

# Investigation on the Impact of Online Physical Exercise on the Physical and Mental Health of Knowledge Workers Working from home under the COVID-19

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**Abstract:** Under the control of the epidemic, the main way of working for knowledge workers is to work from home, and these groups of people often do not pay enough attention to their physical and mental health. In order to understand the impact of online physical exercise behavior on the physical and mental health of knowledge workers who work from home, and put forward the physical exercise methods of knowledge workers who work from home under the background of epidemic lockdown and control. We will use the questionnaire survey and obtain the factors that affect the exercise of knowledge working from home, and use mathematical statistics to analyze the data collected. Through the analysis, we find the relationship between online physical exercise and the physical and mental health of knowledge workers working from home. The results of mathematical statistics show that online physical exercise has a positive effect on improving the physical and mental health of knowledge workers working from home, but it takes time. Finally, at the significance level of  $\alpha=0.05$ , the respondents generally believe that online physical exercise can effectively improve the physical and mental health of knowledge workers working from home. Therefore, if the policy of epidemic control cannot be changed, we should consider popularizing exercise behavior to knowledge workers working from home.

**Keywords:** Online Physical Exercise; Physical Health; Mental Health; Knowledge Workers; COVID-19.

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## 1. Introduction

The new coronavirus outbreak at the end of 2019 has brought serious impacts to China and the world, seriously threatening national safety and public health. In order to prevent the spread of the new coronavirus, the government has taken a series of effective measures to prevent and control the spread and development of the epidemic, such as "closing the city", "isolation" and "working from home". Advocate home non-essential not to go out, as far as possible cut off the route of transmission of the new coronavirus. But at the same time, the range of daily activities of knowledge workers is greatly reduced, and the amount of daily exercise is also reduced. Long hours of living at home not only leads to a lack of exercise, which leads to decreased immunity and disease risk. There will also be anxiety, panic, depression and other negative emotions to a certain extent, and appropriate physical exercise can alleviate the negative emotions of knowledge workers. Therefore, in the context of COVID-19 epidemic, online physical exercise to improve the mental and physical health of knowledge workers at home office has a positive impact cannot be ignored.

With the rapid development of the Internet, the sports field is also closely following the development of The Times and the combination of the internet, and various sports software and platforms have emerged. With the development of social software and video platform, online sports content is more abundant, providing more channels for the public to learn and choose, so that people can learn online sports more quickly and easily. The integration of sports and the Internet has laid the foundation for the development of online sports after the epidemic, and has also promoted the rapid development of online sports while people's activity space is limited.

Knowledge workers under the control of the epidemic are mainly working from home, and when they are removed from their daily commute, they are more likely to adopt a sedentary and sedentary lifestyle. Many studies have shown that sedentary behavior may lead to an increased risk of cardiovascular disease, musculoskeletal disorders, and psychological disorders (depression and anxiety) [1]-[2]. In addition, because knowledge workers need to work, prolonged screen exposure caused by prolonged computer use can lead to fatigue, tiredness, headaches and adverse eye symptoms[3]. Studies have also shown that a lack of typical daily activities can lead to serious health problems and an increased risk of coronary heart disease[3]. In addition, the need to maintain social distancing and loneliness, as well as the outbreak of negative news and many other negative emotions, COVID-19 also has a certain degree of impact on physical and mental health. Studies have shown that COVID-19 will increase the risk of anxiety, stress, despair and other psychological problems[5]-[6]. For knowledge workers with children working from home, the closure of schools and day care centers has forced parents to home-educate their children. Increased daily parenting stress can also lead to a more chaotic work environment and greater vulnerability to negative health effects[7]. For alleviating psychological problems caused by the epidemic, studies have shown that there is a two-way relationship between physical exercise and mental health, which can be a protective factor to prevent mental health deterioration, indicating the necessity and importance of physical exercise at home[8]. In the study of physical activity and depression prevention, physical activity was inversely associated with the risk of depression. Suggests that physical activity can be an effective protection against the risk of depression, and that any level of physical activity,

including low levels such as walking, can reduce the risk[9]. Studies have pointed out that there is a reverse effect between physical exercise and at least one psychological problem, including depression, anxiety, psychosis, stress, etc., and physical exercise can effectively alleviate serious or common mental problems[10].

In summary, after the COVID-19 outbreak, research on physical exercise at home increased dramatically, for knowledge workers working from home, online physical exercise is flexible, varied and easy to operate, which can effectively alleviate the physical and mental health of COVID-19. In addition, in the special period of the epidemic, home sports can also play an effective role in prevention and control.

## 2. Research Methodology

The nature of knowledge workers' daily work determines that they have to be sedentary, which leads to serious lack of physical exercise during working from home. Through questionnaires and in-depth interviews with knowledge workers in universities, research institutes and other work units, From the point of physical and mental health, we know whether knowledge workers do online physical exercise during the period of COVID-19 working from home. Then use SPSS and Excel software to collect the questionnaire for mathematical statistics analysis.

### 2.1. Questionnaire Design

According to the characteristics of COVID-19 working from home and knowledge workers, the questionnaire is divided into two parts: basic information survey and self-rated physical and mental health survey. The basic information questionnaire consists of 11 multiple-choice questions, all of which are single-choice questions. At the same time, the discrimination question was designed to distinguish whether knowledge workers did online physical exercise while working from home. According to the content of the items, the subjects were divided into personality characteristics questions and survey goal description questions. The personality features questions included the subjects' age, gender, and whether they were doing online physical exercise during working from home or not. These variables were used as the basis for the later grouping analysis. The survey objective description includes the way of online physical activity, the frequency of online exercise, the time of each online exercise and the items of online sports and the influencing factors of the online exercise during working from home, etc. It is used to understand the respondents' thoughts on online physical exercise during COVID-19 working at home, combined with attribute variables, and analyzed the data to get the results.

In this paper, we select two dimensions of the SRHMS self-rating checklist to evaluate the physical and mental health of the respondents.

### 2.2. Questionnaire Implementation

Considering the feasibility of this survey, the questionnaire was distributed to knowledge workers in China by online and offline methods. The survey is divided into two stages of pre-research and formal research. Problems are found in the questionnaire analysis and timely correction, then formal research is carried out. Pre-survey begins on July 2, 2022 and ends on July 10. The formal investigation began on July 12 and ended on August 7. A random sampling of respondents

conducted in-depth interviews from August 13 to August 18.

### 2.3. Questionnaires Returned

Table 1. Summary of Case Handling

	Number of cases	%
Number of cases	197	94.6
Excluded a	7	5.4
Total	204	100.0

A total of 210 questionnaires were distributed in this formal investigation, and the collected questionnaires were imported into SPSS software to get the data in Table 1. From Table 1, it can be concluded that 204 questionnaires were collected, the recovery rate is 97%. After the recovery of the questionnaire "COVID-19 working from home, have you done any online exercise?" Finally, 197 valid questionnaires were obtained, and the effective rate was 94.6%.

#### 2.3.1. Reliability Analysis

Cronbach  $\alpha$  reliability coefficient is currently the most commonly used, refers to the questionnaire all possible topic division method to get the average of the half-confidence coefficient, commonly used in the reliability analysis of questionnaires. Generally, the value of Cronbach  $\alpha$  coefficient is between 0 and 1. If the  $\alpha$  coefficient calculated is not higher than 0.6, it is generally considered that the internal consistency of the questionnaire is insufficient. When the  $\alpha$  coefficient is between 0.7 and 0.8, it indicates that the questionnaire has a considerable reliability, and when the  $\alpha$ -coefficient reaches 0.8 to 0.9, the reliability of the questionnaire is very good.

Table 2. Statistical table of reliability analysis

Cronbach $\alpha$	Cronbach $\alpha$ Based on Normalized Terms	Number of items
0.84	0.71	204

SPSS software was used to analyze the reliability of the questionnaire, and the results were summarized in Table 2. From Table 2, the Cronbach  $\alpha$  coefficient of the collected questionnaire data is 0.84, greater than 0.8, indicating that the reliability of the questionnaire is high, and the consistency between the internal options is very good.

#### 2.3.2. Validity Analysis

KMO Test and Bartlett Sphere Test are usually used to analyze the validity of questionnaires. Among them, the KMO Test is used to check the correlation and partial correlation between variables, between 0 and 1, the closer KMO is, the stronger the correlation between variables, the weaker the partial correlation, the better the validity of the questionnaire. And the validity analysis requires that the questionnaire data should pass the Bartlett Sphere Test, and the P obtained by SPSS should be less than 0.05.

Table 3. KMO and Bartlett spherical test table

KMO sampling suitability quantity		0.891
Bartlett Spherical Test	Approximate chi-square	1607.8745
	df	55
	P	0.000

The validity of KMO and Bartlett sphere test was verified by SPSS software, and the results of table 3 were obtained. From Table 3, the KMO is 0.891, greater than 0.8, and the P

obtained by Bartlett's spherical test is less than 0.05, indicating that the validity of the questionnaire is very high.

In summary, the reliability and validity of the questionnaire are very consistent with the established values. The content of this questionnaire and the collected questionnaire data are suitable for the study of COVID-19 online exercise on the physical and mental health of knowledge workers working from home.

### 3. Research Results and Discussion

#### 3.1. Attributes of Respondents

Through the frequency analysis of the attribute variables of the questionnaire, the data in Table 4 are sorted out. Table 4 shows that 36.76 percent of respondents were aged 26-35, 33.82 percent were aged 36-45, 22.06 percent 18-25 and only 7.36 percent over 45; Among them, 54.41% of the respondents were male, slightly higher than the number of women 45.59%; Finally, 96.57% of the respondents said that COVID-19 did online physical exercise while working from home, and only 7 respondents said they never did. Because

this article mainly studies the effect of online physical exercise on the physical and mental health of knowledge workers. Therefore, in the follow-up study, the data of 7 respondents who had never done online physical exercise were removed, and only 194 respondents who did online exercise were analyzed.

**Table 4.** Frequency analysis table of attribute variables

Subject	Choices	Frequency	Percentage (%)	Cumulative percentage (%)
Your age	18-25years	45	22.06	22.06
	26-35 years	75	36.76	58.82
	36-45 years	69	33.82	92.64
	45 and over	15	7.36	100
Your gender	Male	111	54.41	54.41
	Female	93	45.59	100
Have you ever been exercising online while working from home?	YES	197	96.57	96.57
	NO	7	3.43	100
Total		204	100	100

**Table 5.** Frequency analysis table of descriptive variables

Subject	Choices	Freq-uenc	Percentage (%)	Cumulative percentage (%)
How do you choose to exercise online?	Live Online	68	33.33	36.76
	Online recording	44	21.57	58.33
	An exercise program prescribed by the coach	56	27.45	85.78
	QQ, WeChat and other information received, video, etc.	29	14.22	100
What form of online exercise do you choose?	Follow the coach	58	28.43	31.86
	Autonomic exercise	64	31.37	63.24
	Follow the coach+ Autonomic exercise	75	36.76	100
How often do you exercise online each week?	Up to 3	44	21.57	25
	3-5 sessions	117	57.35	82.35
	More than 5	36	17.65	100
How long do you exercise online?	Less than 20 minutes	30	14.71	18.14
	20-35 minutes	90	44.12	62.25
	35-50 minutes	65	31.86	94.12
	More than 50 minutes	12	5.88	100
What does your online physical activity focus on?	Sports-related skills	53	25.98	29.41
	Martial arts	34	16.67	46.08
	Yoga	49	24.02	70.10
	Dance	38	18.63	88.73
	Apparatus exercise	23	11.27	100
What is the purpose of your online exercise?	Enhance physical fitness	92	45.10	48.53
	Learning physical skills	13	6.37	54.90
	Maintain mental health	86	42.16	97.06
	Relax after work	6	2.94	100
Can online physical activity improve your physical and mental health?	YES	190	93.14	96.57
	No significant change	7	3.43	100
What do you think is wrong with online physical exercise?	Neglect of safety	33	16.18	19.61
	Unskilled in exercise skills	82	40.20	59.80
	The home environment is closed and small.	75	36.76	96.57
	Contingent factors	7	3.43	100
Total		197	100	100

After screening and eliminating the data of 7 invalid respondents, the questionnaire data of 197 respondents were sorted out. The frequency analysis of descriptive variables in Table 5 was obtained to understand the respondents' thoughts on online physical exercise during COVID-19 work at home. As can be seen from Table 5, 33.33% of the respondents carried out online physical exercise through live streaming.

The number of knowledge workers trained in this way is more than that of other knowledge workers, which is closely related to the rapid development of the Internet in recent years and is in line with the trend of social development. 57.35% of the respondents said that during the COVID-19 working from home, 3-5 times a week online physical exercise; 44.12% of the respondents said that the duration of each exercise was 20-

35 minutes. Among them, 93.14% of the respondents said that online physical exercise can improve their physical and mental health; 40.20% of the respondents said that there is a problem of unskilled exercise skills in home online physical exercise. Through in-depth interviews, we learned that even if they follow the online live coach, it is not as good as offline teaching, and their mastery of exercise skills is very low.

### 3.2. The Purpose of Online Physical Exercise

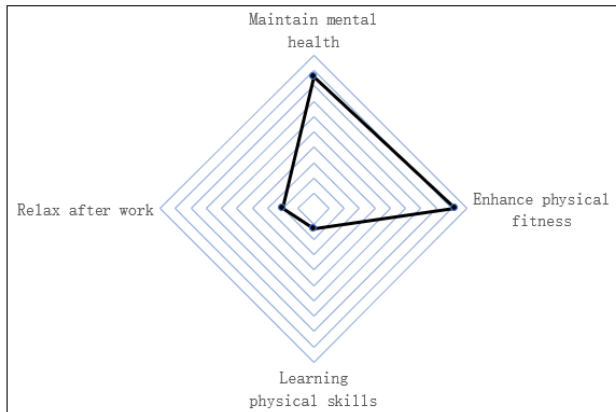


Figure 1. The purpose of physical exercise online

Combined with Table 5 and Figure 1, it can be seen that during the COVID-19 working from home, the main purpose of knowledge workers online exercise is to maintain mental health or improve physical fitness. The proportion of any one of them is far more than the sum of the two items of learning sports skills and relaxing after work, which also shows the significance of this survey.

### 3.3. Descriptive Analysis of Physical and Mental Health of Respondents

According to the selection of self-assessment options in the SRHMS scale, there are 5 self-assessment options for physical health and mental health, all of which are positive options, and the option score is 1-10 points, with the increase of the score, it represents the physical or psychological health of the respondent, and finally the average score is calculated to represent the number of physical and mental health self-scores of the respondents. Through the mathematical statistical analysis of the data of the recycled questionnaire, the collation results can be obtained in Table 6, as shown in the following table:

Table 6. Descriptive statistics of SRHMS physical and mental health

	Subject	Sample size	Minimum	Maximum	Mean	Standard deviation	Median
Physical health indicators	How is your sleep quality?	197	1	10	8.3333	1.8587	9
	How is your appetite?	197	1	10	8.0637	1.4692	8
	How is your memory?	197	1	10	8.5	1.7005	9
	Is your body in a relaxed state?	197	2	10	8.6127	1.4862	9
	Are you comfortable with housework?	197	1	10	8.1422	1.5487	8
Mental health indicators	Are you optimistic about the future?	197	1	10	8.5343	1.5131	9
	Do you have confidence in yourself?	197	1	10	8.2157	1.4324	8
	Do you feel happy?	197	1	10	8.652	1.4423	9
	Do you easily concentrate on one thing?	197	3	10	8.5392	1.2451	9
	Are you satisfied with the current situation?	197	1	10	8.3333	1.367	9

Combined with the determination of SRHMS self-rating checklist and the results of table 6, the average of the indicators of physical health are more than 8.0 and the overall average of health is 8.33, It shows that the knowledge workers surveyed basically think that online physical exercise is good for their health when they are working from home. The average of all indicators of mental health is above 8.2 and the overall average of mental well-being is 8.45, indicating that the respondents believe that online physical exercise is conducive to maintaining mental health.

### 3.4. Linear Regression Model

This article mainly studies the impact of online physical

exercise on the physical and mental health of home office knowledge workers under the COVID-19, and asks respondents to self-evaluate their physical and mental health after online physical exercise. Therefore, combining the two parts of the questionnaire data, the respondents in the questionnaire frequency of online physical exercise ( $X_1$ ) and each time online exercise time ( $X_2$ ) as independent variables, whether online physical exercise can improve physical and mental health ( $Y$ ) as a dependent variable, three related data into the SPSS for linear regression analysis, the results obtained in Table 7, as follows:

Table 7. Results of linear regression analysis

	Unstandardized coefficients		standardized coefficient	t	p	VIF	R <sup>2</sup>	Adjusted R <sup>2</sup>	F
	B	Standard error	Beta						
Constant	-0.071	0.0854	-	-0.8311	0.4069	-	0.4823	0.4772	F (2,201) = 93.6352 p=0.0000
X <sub>1</sub>	0.3671	0.0593	0.4882	6.1923	0.0000**	2.4133			
X <sub>2</sub>	0.1632	0.0524	0.2457	3.1168	0.0021**	2.4133			

Dependent variable Y: Whether online physical exercise can improve physical and mental health.  
\*\*P<0.01.D-W=2.1555

From Table 7, The frequency of online physical exercise ( $X_1$ ) and the duration of each online physical activity ( $X_2$ ) were used as independent variables. The linear regression model with online physical activity improving physical and

mental health ( $Y$ ) as a dependent variable is:

$$Y = -0.071 + 0.3671 * X_1 + 0.1632 * X_2$$

Model  $R^2$  is 0.4823, which means that  $X_1$  and  $X_2$  can explain 48.23% of the variation of  $Y$ . The model passed the F test ( $F = 93.635$ ,  $P = 0.000 < 0.05$ ), which also indicates that at least one of  $X_1$  and  $X_2$  has an effect on  $Y$ . Finally, for the multicollinearity of the model, we find that the VIF in the model are all less than 5, which means that there is no multipolarity; And the value of D-W is near the number 2, which shows that the model does not exist autocorrelation, there is no relational model between samples, indicating that this model is suitable. Specific analysis of the linear regression model formula can be seen: The coefficient of regression of  $X_1$  was 0.3671 ( $t = 6.192$ ,  $P = 0.000 < 0.01$ ), which indicated that  $X_1$  had significant positive effect on  $Y$ . The coefficient of regression of  $X_2$  was 0.1632 ( $t=3.1168$ ,  $P=0.0021<0.01$ ), which indicated that  $X_2$  also had significant positive effect on  $Y$ . And the constant term of the linear regression model is  $-0.071 < 0$ , indicating that even if  $X_1$  and  $X_2$  have a positive impact on  $Y$ . It is also necessary for  $X_1$  and  $X_2$  to be large enough to make  $Y$  greater than 0, indicating that knowledge workers must adhere to a certain degree of frequency and duration of online physical exercise in order to improve their physical and mental health.

In summary, through the mathematical statistics of the questionnaire, at the significance level of  $\alpha=0.05$ , knowledge workers believe that online physical exercise can effectively improve the physical and mental health of knowledge workers working from home. At the same time, the linear regression model shows that online physical exercise has a positive effect on improving the physical and mental health of knowledge workers working from home.

## **4. Suggestions on Physical Exercise for Knowledge Workers Working from Home on COVID-19**

### **4.1. The Government Gives Full Play to the Macro Guidance Ability**

Active government guidance is one of the important ways for the public to learn safe home exercise. Departments at all levels have vigorously publicized the scientific online physical exercise guidelines at home, strengthened the safety and health prevention knowledge and daily physical exercise awareness of the knowledge worker population, and made the home office knowledge workers take the initiative and habit of physical exercise. Make full use of various publicity platforms such as television and mobile APPS to further provide diversified and personalized services, innovate and develop sports activities, organize online physical exercise activities, actively guide knowledge workers to participate in physical exercise, and maintain physical exercise habits after the end of the epidemic, forming a good sports culture atmosphere. Improve the enthusiasm of home office knowledge workers to take the initiative to carry out scientific physical exercise, and enhance sports awareness. As an indispensable part of society, knowledge workers should be encouraged to continuously improve their physical fitness, establish a healthy lifestyle, and contribute to social development and national rejuvenation.

### **4.2. Sports Workers Contribute to the Development of Sports at Home**

To truly integrate sports into people's lives, we not only need the support and guidance of society and the state, but

also require sports workers to have the courage to assume the responsibility of promoting physical exercise. Knowledge workers due to the characteristics of the work, less concern for physical exercise knowledge, sports knowledge is relatively weak, rushing to carry out home physical exercise may be due to lack of movement or different sports foundation resulting in injury. Sports workers can provide different home physical exercise programs for home office knowledge workers, and provide diversified programs and suggestions for knowledge workers with different physical qualities. Provide detailed guidance on exercise time, exercise intensity and exercise environment, and provide different exercise methods for different sports foundations and different ages, so that knowledge workers can timely distinguish and select the positive ones when faced with a lot of complex physical exercise information. It can help people improve their physical and mental health caused by the epidemic, improve their physical fitness, enhance their resistance, and fight the epidemic with practical actions.

### **4.3. Establishing Correct Concept of Sports Consciousness**

Because of the impact of COVID-19 epidemic, people are threatened by the survival and health, Mental pressure has increased, the demand for physical fitness and psychological adjustment has increased significantly, and knowledge workers' awareness of physical exercise has been enhanced, creating good conditions for forming a sense of physical activity at home. Promote physical and mental health, enhance family relations, form a good atmosphere of physical exercise, not only to meet the people in the new era of the state of health in the pursuit of a better state of mind and body, but also on the home health behavior norms. At the same time, any physical exercise activities are achieved through the participation of the subject, knowledge workers as the main body of practical activities, their consciousness determines the quality of online physical exercise. The concept of positive sports awareness is based on a good and stable participation attitude of knowledge workers, and with the effective implementation of online physical exercise, Knowledge workers will produce positive and pleasant emotions and emotional experiences, exercise body and mind in a good situation, and cultivate knowledge workers' long-term enthusiasm for participation, and improve the effect of online physical exercise teaching.

## **5. Conclusion**

Under the COVID-19 epidemic Prevention and Control System, the main purpose for knowledge workers to do online physical exercise while working from home is to maintain mental health and improve physical fitness. Online physical exercise has a positive effect on improving the physical and mental health of knowledge workers working from home. In addition, some knowledge workers working from home said that online physical exercise has certain disadvantages, compared with offline physical exercise, the effect is not satisfactory. It shows that there is still room for development in the field of online physical exercise, and the government and sports workers can correctly guide and safe and healthy online physical training knowledge.

In addition to bringing health challenges to the world, COVID-19 epidemic has also made people aware of the importance of physical exercise. Especially for knowledge

workers working from home, online physical exercise has a significant positive effect on physical fitness and mental health. It is of great significance to fight against the epidemic and maintain social stability.

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