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RESEARCH ARTICLE

Evaluation of the Effect of Physical Activity on The Treatment of Depression in Patients with Chronic Diseases

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ARTICLE INFO	ABSTRACT
	Physical exercise therapy is a branch of psychotherapy and creative integrative therapy, which was defined by the American Therapy Association (ADTA) in 1972 as 'the use of exercise in psychotherapy to promote the process of emotional and physiological integration of the individual' (Fran J, 1988). As a result, physical exercise can have a positive effect on depression, allowing individuals to gain pleasure from physical exercise and significantly reduce their negative emotions such as tension, anxiety and depression (Motl et al., 2001; Mengyang Wang, 2021) and enhanced their vitality level and happiness (Yichen Chen & Zhiyong Bai, 2017). Physical exercise can have a direct effect on depression, both of which can reduce the mental burden of individuals, untie their knot of heart, make them no longer stubborn, thus conducive to concentration, improve their "acceptance" level of things, such physical and mental feelings will lead to higher physical satisfaction of individuals (Chandna et al., 2022), Leads to higher levels of physical self-esteem, which is undoubtedly important for relieving negative emotions such as depression. Especially with the implementation of the important national strategy 'Healthy China', physical activity as a 'non-medical health intervention' has received increasing attention (Gentle, 2019). Against this background, this study systematically compiled and analysed the applied research of physical activity therapy in China, with a view to providing a reference for subsequent research and contributing to the deepening and development of the field.

INTRODUCTION

Physical exercise is often used interactively with the term physical activity, and the two share some commonality in characteristics. Both involve skeletal muscle contraction, both produce energy expenditure, and both have characteristics that are positively correlated with physical fitness as the intensity, duration, and frequency of exercise increases. However, physical exercise is not a synonym for physical activity; it is a subcategory of physical activity. Physical exercise is planned, organized, and repetitive physical activity with the meaning of improving and maintaining one or more components of physical fitness. Therefore, physical exercise is also called physical exercise, which belongs to the lower concept of physical activity. (Tao Baole, 2023).

Background to the study

The World Health Organization (WHO) has released the World Health Statistics 2023 report, which shows that the global premature death rate from non-communicable diseases fell from 22.9 percent

in 2000 to 17.8 percent in 2023. In China, the probability of people aged 30 to 69 being injured by any of the four major NCDS, namely cardiovascular disease, disease, diabetes and chronic kidney disease, is 15.9% (nearly 1/6) in 2023. The total number of people suffering from chronic diseases in 2023 in China is 180 million. According to the data of China's 7th population census, the population over 60 years old in China will reach 260 million in 2023. It is found through research that the incidence of chronic diseases among China's aging population is as high as 50%, so about 130 million elderly people will suffer from various chronic diseases. The rest of the population has about 50 million chronic diseases, a total of 180 million people (World Health Organization, 2023). At present, the global medical community has not found a systematic, scientific and effective way to prevent and treat chronic diseases, resulting in the high incidence, multiple occurrence and serious consequences of chronic diseases, which is also a serious dilemma facing the development of human society.

Studies have found that depression is more common when it is accompanied by a physical condition. A foreign meta-analysis showed that the prevalence of depression in diabetic people was about twice that of non-diabetic people (17.6%vs.9.8%), and depression could increase the mortality of diabetic patients by 1.5-2.6 times (Ali S et al., 2006). At the same time, depression is often coexisting with diabetes. According to a recent survey conducted by domestic scholars in Bengbu Third People's Hospital, the prevalence rate of diabetic foot disease combined with depression is relatively high, accounting for 51.7% (Li Wei, 2020). A domestic survey of urban and rural residents in Dali City showed that depression was common in asthmatic patients, and the patients' depression scale score was 4 points (Kong Yanling, 2021). Recent studies have found a bidirectional relationship between depression and obesity. Compared with adults without mental illness, the prevalence of obesity in adults with mental illness is almost double (Allison D B et al., 2009). Compared with adolescents with normal weight, Obese adolescents were 1.3 times more likely to develop depression (Quek Y H et al., 2009).

Physical stress increases the risk of depression, and the prevalence of depression is much higher in patients with chronic diseases than in the general population, with the prevalence of major depression ranging from 3.7-6.7%, compared to 5-10% in hospitalized patients with depression accompanied by physical illness and 9-16% in outpatient patients (Egede L E, 2007). Depression affects a person's physical and mental symptoms, thereby reducing quality of life and contributing to public health problems such as alcohol use, smoking and drug use. Depression can aggravate existing physical conditions and lead to higher than expected mortality and morbidity, and depression management is important in patients with chronic diseases (Tong Li, 2023).

Problem Statement

Lack of physical exercise research and application in the Chinese cultural context, Individuals will have different experiences in the whole process of physical exercise. Serious participation in physical exercise will promote the release of psychological potential and make them more positive and optimistic. Compared with simply mastering skills, guiding people to pay attention to the exercise experience itself and letting them understand the profound connotation of physical exercise is the only way to feel the meaning of life through physical exercise (Chen Huiying, 2023). Physical exercise can promote the accumulation of positive emotions, allowing people to enjoy the expression of emotions as much as possible (Xu Wei, 2021). Therefore, compared with exercise attributes such as exercise amount or exercise frequency, the positive experience of physical exercise is more likely to have a direct impact on depression (Ekkekakis et al., 2019), which is in urgent need of in-depth discussion and research. At present, it is not clear what is the theory of positive experience of physical exercise? What factors are involved? How is it related to depression? What are the mediating and moderating effects of these two variables? It is an important research task to construct the effect and mechanism system of physical exercise on depression in China.

LITERATURE REVIEW

The research on physical activity and life satisfaction has been studied more in foreign countries, and the recent research on this study has been continuous in foreign countries, Hsin et al. In the study of the relationship between physical activity and life satisfaction and happiness in young, middle-aged and elderly people Sirinya used a questionnaire to find out that physical activity is significantly related to life satisfaction (Hsin et al., 2020). Domestic research on physical activity and life satisfaction in China is relatively weak, Cui Yuanzi in the study of the relationship between physical activity habits and life satisfaction of female college students, physical activity habits and life satisfaction have a significant correlation (Cui Yuanzi, 2021).The current measurement of physical exercise is divided into two kinds: objective measurement and subjective measurement. Objective measurement using mechanical and electronic devices, such as pedometer, acceleration sensor, etc., can also be heart rate measurement, double standard water method and indirect calorimetry, etc. Objective measurement accuracy is high, but not suitable for large-scale applications, and in some sports (such as swimming) can not be used. Subjective measures include questionnaire survey and activity recall method. These methods provide more information, are economical, practical and easy to accept, and are the most common and practical methods to evaluate physical exercise in epidemiological studies. However, these methods are prone to the influence of subjective reports of subjects, thus overestimating or underestimating their actual exercise level. Therefore, given the need for a large sample survey in this study, questionnaire survey is a suitable physical exercise measurement method (Lou Yaxin, 2023).

With the improvement of living and economic conditions, people increasingly pursue the quality of life, and pay special attention to physical health in order to enjoy life. Studies have confirmed that physical exercise can have an impact on people's physiological and psychological aspects, and the development of sports medicine has confirmed the impact of sports on People's Daily life. Mental health is an important aspect of people's health pursuit, the relationship between physical exercise and mental health research has been widely carried out, as well as to understand the influence mechanism, the research of physical education and brain science has been in-depth, in order to enrich and deepen the relationship between physical education and mental health, researchers have carried out gradual research on the effects of physical exercise and mental health indicators. In the context of the new coronavirus epidemic, maintaining people's mental health is a major challenge. Wu Jingtao conducted a questionnaire survey and found from the feedback of 673 college students that strengthening daily physical exercise can improve self-efficacy and enhance self-confidence. Yang conducted a systematic dancesport exercise intervention on 188 college students, and the results showed that it can make college students have more positive coping styles and better mental health. Zhou Hao, who also used questionnaires, surveyed 722 college students and found a significant positive correlation between physical exercise and cognitive reassessment and mental resilience, suggesting that physical exercise can promote cognitive development, accumulate mental energy, cope with a positive life, and ultimately improve happiness. Zhou Caibo conducted a questionnaire survey on 1,258 college students and found a significant negative correlation between physical exercise and social anxiety. An increase in physical exercise can reduce the dependence on mobile phones, thereby reducing social anxiety. Both Wei Yinuo and Hai Yujuan conducted research on physical exercise and body self-esteem of college students, and found that physical exercise can improve physical self-esteem, thereby improving the mental health of college students. These studies were conducted in the context of the COVID-19 pandemic. To sum up, the research on the impact of physical exercise on mental health has been confirmed in all aspects. In order to enrich the research on physical exercise and mental health, explore more detailed impact mechanisms, and integrate more variables into the research direction, so as to better serve people's pursuit of health (Lou Yaxin, 2023).

THEORY

Cognitive Behavioral therapy,In the 1960s, Baker et al. proposed and developed cognitive behavioral therapy, a modern treatment technique centered on humanism. Knapp &Beck(Knapp, P &Beck, A. T., 2008) argues that CBT is A therapeutic model with a clearly educational character and therefore, in clinical application, its mechanism of action is the idea of combining intervention with prevention. Zhang Rong (Zhang Rong, 2014) Cognitive behavioral therapy (CBT), as the most important treatment method with the most empirical value for its effectiveness, is of great significance in the intervention after the occurrence of adolescent anxiety and other problems, and has been highly evaluated by researchers and professional practitioners as "most worthy of clinical promotion". Cognitive behavioral therapy (CBT) theory holds that personal beliefs, different evaluations of events, interpretation of phenomena or philosophical theories and views on experienced events are the source of human emotions, rather than the events themselves. Thus, cognitive behavioral therapy helps eliminate negative emotions and mental behaviors that the patient averts by aiming to radically change the patient's misconceptions about something with the goal of changing the patient's personal beliefs and behavioral states.

In this study, based on Cognitive Behavioural Therapy, when chronically ill patients realise that depressive moods can cause them physical and mental harm, they should replace their previous irrational thinking and cognition with rational thinking and correct cognition. Finally, their anxiety is reduced by helping them increase appropriate cognitions and behaviours (e.g., physical exercise).

RESEARCH METHODS

Variables

Relationships between variables used in this study,A conceptual framework was developed for these variables involved in this study based on the established relationships found by previous scholars, including physical activity (PE), depression management (DM).

Research hypotheses

Previous research (Zhao Yongfeng, 2014; Wen Jun, 2006; Cui Jian & Luo Ping, 2011; Hong Zhang et al., 2005) provides evidence of a relationship between physical activity and depression management. For example, physical exercise (Liu Yang et al., 2020; Zhu Congqing & Dong Baolin, 2016; Jiang Yuan et al., 2018; Qiu Fen et al., 2011; Chen Zusong & Ji Liu et al., 2003), Depression Management (Wen Jiexi & Xing Guogang, 2012; He Hairan, & Xue Zhanxia, 2016; Wang Jingxin & Wang Chunmei, 2015). These studies are used to propose hypothesis H1.

H1: Physical exercise can effectively alleviate depression in chronic disease patients, and there is a significant correlation between the two.

Study population

The subjects of this study were patients with chronic diseases in the First Hospital of Peking University in China, and those who met the entry and exclusion criteria were included in the study, and the inclusion and exclusion criteria of the study population were as follows. First, the study population: patients with chronic diseases in the First Hospital of Peking University, China. Second, the inclusion criteria: (1) meeting the diagnosis of chronic diseases; (2) age 18 years or older; and third, the exclusion criteria: (1) pregnancy or preparation for pregnancy; (2) severe arthritis and diabetes complications; (3) severe liver and kidney diseases; and (4) inability to use smart electronic products.

Data type

The first data (i.e., primary data) for this study was collected by hand-delivered questionnaires. Scales such as the Depression Self-Assessment Scale and the Physical Activity Scale were used to assess this study. These scales have been widely used outside of China and have reliable reliability and validity.

DATA ANALYSIS

Reliability test

Table 5.1: Results of reliability analysis

	Cronbach's Alpha	N of Items
PE	0.934	14
DM	0.911	10

Reliability analysis, also known as reliability analysis, is the test of the stability, consistency and reliability of the measurement results. In order to ensure the accuracy of the measurement results, reliability analysis of the valid data in the questionnaire is required before the analysis. At present, Cronbach α coefficient is usually used for analysis in social science research. Generally speaking, if the reliability coefficient is above 0.9, it indicates that the reliability is very good; If the coefficient is between 0.8 and 0.9, it indicates that the reliability is very good; Between 0.7 and 0.8, it is good; 0.6~0.7, indicating acceptable; Below 0.6, it indicates that revision is needed.

Validity test

Exploratory factor analysis（EFA）

Table 5.2: KMO and Bartlett tests of physical exercise

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.963
Bartlett's Test of Sphericity	Approx. Chi-Square	4263.532
	df	91
	Sig.	0.000

Table 5.3: Depression Management KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.946
Bartlett's Test of Sphericity	Approx. Chi-Square	2832.242
	df	45
	Sig.	0.000

Validity refers to the degree to which the psychological and behavioural characteristics to be measured can be accurately measured by a test or scale instrument, i.e. the accuracy and reliability of the test results. In general, the smaller the significance level of the Bartlett's test of sphericity ($p<0.05$), the more likely it is that there is a meaningful relationship between the original variables. The KMO value is used to compare the coefficients of simple correlation and partial correlation between the items, and takes a value between 0 and 1. The criteria for suitability for factor analysis are: greater than 0.9, very suitable; 0.7-0.9 suitable; 0.6-0.7 more suitable; between 0.6-0.5 less suitable; and less than 0.5 to be discarded. The Bartlett's spherical test value is used to test the significance of correlation coefficients between the items, and if the significance is less than 0.05, then it indicates that each item is suitable for factor analysis. As can be seen from the above table, the KMO value is 0.946, which is greater than 0.6 and meets the prerequisite requirements for factor analysis, indicating that the data can be used in the study of factor analysis. At the same time, the data passed

the Bartlett's test of sphericity (p<0.05), indicating that the data of this study is suitable for factor analysis.

Confirmatory factor analysis（CFA）

Table 5.4: Model Fit for physical exercise									
Commonly indicators	x2	df	x2/df	RMSEA	GFI	AGFI	CFI	IFI	TLI
Criteria	-	-	＜5	＜0.08	＞0.8	＞0.8	＞0.9	＞0.9	＞0.9
Value	214.135	77	2.781	0.056	0.949	0.931	0.967	0.968	0.962
Result	-	-	Good	Good	Good	Good	Good	Good	Good

The table above shows the main fitness indicators obtained from the structural model test. x2/df = 2.781, less than the criterion of 5, RMSEA = 0.056, less than the criterion of 0.08, GFI = 0.949, AGFI = 0.931, CFI = 0.967, IFI = 0.968, TLI = 0.962, and the majority of the fit indicators are model fit criteria within. It can be seen that the present theoretical model is acceptable.

Table 5.5: Model Fit for depression management									
Commonly indicators	x2	df	x2/df	RMSEA	GFI	AGFI	CFI	IFI	TLI
Criteria	-	-	＜5	＜0.08	＞0.8	＞0.8	＞0.9	＞0.9	＞0.9
Value	106.375	35	3.039	0.060	0.962	0.941	0.975	0.975	0.967
Result	-	-	Good	Good	Good	Good	Good	Good	Good

The table above shows the main fitness indicators obtained from the structural model test. x2/df = 3.039, less than the criterion of 5, RMSEA = 0.060, less than the criterion of 0.08, GFI = 0.962, AGFI = 0.941, CFI = 0.975, IFI = 0.975, TLI = 0.967, and the majority of the fitness indicators are model fit criteria within. It can be seen that the theoretical model is acceptable.

Table 5.6: Overall Model Fit									
Commonly indicators	x2	df	x2/df	RMSEA	GFI	AGFI	CFI	IFI	TLI
Criteria	-	-	＜5	＜0.08	＞0.8	＞0.8	＞0.9	＞0.9	＞0.9
Value	2729.935	1642	1.663	0.034	0.858	0.847	0.941	0.942	0.939
Result	-	-	Good	Good	Good	Good	Good	Good	Good

The table above shows the main fitness indicators obtained from the structural model test. x2/df = 1.663, less than the criterion of 5, RMSEA = 0.034, less than the criterion of 0.08, GFI = 0.858, AGFI = 0.847, CFI = 0.941, IFI = 0.942, TLI = 0.939, and the majority of the fit indicators are model fit criteria Within. All metrics met the criteria and the model fit was good. No modifications to the initial model were required because, the initial model showed best fit indices, goodness-of-fit indices only provide statistical evidence (Anderson & Gerbing, 1988; Byrne, 2010), and the model under consideration does not rely solely on statistical significance as detailed by Byrne (2010). Therefore, the initial model has a best fit index and no modifications are required to the initial model.

Structural equation model test

Table 5.7: Overall structural equation fit index									
Commonly indicators	x2	df	x2/df	RMSEA	GFI	AGFI	CFI	IFI	TLI
Criteria	-	-	＜5	＜0.08	＞0.8	＞0.8	＞0.9	＞0.9	＞0.9
Value	2723.195	1642	1.658	0.034	0.859	0.848	0.943	0.943	0.940

Result	-	-	Good	Good	Good	Good	Good	Good	Good

The table above shows the main fitness indicators obtained from the structural model test. x2/df = 1.658, less than the criterion of 5, RMSEA = 0.034, less than the criterion of 0.08, GFI = 0.859, AGFI = 0.848, CFI = 0.943, IFI = 0.943, TLI = 0.940, and the majority of the fitness indicators are model fit criteria within. This shows that the theoretical model is acceptable.

Table 5.8: Path coefficient testing and hypothesis testing analysis of structural equation

Path			Estimate	S.E.	C.R.	P	Std.Estimate	hypothesis
DM	<---	PE	0.147	0.047	3.115	0.002	0.151	H1
PE1	<---	PE	1				0.71	
PE2	<---	PE	1.01	0.061	16.666	***	0.719	
PE3	<---	PE	1.244	0.07	17.726	***	0.765	
PE4	<---	PE	1.087	0.065	16.722	***	0.721	
PE5	<---	PE	1.104	0.064	17.141	***	0.739	
PE6	<---	PE	0.948	0.067	14.228	***	0.614	
PE7	<---	PE	1.037	0.064	16.131	***	0.696	
PE8	<---	PE	1.038	0.064	16.293	***	0.703	
PE9	<---	PE	1.051	0.066	15.958	***	0.688	
PE10	<---	PE	1.09	0.067	16.271	***	0.702	
PE11	<---	PE	1.125	0.064	17.446	***	0.753	
PE12	<---	PE	1.166	0.068	17.24	***	0.744	
PE13	<---	PE	0.977	0.064	15.33	***	0.661	
PE14	<---	PE	1.032	0.063	16.276	***	0.702	
DM1	<---	DM	1				0.778	
DM2	<---	DM	0.771	0.046	16.786	***	0.677	
DM3	<---	DM	1.062	0.052	20.612	***	0.803	
DM4	<---	DM	0.933	0.053	17.624	***	0.705	
DM5	<---	DM	0.76	0.048	15.672	***	0.638	
DM6	<---	DM	0.845	0.052	16.364	***	0.662	
DM7	<---	DM	0.854	0.053	16.003	***	0.649	
DM8	<---	DM	0.978	0.051	19.093	***	0.754	
DM9	<---	DM	0.891	0.053	16.953	***	0.682	
DM10	<---	DM	0.997	0.051	19.47	***	0.767	

Note: PE= Physical activity goals, DM= Management of depression.

Note：*** p<0.001, **p<0.01, *p<0.05

The hypothesised relationships are: H1. physical activity (PE) → depression management (DM); The validity of the structural equation model was verified by analysing the fitted indicators and analysing the model paths. This study used AMOS software to test the hypothesised relationships in the research model. The results of the specific hypothesis testing are as follows.

H1. The standardised path coefficient of physical exercise (PE) → depression management (DM) was 0.147 (C.R. = 3.115, p < 0.01), indicating that physical exercise (PE) → depression management (DM) has a significant positive effect.

DISCUSSION AND FINDINGS

Relationship between physical exercise and depression management

As a result, physical exercise can have a positive effect on depression, allowing individuals to gain pleasure from physical exercise and significantly reduce their negative emotions such as tension, anxiety and depression (Motl et al., 2001; Mengyang Wang, 2021) and enhanced their vitality level and happiness (Yichen Chen & Zhiyong Bai, 2017). Physical exercise can have a direct effect on depression, both of which can reduce the mental burden of individuals, untie their knot of heart, make them no longer stubborn, thus conducive to concentration, improve their "acceptance" level of things, such physical and mental feelings will lead to higher physical satisfaction of individuals (Chandna et al., 2022), Leads to higher levels of physical self-esteem, which is undoubtedly important for relieving negative emotions such as depression.

Countermeasures and suggestions for patients with chronic diseases

Patients with chronic diseases should pay attention to cultivating individual's habit of physical exercise, take the enhancement of positive experience of exercise as the important starting point and landing point of carrying out physical practice activities, pay attention to the trend of positive experience of exercise in the whole process, and consciously take part in physical exercise, which belongs to the activities to meet the needs of individuals, and all the simple and easy to carry out physical activities can achieve the purpose of exercising the body and mind as long as the individuals make reasonable use of them. Physical exercise is an activity that meets the needs of the individual. Choosing to exercise in sports that do not require or only require very simple facilities and equipment and can be performed anywhere at any time is undoubtedly conducive to the perseverance of exercise, such as brisk walking, running, jumping rope, broadcasting exercises, self-composed exercises, pulling oneself upwards, push-ups, sit-ups, and so on. The fundamental purpose of exercise is to promote physical and mental health, therefore, observing and experiencing the positive changes in body and mind caused by exercise can deepen an individual's understanding of exercise and fitness, promote the gradual formation of an individual's belief in exercise and fitness, and gain the supportive power to persist in exercise.

Government-oriented Countermeasures and Suggestions

The resources of the national fitness movement are the inexhaustible source of physical exercise, and the social movement and fitness culture is the catalyst for the cultivation of physical exercise habits. As long as a country or region has a vigorous national fitness movement and a solid social foundation for physical activity, the cultivation of physical activity habits will become a smooth sail. To promote the national fitness movement, it is necessary to continue to increase investment in the construction of community and park sports venues and facilities, to continuously improve the conditions for sports and fitness, to improve the management of national fitness, and to introduce more convenient sports services for the people. We must provide in-depth and lasting education and guidance to the masses, stimulate their desire for exercise and fitness, enhance their enthusiasm for learning and mastering scientific fitness knowledge, techniques and methods, and improve their level of scientific fitness. Therefore, in order to better promote the construction of school sports facilities, we should also actively explore effective modes of opening up school sports facilities to the community and making social sports facilities available to schools, so as to create a benign situation in which the resources of schools and social sports facilities are shared.

Implications for future research

Relevant research on physical activity could be expanded in the following ways: firstly, the composition of physical activity in different groups. This study explored the components of physical activity with patients as subjects, which may vary across groups, as evidenced by a study suggesting that for athletes a positive pre-workout experience is also important for individuals to perform at a higher level of competitiveness (Yang Jian, Yang Shuhong, 2017). The answer to the question of what components are included in physical activity in social groups can help to construct a complete picture

of physical activity. Secondly, what is the neural activity when individuals experience exercise positive experiences, what is the neural activity when individuals recall exercise positive experiences, and what are the similarities and differences between the two, which are worthy of further exploration. Finally, the relationship between positive and negative experiences of exercise. This study focused on physical exercise, but exercise may also have negative experiences, so what components do negative experiences include, how do positive experiences relate to negative experiences, and which experience is more closely related to an individual's future participation in physical exercise. These need to be explored further.

CONCLUSION

With the progress of human society and the development of global public health, people's demand for health continues to increase, the quality of medical services is growing, and the corresponding requirements for the management of depression are rising. In the future, along with the continuous deepening of management strategy research, it will develop in the direction of more standardisation, systematisation and scientification, and continue to mature and improve. This new management strategy will play an important role in fully ensuring the ability to manage patients' depression, alleviating patients' pain, improving patients' physiological and psychological conditions, as well as improving patients' quality of life. The development of discipline is the foundation of application. In the future, physical exercise should produce a closer connection with psychology, physiology, medicine and other disciplines, because it needs more theoretical and empirical research as support. Only when more people understand it and apply it, will this approach become inseparable from the Chinese mainland. Only then can it be recognised by more people in the country and be developed.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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