognized by the relevant departments) and engage in professional work with their professional skills and thus obtain corresponding benefits, such as doctors, nurses, teachers, and engineers.
Nonprofessional technical personnel refer to those who have no specific professional skills, such as students, farmers, general staff, civil servants, self-employed entrepreneurs, and waiters.

Excessive sleep disorder is defined as sleeping time longer than 9 h (Lammers et al., 2020).

2.4 | Participants

The inclusive criteria of the study subjects including gender, age (juvenile, 12–18; youth, 19–35; middle age, 36–59; elderly, above 60 years), occupation (students, workers, farmers, general staff, civil servants, teachers, doctors, nurses, soldiers, self-employed entrepreneurs, waiters among others), educational level (primary, junior school, high school, vocational degree, bachelor’s, master’s, and doctoral degrees), residence (Wuhan city, Hubei province excluding Wuhan city, mainland China excluding Hubei province, outside of China) were collected through online sources via questionnaire. Other associated symptoms such as insomnia, hypersomnia, anxiety, depression, fatigue, lack of enthusiasm, inattention, uncertainty of the infection, and concerns about infection were assessed (Dar et al., 2017; Karimi et al., 2020). In reference to Depression, Anxiety, and Stress Scale-21 (DASS-21) in a self-report questionnaire, the score was assigned for each item of psychological manifestation, which was according to different degrees, such as never as 0, sometimes as 1, often as 2, and almost always as 3 (Karimi et al., 2020). To analyze the risk factors of psychological stress, we categorized it into gender (male and female), occupation (professional technicians and nonprofessional technicians), and place of residence (Wuhan city and non-Wuhan city).

2.5 | Procedure

In this study, the prevalence and ownership of pet types (dogs, cats, rabbits, turtles, birds, among other pets), as well as the period of ownership (1 year, 2 years, 3 years, and more than 3 years), the purpose of having pets, relationship with pet owners, and their attitudes towards their pets were investigated. Description of the behaviors of pet owners and the positive changes accompanied with psychological symptoms were also included. We set up six questions to investigate the subtle changes of pet owners’ behavior on their pets. Question 27: During the COVID-19 epidemic, did you spend more time with your pets? Question 28: During the COVID-19 epidemic, would you speak to your pets? Question 29: Would you hug your pets during the COVID-19 epidemic? Question 30: During the COVID-19 pandemic, did you spend more time hugging your pets? Question 31: During the COVID-19 epidemic, would you let your pets sleep in your bedroom? Question 32: During the COVID-19 pandemic, would you let your pets go to bed with you? Finally, loyalty analysis of pet owners and their pets and individual’s propensity to own pet during and after the COVID-19 epidemic were analyzed. On the effect analysis of pet’s psychological intervention, the reported results of this study were divided into two groups; one is without any influence and change, whereas another is with various degrees of influence and change, such as mild, moderate, and severe.

2.6 | Statistical analyses

Descriptive statistical analysis was calculated as frequency and percentage analysis of each categorical variable. Logistic regression analyses were performed; the variables (gender, occupation, and place of residence) were entered into the model to explore the risk factor of psychological stress. They were analyzed by \( \chi^2 \) test and Student’s \( t \) test to determine relationships between symptoms such as insomnia, excessive sleep, worries about COVID-19 infection, lack of enthusiasm among a group of pet owners, and individuals without pets. \( \chi^2 \) tests were also made to analyze the psychological influences of pets on their owners. Two-sided \( p \) values \(< 0.05 \) were considered statistically significant. All analyses were performed using SPSS for Windows version 20.0 (IBM Corp., Armonk, NY, USA).

3 | RESULTS

3.1 | Demographic characteristics of participator and attitude of pet owners towards pet during COVID-19 epidemic

A total of 756 participants completed the survey that took place between April 9 and 29, 2020. The information on demographic characteristic was represented in Table 1, which included 181 people who own pets and 575 have no pets. The most popular pets in this study are dogs (60.8%) and cats (33.7%). Furthermore, about 49.2% of pet owners have been keeping pets for more than 3 years, and 90.1% of the owners keep pets because they love them. The most common relationships between pet owners and pets have been likened to parents and friends, which account for 42.5% and 34.3%, respectively. When pet owners are in a bad mood, an estimated rate of 85.1% of them choose not to violently treat their pets, and about 12.2% of pet owner decide to speak to their pets. About 97.2% of pet owner have regretfully expressed the thought of abandoning their pets. In spite of interferences with the individual’s normal life, about 89.5% of pet owners will not treat their pets violently. Once pets start disturbing their environment, 90.6% of pet owners choose to discipline their pets’ behavior instead of abandoning them. About 44.2% of pet owners have responded that they spend money on pet consumption. About 16.0% of pet owners want to spend more time with their pets during COVID-19 epidemic.

3.2 | The high-risk factors of psychological stress during COVID-19 epidemic

Pet owners displayed higher prevalence of insomnia (68.0% vs. 56.3%, \( p = 0.006 \)), hypersomnia (72.4% vs. 60.7%, \( p = 0.005 \)), and lack of
| Characteristics\(^a\) | Total % (\(n = 756\)) | Pet owners % (\(n = 181\)) | Individuals without pet % (\(n = 575\)) | \(p\) value\(^b\) |
|-----------------------|-------------------------|-----------------------------|----------------------------------------|----------------|
| Gender                |                         |                             |                                        |                |
| Male                  | 27.6 (209)              | 19.9 (36)                   | 30.1 (173)                             |                |
| Female                | 72.4 (547)              | 80.1 (145)                  | 69.9 (402)                             |                |
| Age (years)           |                         |                             |                                        |                |
| 12–18                 | 2.1 (16)                | 1.7 (3)                     | 2.3 (13)                               |                |
| 19–35                 | 61.6 (466)              | 65.2 (118)                  | 60.5 (348)                             |                |
| 36–59                 | 34.5 (261)              | 30.9 (56)                   | 35.7 (205)                             |                |
| >60                   | 1.7 (13)                | 2.2 (4)                     | 1.6 (9)                                |                |
| Occupation            |                         |                             |                                        |                |
| Students              | 13.2 (100)              | 10.5 (19)                   | 14.1 (81)                              |                |
| Workers               | 2.2 (17)                | 1.7 (3)                     | 2.4 (14)                               |                |
| Farmers               | 1.5 (11)                | 0                           | 1.9 (11)                               |                |
| General staff         | 14.6 (110)              | 18.2 (33)                   | 13.4 (77)                              |                |
| Civil servants        | 1.9 (14)                | 1.7 (3)                     | 1.9 (11)                               |                |
| Doctors, nurses, teachers | 52.5 (395)         | 53.0 (96)                   | 52.0 (299)                             |                |
| Soldiers              | 0                       | 0                           | 0                                      |                |
| Self-employed entrepreneurs | 2.6 (20)           | 3.9 (7)                     | 2.3 (13)                               |                |
| Waiters               | 2.2 (17)                | 0.6 (1)                     | 2.8 (16)                               |                |
| Others                | 9.5 (72)                | 10.5 (19)                   | 9.2 (53)                               |                |
| Education             |                         |                             |                                        |                |
| Primary school        | 1.2 (9)                 | 1.1 (2)                     | 1.2 (7)                                |                |
| Junior school         | 3.4 (26)                | 1.7 (3)                     | 4.0 (23)                               |                |
| High school           | 7.4 (56)                | 7.2 (13)                    | 7.5 (43)                               |                |
| College graduated     | 9.1 (69)                | 8.8 (16)                    | 9.2 (53)                               |                |
| Bachelor              | 45.4 (343)              | 50.8 (92)                   | 43.7 (251)                             |                |
| Masters and above     | 33.5 (253)              | 30.4 (55)                   | 34.4 (198)                             |                |
| Living city           |                         |                             |                                        |                |
| Wuhan city            | 43.4 (328)              | 52.5 (95)                   | 40.5 (233)                             |                |
| Hubei province excluding Wuhan | 16.1 (122)         | 11.0 (20)                   | 17.7 (102)                             |                |
| China excluding Hubei | 40.1 (303)              | 35.9 (65)                   | 41.4 (238)                             |                |
| Foreign               | 0.4 (3)                 | 0.6 (1)                     | 0.3 (2)                                |                |
| Insomnia              |                         |                             |                                        |                |
| No                    | 40.9 (309)              | 32.0 (58)                   | 43.7 (251)                             | 0.006**        |
| Yes                   | 59.1 (447)              | 68.0 (123)                  | 56.3 (324)                             |                |
| Excessive sleep       |                         |                             |                                        |                |
| No                    | 36.5 (276)              | 27.6 (50)                   | 39.3 (226)                             | 0.005**        |
| Yes                   | 63.5 (480)              | 72.4 (131)                  | 60.7 (349)                             |                |
| Anxiety               |                         |                             |                                        |                |
| No                    | 22.4 (169)              | 22.7 (41)                   | 22.3 (128)                             | 0.912          |
| Yes                   | 77.6 (587)              | 77.3 (140)                  | 77.7 (447)                             |                |
| Depression            |                         |                             |                                        |                |
| No                    | 33.5 (253)              | 29.3 (53)                   | 34.8 (200)                             |                |
| Yes                   | 66.5 (503)              | 70.7 (128)                  | 65.2 (375)                             | 0.171          |
| Fatigue               |                         |                             |                                        |                |
| No                    | 25.7 (194)              | 23.2 (42)                   | 26.4 (152)                             | 0.386          |
| Yes                   | 74.3 (562)              | 76.8 (139)                  | 73.6 (423)                             |                |
| Lack enthusiasm       |                         |                             |                                        |                |
| No                    | 27.4 (207)              | 19.3 (35)                   | 29.9 (172)                             | 0.005**        |
| Yes                   | 72.6 (549)              | 80.7 (146)                  | 70.1 (403)                             |                |
| Inattention           |                         |                             |                                        |                |
| No                    | 39.0 (295)              | 37.6 (68)                   | 39.5 (227)                             |                |
| Yes                   | 61.0 (461)              | 62.4 (113)                  | 60.5 (348)                             | 0.646          |
| Uncertainty of infection |                     |                             |                                        |                |
| No                    | 52.4 (396)              | 46.4 (84)                   | 54.3 (312)                             | 0.065          |
| Yes                   | 47.6 (360)              | 53.6 (97)                   | 45.7 (263)                             |                |
| Worried about infection |                     |                             |                                        |                |
| No                    | 22.5 (170)              | 19.3 (35)                   | 23.5 (135)                             |                |
| Yes                   | 77.5 (586)              | 80.7 (146)                  | 76.5 (440)                             | 0.244          |

\(a\) Descriptive statistical analysis was calculated as frequency and percentage analysis of each categorical variable.

\(b\) Pearson \(\chi^2\) test was performed to compare the grouped differences of categorical variables.

\(*p < 0.05. **p < 0.01. ***p < 0.001.\)
enthusiasm (80.7% vs. 70.1%, p = 0.005) than individuals without pets (Table 1). The score of each psychological manifestations item was calculated, and pet owners exhibited higher than average scores of insomnia (0.84 ± 0.70 vs. 0.65 ± 0.65, p = 0.001), hypersonia (0.93 ± 0.69 vs. 0.75 ± 0.71, p = 0.004), worries of being infected with SARS-CoV-2 (0.93 ± 0.56 vs. 0.84 ± 0.53, p = 0.042), and lack of enthusiasm (1.03 ± 0.68 vs. 0.83 ± 0.65, p = 0.001) than individuals without pets (Table 2). The logistic regression analysis showed that living in Wuhan city was a risk factor for insomnia, excessive sleep, lack enthusiasm, and worried about infection of SARS-CoV-2 and odds ratio (OR) 1.976, 95% confidence interval (95% CI) 1.458–2.679, p = 0.0001; 1.390 (1.026–1.884), p = 0.034; 1.671 (1.194–2.338), p = 0.003; and 2.001 (1.388–2.915), p = 0.0001, respectively (Table S1).

## 3.3 Pet owners experienced obvious behavioral changes to pets during COVID-19 epidemic

The attitude of pet owners towards their pets has changed significantly during the COVID-19 epidemic. About 35.9% of pet owners have been staying with their pets for longer periods of time, and also 35.4% have responded that their pets were always by their sides. Notably, 63.5% of pet owners routinely speak to their pets, whereas 32.1% have reported that they now speak for a longer time. Furthermore, whereas 52.5% of pet owners embraced pets as usual, 35.3% of pet owners admitted they now embraced more often. It was also noted that 55.2% of pet owners embraced pets for the usual duration, and 33.7% embraced their pets for a longer time. An estimated 63.5% of pet owners normally let their pets sleep in the bedroom, whereas 2.8% of pet owners claimed they have allowed their pets to sleep in the bedroom only during this special period. Besides, 35.4% of pet owners usually let their pets sleep on their beds, whereas 5.5% of pet owners have allowed their pets to sleep on their beds in this confinement period.

## 3.4 Psychological manifestations of dog owners versus cat owners

The scores of each psychological manifestation items were calculated. The dog owners exhibited lower than average scores of

### TABLE 2 Psychological manifestations of pet owners versus individuals without pets

|                        | Pet owners (n = 181) mean ± SD | Individuals without pet (n = 575) mean ± SD | p value<sup>b</sup> |
|------------------------|-------------------------------|------------------------------------------|-------------------|
| Insomnia<sup>a</sup>   | 0.84 ± 0.701                  | 0.65 ± 0.647                            | 0.001***          |
| Excessive sleep<sup>a</sup> | 0.93 ± 0.691               | 0.75 ± 0.706                            | 0.004**           |
| Anxiety<sup>a</sup>    | 0.94 ± 0.651                  | 0.92 ± 0.608                            | 0.667             |
| Depression<sup>a</sup> | 0.84 ± 0.643                  | 0.75 ± 0.637                            | 0.111             |
| Fatigue<sup>a</sup>    | 0.94 ± 0.660                  | 0.89 ± 0.663                            | 0.422             |
| Lack enthusiasm<sup>a</sup> | 1.03 ± 0.678               | 0.83 ± 0.647                            | 0.001***          |
| Inattention<sup>a</sup> | 0.82 ± 0.761                 | 0.74 ± 0.713                            | 0.202             |
| Uncertainty of infection<sup>a</sup> | 0.61 ± 0.646      | 0.53 ± 0.662                            | 0.168             |
| Worried about infection<sup>a</sup> | 0.93 ± 0.564         | 0.84 ± 0.533                            | 0.042*            |

<sup>a</sup>Each item of psychological manifestation was assigned a score according different degree.

<sup>b</sup>Student’s t test was performed to compare the grouped differences of categorical variables.

<sup>*p < 0.05. **p < 0.01. ***p < 0.001.</sup>

### TABLE 3 Psychological manifestations of dog owners versus cat owners

|                        | Dog (n = 110) Mean ± SD | Cat (n = 61) Mean ± SD | p value<sup>b</sup> |
|------------------------|-------------------------|------------------------|-------------------|
| Insomnia<sup>a</sup>   | 0.64 ± 0.483            | 0.74 ± 0.444           | 0.004**           |
| Excessive sleep<sup>a</sup> | 0.72 ± 0.452          | 0.75 ± 0.434           | 0.303             |
| Anxiety<sup>a</sup>    | 0.79 ± 0.409            | 0.74 ± 0.444           | 0.125             |
| Depression<sup>a</sup> | 0.69 ± 0.464            | 0.72 ± 0.452           | 0.399             |
| Fatigue<sup>a</sup>    | 0.76 ± 0.427            | 0.77 ± 0.424           | 0.840             |
| Lack enthusiasm<sup>a</sup> | 0.78 ± 0.415          | 0.84 ± 0.373           | 0.082             |
| Inattention<sup>a</sup> | 0.60 ± 0.492           | 0.67 ± 0.473           | 0.051             |
| Uncertainty of infection<sup>a</sup> | 0.48 ± 0.502      | 0.64 ± 0.484           | 0.004**           |
| Worried about infection<sup>a</sup> | 0.81 ± 0.395         | 0.79 ± 0.413           | 0.493             |

<sup>a</sup>Each item of psychological manifestation was assigned a score according different degree.

<sup>b</sup>Student’s t test was performed to compare the grouped differences of categorical variables.

<sup>*p < 0.05. **p < 0.01. ***p < 0.001.</sup>
The influence of pet on psychological interventions

In order to analyze the psychological influences of pets on people, this study has discovered that pets can bring a sense of security and significant comfort to their owners ($p < 0.0001$). Pets can reduce the frequency of insomnia and excessive sleep, relieve anxiety, depression, fatigue, lack of enthusiasm, inattention, and worry about infected with SARS-CoV-2 and had no difference in dog owner and cat owner groups (Table 3). In our first questionnaire survey, we did not design the number of pets owned by pet owners and pet owners live with their family or alone. We once again launched the second questionnaire survey. There were 68 people who participated in this study, and 52 people had companion animals. Thirty-two people had one pet, and 20 people had more than one pet. Fourteen pet owners lived alone, and 38 pet owners lived with their family. Psychological manifestations of pet owners who had one pet versus owners lived alone, and 38 pet owners lived with their family. Psychological manifestations of pet owners who had one pet versus more than one pets and who live alone versus live with their family were shown in Tables S2 and S3.

3.5 Pets bring their owner to subjective well-being for positive psychological influence

In order to analyze the psychological influences of pets on people, this study has discovered that pets can bring a sense of security and significant comfort to their owners ($p < 0.0001$). Pets can reduce the frequency of insomnia and excessive sleep, relieve anxiety, depression, fatigue, lack of enthusiasm, and inattention ($p < 0.0001$) and also alleviate the worries of possible COVID-19 infection ($p = 0.005$) and concerns about COVID-19 infection ($p < 0.0001$) (Table 4).

TABLE 4 The influence of pet on psychological interventions

| Interventions                  | No$^a$ (%) | Yes$^b$ (%) | $p$ value$^c$ |
|-------------------------------|------------|-------------|---------------|
| Bring sense of security       | 14.9 (27)  | 85.1 (154)  | 0.0001***     |
| Bring sense of comfort        | 11.0 (20)  | 89.0 (161)  | 0.0001***     |
| Relieve insomnia              | 23.8 (43)  | 64.6 (145)  | 0.0001***     |
| Relieve excessive sleep       | 26.0 (47)  | 49.7 (90)   | 0.0001***     |
| Relieve anxiety               | 5.0 (9)    | 80.1 (145)  | 0.0001***     |
| Relieve depression            | 6.1 (11)   | 79.0 (143)  | 0.0001***     |
| Relieve fatigue               | 6.6 (12)   | 79.6 (144)  | 0.0005***     |
| Increase enthusiasm           | 6.6 (12)   | 76.3 (138)  | 0.0001***     |
| Relieve inattention           | 19.9 (36)  | 53.6 (97)   | 0.0001***     |
| Mitigate sense of uncertainty | 24.9 (45)  | 42.0 (76)   | 0.0001***     |
| Mitigate sense of worry       | 19.9 (36)  | 55.8 (101)  | 0.0001***     |

$^a$Pets had no roles on psychological Interventions for their owner.
$^b$Pets had varying degrees of psychological interventions on their owners.
$^c$The number of people whose pets had no roles on psychological interventions for their owner.
$^d$The number of people whose pets had varying degrees of psychological interventions on their owners.
$^e$Student’s $t$ test was performed to compare the grouped differences of categorical variables.

$*p < 0.05. **p < 0.01. ***p < 0.001.$

4 DISCUSSION

The majority of the people surveyed have been experiencing psychological problem during the spread of COVID-19 epidemic (Ahmed et al., 2020). The National Health Commission of China published guidelines for psychological crisis management for the COVID-19 epidemic, where timely mental health care is essential (Xiang et al., 2020). Online mental health services were being used as emergency media for psychological interventions such as psychological assistance hotlines, online psychological counseling services (WeChat-platform resources), online mental health education (WeChat and Weibo), online psychological self-help intervention systems (WeChat), and artificial intelligence (AI) programs (Liu et al., 2020). Although online psychological services are of great assistance to psychological intervention, some deficiencies were still reported. Online psychological services are based on networking services that are virtually contactless, with the aim to seek and receive help, rather than really mutual contact, which always fosters companionship in addition to meeting psychological needs and comfort. However, human–pet interaction, instead of human–human, might provide a significant source of social support during COVID-19 epidemic (Hajek & König, 2019). The furry companions have the potential to promote healthy emotions through mutual and dynamic relationships among persons and animals (Purewal et al., 2017). Pet owners have a decreased feeling of loneliness, depression, and stress; thus, pet ownership increases children’s safety and self-confidence in the community (Smith, 2012). Unfortunately, in our study, the number of children who receive this study was too little; we could not get reliable data for the follow-up analyze.

In this study, we observed the HAI prolonged. We also observed the behavior of people toward their pets subtly changed, for instance, extended time spent conversing with their pets, increased frequency and time to embrace their pets, also allowed their pets to stay in their bedroom or even sleep on the bed. On the contrary, our findings in this study seemed to be different from our original perspective, whereby pet owners appeared to be more susceptible to psychological problems, such as pet owners were more likely to suffer from insomnia, as Jitka Pikhartova et al.’s research suggested that having a pet increased the likelihood of reporting loneliness. They thought that pet ownership was a response to loneliness. In fact, people especially women were more inclined to keep pets to alleviate their psychological stress instead of causing people’s psychological stress after keeping pets (Jitka et al., 2014).

Additionally, among people who received the questionnaire, there were 72.4% female, 61.6% young people, 52.5% professionals, 78.9% people with bachelor’s degree and above, and 43.4% people living in Wuhan city, which may not reflect general distribution. Concerning the influence analysis and the psychological interventions, we have established that pets still play a significant role as subjected feelings and positive psychological changes for pet owners ($p \leq 0.005$). However, another reasonable explanation is that pet owners are more sensitive to changes in psychological pressure. Undoubtedly, pet owners might adjust their psychological pressure through behavioral changes...
towards their pets in the early stage, which can significantly decrease the damage to mental health. In this study, we were pleased to find that dogs have more positive mental health influence on people than cats, such as insomnia and uncertainty of infection with SARS-CoV-2, and the scores were 0.64 ± 0.483 versus 0.74 ± 0.444 (p = 0.004) and 0.48 ± 0.502 versus 0.64 ± 0.484 (p = 0.004). In our second questionnaire survey, however, small part of people participated in the survey. We found that people with more than one pet are more capable of relieving depression than having one pet (1.89 ± 0.323 vs. 1.97 ± 0.186, p = 0.040). However, in the performance of inattention, the pet owner who kept one pet performed better (1.69 ± 0.471 vs. 1.87 ± 0.352, p = 0.007) (Table S2). We also found that pet owners living with their family seemed to be better in terms of psychological stress (Table S3).

Pets, such as cats and dogs, are usually in close contacts with their humans, and it is important to understand their susceptibility to SARS-CoV-2 for COVID-19 control. The study by Shi et al. in 2020 reported that ferrets and cats are highly susceptible to SARS-CoV-2, whereas dogs have low susceptibility, and livestock including pigs, chickens, and ducks are not susceptible to the virus. They also documented that SARS-CoV-2 can replicate efficiently in cats, especially in younger ones, and get transmitted via airborne routes (Shi et al., 2020). Another study reported that cats and dogs can be infected with SARS-CoV-2, and this evidence supports that people can transmit SARS-CoV-2 to cats and dogs. Presently, there is no evidence that cats and dogs could be carriers in spreading the virus from cats and dogs to people or vice versa (Almendros & Gascoigne, 2020; Li, 2020). The World Health Organization mentioned that if the animal is healthy and has had regular checkups, they pose minimal risk of transmission of any kind of zoonotic diseases to humans (Unnati & Jayasankara, 2020). The role of animals in COVID-19 pandemic needs to be further investigated. Even though there is a possibility that pets are at risk of infection to COVID-19, 93.4% of pet owners are not willing to abandon their pets, 23.8% of people are willing to adopt a pet, and 30.6% of people have considered adopting a pet. The authors have also noted an increasing number of stray cats and dogs in the streets of Wuhan city during COVID-19 epidemic. We therefore advocate that pets be regarded as members of the family. There is no need to abandon them as they will become stray animals, which might cause greater harm to the society in this era of COVID-19 epidemic.

This study seems to have certain limitations. Firstly, the study did not assess the socioeconomic status, which might be related to one’s own psychological state and ability to keep pets. Second, the study was performed in the post-period of COVID-19 epidemic and majority of the participants in this questionnaire came from mainland China. The timing and geographical differences of the questionnaire survey might lead to biased conclusions. Third, psychological assessment was based on an online survey and that is defined as self-report tool such as DASS score and artificially assigned score for each item according to the different degrees. Lastly, there were smaller clusters of participants who took part in this study that can lead to bias information on demographic characteristics. This may lead to data deviations and incorrect assumptions. There is a need for a more rigorous experimental design, a larger sample size, and a wider coverage of similar investigations, and subsequent follow-up is desirable.

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CONFLICT OF INTEREST

Authors declare no conflict of interests for this article.

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