

A Metaanalysis of the relationship between growth mindset and mental health in Chinese samples

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ABSTRACT

Innovations in mental health are desperately needed in Healthy China with increasing benefits of a growth mindset on mental health among Chinese. Currently, empirical research in China reveals significant discrepancies in the correlation between growth mindset and mental health. To elucidate this discrepancy, we conducted a meta-analysis on 59 studies utilizing a random-effects model, with 68 effect sizes and 54,302 participants included. The main effects revealed a significantly positive correlation between growth mindset and positive indicators of mental health ($r = 0.36$, [0.27, 0.45]), as well as a significantly negative correlation between growth mindset and negative indicators of mental health ($r = -0.25$, [-0.31, -0.20]). Subgroup test and meta-regression results indicated that age, economic region, and measurement instruments moderated the growth mindset and positive indicators of mental health. In contrast, negative indicators were moderated by gender and measurement instruments. The above findings suggest that a growth mindset significantly correlates with mental health. Consequently, it can be developed into an effective psychological service strategy in Healthy China. Future empirical studies should continue to examine this relationship and explore additional potential moderating variables. Furthermore, the clinical effects of growth mindset interventions in mental health should be tested.

1. Introduction

The global challenge that the mental health situation is getting worse has captured the attention of the public and academia. The prevalence of mental disorders in China has been steadily increasing over the past 30 years (Huang et al., 2019), posing a potential threat to China's public health. The "Healthy China 2030" plan (hereinafter referred to as HC2030), issued by the Central Committee of the Communist Party of China on October 25, 2016, aims to improve its people's health through the following aspects: promoting healthy lifestyles, improving health level, optimizing health services, building a healthy environment, and developing health industries. It is currently recognized as China's most influential and sustainable national health policy and localization of the United Nations' sustainable development goals (Tan et al., 2019). To achieve the targets of Healthy China, we must transform the blueprint planning of the system into action (Zhang & Gong, 2019). Three years later, the State Council rolled out "Action for a Healthy China (2019-

2030)", specifying fifteen major actions to refine the policies and improve measures of the HC2030, which includes the goal of "Mental Health Promotion Action" to improve mental health literacy among Chinese population and reduce the rising prevalence of mental illness. Since the implementation of the HC2030, there has been a significant advancement in the positive emotions of the Chinese people (Ning et al., 2024). However, there are still shortcomings in the specific strategies to promote mental health (Wang & Guo, 2024), and mental health education still needs to be strengthened (Wang & Gu, 2022).

So far, most research on using a growth mindset to promote mental health or relieve pain from mental disorders has achieved positive results (Calvete et al., 2019; Schleider et al., 2019; Smith et al., 2018; Yeager et al., 2022), which seems effective for developing psychological services to pursue a Healthy China. However, OECD (2021) research has found that although Chinese students perform well academically, their growth mindset levels, closely related to academic achievement, are lower than the OECD average. Regarding the results observed in China,

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American researchers Yeager and Dweck (2020) posit a positive correlation between growth mindsets and mental health despite the limited influence of growth mindsets on the academic performance of Chinese students. Moreover, there is ample evidence that a growth mindset is conducive to building a Healthy China: 1. Growth mindset education/intervention possesses the distinctive attributes of high replicability, minimal cost, and accessible scalability (Schleider & Weisz, 2018; Smith et al., 2018), suitable for China's underdeveloped economic situation. 2. The intervention effect of growth mindsets is good. Previous studies have found that it can significantly reduce symptoms of depression and anxiety (Calvete et al., 2019; Schleider et al., 2019; Schleider & Weisz, 2018; Yeager et al., 2022), even more effective than antidepressants ($d = 0.32$ vs $d = 0.20$) (Burnette et al., 2023). 3. Growth mindsets are more conducive to the development of appropriate concepts for health (Reffi et al., 2020; Schroder et al., 2015) and to promote the achievement of the health goal of "improving the mental health literacy of residents". 4. Growth mindset education/intervention can be seen as a form of empowerment (Dahl et al., 2018; Yeager et al., 2018). This implies that empowered individuals are respected, which is consistent with the principle mentioned in the HC2030, which explains that we should work to build a Healthy China, a community with a shared future for humanity and proactive health. Therefore, exploring the relationship between Chinese people's growth mindsets and mental health can provide valuable insights, particularly given the implications for the well-being of 1.4 billion individuals in China and its contribution to global health security.

A meta-analysis of Western studies has investigated the relationship between growth mindset and mental health. Their findings demonstrated a negative correlation between a growth mindset and negative indicators of mental health (psychological distress) ($r = -0.22$, 95 % CI $[-0.257, -0.184]$) (Burnette et al., 2020). In contrast, a fixed mindset is positively correlated with psychological disorders ($r = 0.25$, 95 % CI $[0.19, 0.32]$) (Schleider et al., 2015). Additionally, the findings suggest that growth mindset intervention has a significant effect on mental health ($d = 0.32$, 95 % CI $[0.10, 0.54]$) (Burnette et al., 2023). In China, relevant empirical studies have demonstrated notable discrepancies in the degree of the correlation between the growth mindset and mental health. The r -value for the correlation between growth mindset and positive indicators of mental health ranged from -0.04 to 0.86 (Lan et al., 2019; Zhang & Lin, 2022), while the r -value for the correlation between growth mindset and negative indicators of mental health ranged from -0.65 to 0.01 (Gu, 2022; Li, 2023; Li et al., 2018). It is unclear whether these discrepancies are caused by variables (e.g. gender, age, economic region) and research characteristics (measurement instruments). Even though scholars in China have conducted a comprehensive review of the development of a growth mindset in mental health (Yu et al., 2022; Yu & Lian, 2019), there has not yet been a meta-analysis of this topic. In the current study, we have reviewed the evidence on the potential that growth mindsets are used to reduce the burden of mental health disorders within the Chinese population. Specifically, we examined the link between Chinese people's growth mindsets and mental health with meta-analysis.

1.1. Growth mindset and its measurement

Based on the social cognitive theory and attribution theory, Dweck believes that "mindset" organizes and illustrates the fundamental hypothesis about the world, thereby influencing individuals' different cognitive judgments, psychological behavioral responses, and coping styles (Dweck, 2008; Dweck & Yeager, 2019). There are mainly two types of mindsets: a growth mindset refers to people's belief that individual attributes can evolve over time, and a fixed mindset, which has been shown that one's attributes are immutable and unalterable (Dweck & Leggett, 1988; Ji et al., 2024). According to the SOMA model, people who support the growth mindset employ mastery-oriented strategies and a higher level of self-regulation and action, which enables them to

cope better with setbacks; people who support the entity theory, employ helpless-oriented strategies, which attributes adverse life events to unchangeable, global, and internal causes, predispose individuals to lose the ability to solve problems (Burnette, & O'boyle, E. H., VanEpps, E. M., Pollack, J. M., & Finkel, E. J., 2013).

The earliest scale employed for assessing a growth mindset was a unidimensional scale (Theories of Intelligence Scale, TOI) devised by Dweck and her colleagues (1995). Subsequently, Dweck (2000) expanded the original one-dimensional scale into a two-dimensional model (the Theory of Intelligence Scale, TIS), presenting growth and fixed options and designing fewer than ten questions. Additionally, the scale (TIS) was then expanded to 20 questions, forming the GMS scale (Growth Mindset Scale) (Dweck, 2006). The GMI scale (The Growth Mindset Inventory) is a simplified version of the TIS scale used by Chinese scholars (Zeng et al., 2016). Furthermore, there is also the TOE scale (Theories of Emotion Scale) in the emotional field (Tamir et al., 2007), and the TOP scale (Theories of Personality Scale) in the personality field (Dweck & Leggett, 1988). The current studies consider the measurement results of these scales as indicators to examine the relationship between growth mindset and mental health in greater detail.

1.2. The conceptualization and assessment of mental health

Mental health is a dynamic state of internal equilibrium that enables individuals to use their abilities in harmony with the universal values of society. Basic cognitive and social skills; the ability to recognize, express, and modulate one's own emotions, as well as empathize with others; flexibility and the ability to cope with adverse life events and function in social roles; and harmonious relationship between body and mind are represented essential components of mental health that contribute, to varying degrees, to the state of internal balance (Galdieri et al., 2015). The Dual-Factor Model of Mental Health (DFM) suggests that the degree of mental health should be measured on two dimensions: positive indicators and negative indicators (Keyes, 2002). The World Health Organization (WHO) identifies happiness as a primary positive indicator of mental health (Gao & Bai, 2021; World Health Organization, 2004). Furthermore, life satisfaction and positive affect are positive indicators for evaluating mental health (Liu, 2020; Liu et al., 2021; Zhu et al., 2020). In addition, a significant correlation is found between psychological resilience and positive mental health indicators (Liu et al., 2019). In the context of mental health assessments, anxiety, depression, and stress are often used as negative indicators (Huang et al., 2022; Lovibond & Lovibond, 1995; Zhu, Zhu et al., 2022). Given the above, happiness, life satisfaction, positive and negative emotions, psychological resilience, anxiety, depression, and stress are included in the assessment of the degree of mental health.

1.3. The relationship between growth mindset and mental health

The integrated mechanism of implicit theory affecting mental health suggests that individuals with different mindsets will have different emotional responses and behavioral choices when confronted with social challenges and threats due to differences in goal setting, attribution methods, control beliefs, and effort levels (Yu & Lian, 2019). Individuals with growth mindsets are likely to mobilize more protective factors, such as adopting positive attribution methods and coping strategies to improve their ability to cope with difficulties and setbacks when facing adversity or unfavorable conditions. In this way, they can have more positive physiological and psychological responses. Conversely, entity theorists often complain about their inability to adapt when encountering setbacks, and they are prone to helplessness and developing negative emotions and behaviors (Burnette et al., 2020). Generally, people who support the growth mindset have better functional adaptability and higher mental health levels than those who support the entity theory.

There is a strong relationship between growth mindset and mental

health. A substantial body of empirical evidence has demonstrated that individuals with a growth mindset exhibit higher levels of positive indicators of mental health, including greater happiness (Zhu et al., 2020), enhanced life satisfaction (Chan, 2012; Chen et al., 2022; Diao et al., 2020; Lam & Zhou, 2020) and psychological resilience (Jia et al., 2022; Ju, 2022; Liu, 2021; Qu et al., 2021; Song & Xu, 2019; Tang et al., 2022). Furthermore, individuals who hold a growth mindset tend to exhibit lower negative indicators of mental health, including depression (Hu et al., 2022; Hu & Chen, 2018; Niu et al., 2020; Schleider & Weisz, 2018; Xiong, 2022), stress (Joo et al., 2023; Zhao, Xiong, et al., 2021), and anxiety (Lai et al., 2022; Su, 2022). It can be assumed that a growth mindset is positively correlated with positive indicators of mental health and negatively correlated with negative indicators of mental health.

1.4. Effect of moderating variables

An unstable correlation was found between a growth mindset and mental health when reviewed in earlier studies, and the instability is likely to be influenced by moderating variables.

1.4.1. Age

There may be differences in the relationship between growth mindset and mental health among different age groups of participants. One study found that a growth mindset gradually declines from childhood to adolescence, accompanied by an increase in the incidence of depression (Ford et al., 2018). Another study also found that from age 14 to 17, a growth mindset (in the field of intelligence, ability, personality, and relationships) shows a declining trend, which affects mental health (Chan et al., 2022). In a study involving adults (18–73), a growth mindset was significantly negatively correlated with age ($r = -0.27$). As age increases, the ability to process emotions decreases (Cabello & Fernandezberrocal, 2015). Therefore, We hypothesize that age may influence the relationship between growth mindset and mental health. Specifically, we propose that individuals may exhibit a diminished growth mindset as age increases, which weakens the correlation with positive mental health indicators.

1.4.2. Gender

The findings of Wang and Xu (2022) indicate that women (2.59) scored lower than those of men (2.71) ($p < 0.001$) on the growth mindset scale. Additionally, the results revealed that women exhibited higher levels of failure anxiety than men. A study of a sample of high school students in China also found that men had higher levels of growth mindset than women, and women had significantly higher stress levels than men (Zhang, Qi, et al., 2022). Schleider and Weisz (2016) argue that differences in parenting styles, interpersonal stress perception and response, sense of control, and coping strategies between men and women contribute to women exhibiting a lower growth mindset than men and being susceptible to psychological disorders. It can be inferred that gender may serve as a moderating variable for the relationship between growth mindset and mental health. Specifically, females tend to exhibit a lower growth mindset compared to males, and female's growth mindset is significantly negatively correlated with negative indicators of mental health.

1.4.3. Economic region

Past studies on mindsets have indicated that an individual's economic status can influence their mindsets, and different results have been found both in the East and West. In the West, Claro et al. (2016) found that students from higher-income families were more likely to hold growth mindsets than their poorer peers. Individuals with a higher socioeconomic status (SES) tend to benefit more from growth mindsets (King & Trinidad, 2021). However, the study results in China are contrary to the above finding. For instance, Teenagers from low-income households tended to develop more growth mindsets than those from high-income ones (Chen, 2022). College students who lived in Beijing

(the capital of China) had lower growth mindsets than those from Hubei province and perceived from higher stress levels (Zhao, Zhang, Yu, et al., 2023). Due to the uneven economic development among regions in China, it is assumed that participants from different regions may have differences in the relationship between growth mindset and mental health. That is, people from advantaged economic regions will have lower growth mindsets than those from disadvantaged economic regions, and its correlation with positive indicators for mental health will be weaker.

1.4.4. Measurement instrument

Previous research on growth mindsets found that the original, adapted, or translated versions of the TIS instrument may yield different results (Costa & Faria, 2018). Even using different narrative styles within the same version can affect growth mindset measurement results (Zhang, Yang, & Gu, 2022). Different cultural understandings can affect the effectiveness of measuring growth mindsets (Troche & Kunz, 2020). Moreover, some Chinese researchers have begun investigating the application of one-dimensional growth mindset scales (Zhu et al., 2022) and different types of growth mindset scales in mental health (Chan et al., 2022). Thus, it is reasonable to suppose that measurement instruments moderate the relationship between growth mindset and mental health. The Chinese version of the instrument may measure a stronger relationship between growth mindset and mental health.

In summary, the main tasks of the meta-analysis are: (1) to organize relevant studies and use meta-analysis techniques to investigate the main effects of positive and negative indicators between growth mindset and mental health with Chinese samples; (2) to identify the moderating effects of age, gender, economic region, and measurement instruments on the relationship between growth mindset and mental health with Chinese samples.

2. Methods

2.1. Literature search

The literature search refers to the PRISMA literature search guide (Rethlefsen et al., 2021), and Fig. 1. illustrates the process of literature search. An initial search was conducted using CNKI, Wanfang, PubMed, and Web of Science. Search terms included combinations of the keywords *growth mindset, implicit theory, incremental theory, fixed mindset, lay theory, stress, depression, anxiety, happiness, mental health, life satisfaction, psychological resilience, China, and Chinese*. In addition, citation searching was employed to supplement the literature. In order to incorporate literature comprehensively, Google Scholar will be used as a supplementary tool for grey literature. In order to obtain the most complete and recent data, the literature search occurred in two phases that adopted the same methodology. The first search occurred on November 15, 2023; an updated search was conducted on July 10, 2024. Ultimately, 59 articles were included, including 28 Chinese and 31 English articles, with a total sample size of 54,302.

2.2. Inclusion criteria

The following are criteria classification and sorting methods for literature search: (1) Studies must be empirical ones and focus on the relationship between growth mindset and mental health; (2) Participants should be Chinese; (3) Studies provide the required effect size or other data that can be obtained through calculation; (4) In order to ensure the independence of effect size, collect only the first measured data among longitudinal data literature. If there are multiple indicators of the same type of mental health among the same group of participants, they should be aggregated. If multiple independent samples are investigated in the same literature, they should be coded separately; (5) The independent and dependent variables are consistent with the meta-analysis, except for literature on fixed mindset and mental health; (6)

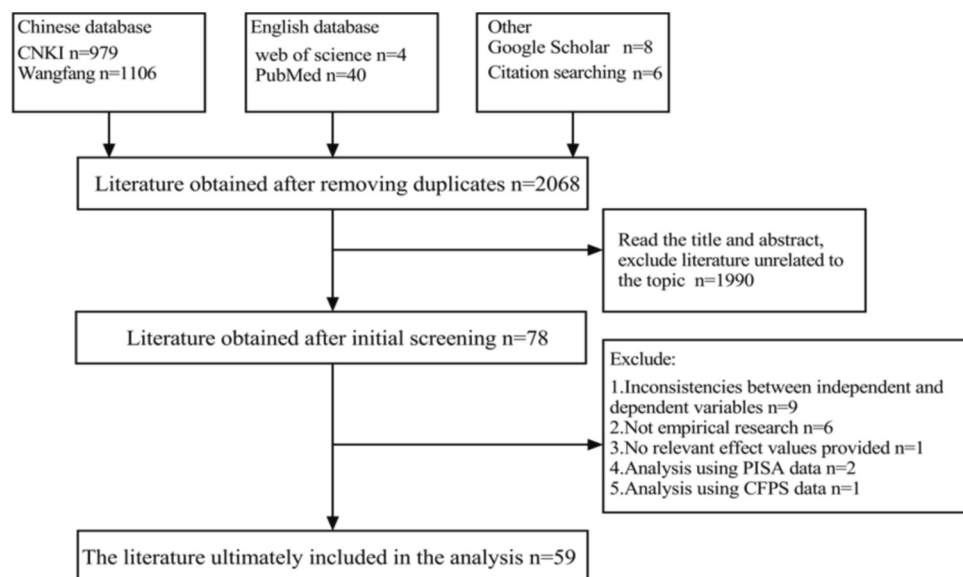


Fig. 1. Flow diagram of identification and selection of included studies.

The full text is accessible.

2.3. Coding of the studies

The collected literature that met the inclusion criteria was coded for the following characteristics (Table 1): literature information (author name+publication date), sample size, age of participants (children, adolescents, early adults, adults), economic region (Northeast China, North China, Central China, East China, South China, Northwest China, and Southwest China), average age, female proportion, measurement instrument, type of measurement results, and quality assessment for literature. Two coders (YJM and JTT) conducted independent coding using the above criteria, negotiated discrepancies and reached a consensus on the literature inconsistent with the established criteria.

2.4. Data analysis plan

Meta-analysis in this thesis adopted the Pearson correlation coefficient r as the effect size, which was converted into Fish's Z to ensure comparability of the effect size to facilitate the interpretation of the results. The conversion formula is $Z = 0.5 \times \ln\left(\frac{1+r}{1-r}\right)$ (Borenstein & Hedges, 2019). The corresponding formula was used in studies that do not report r values but report F , t , or χ^2 values to convert them to r values. Multiple effect sizes of the same type of mindset measured by the same participant were aggregated to correct standard error (Hedges et al., 2010). The formula involved in aggregation is $M = \frac{\sum_{i=1}^k w_i Y_i}{\sum_{i=1}^k w_i}$ (W represents the weight of each study, and Y represents each study's effect) (Borenstein et al., 2009).

Heterogeneity testing employs Q -test results, I^2 values, and H values to ascertain the presence of heterogeneity. We suppose that the effect sizes included in this study are all identical in the Q -test. If the Q -value increases beyond the range explained by sampling error, heterogeneity is considered to exist. The I^2 value represents the proportion of heterogeneity in the total variation of the effect sizes after excluding sampling errors. The low, middle, and high degree of heterogeneity is typically determined by 25 %, 50 %, and 75 %, respectively. The calculation formula is $100 \% \times (Q-df)/Q$. The H -test serves to correct the Q value, overcoming the influence of sample size on the results of heterogeneity testing. Here, we get: $\sqrt{Q/k-1}$, When $H > 1.5$, heterogeneity exists (Ren & Lai, 2023).

For a long time, the published literature may have focused on statistical significance, leading to publication bias and affecting the accuracy of meta-analysis results. First, this study searched unpublished master's and doctoral thesis databases, which helped reduce publication bias. Additionally, funnel plots and the Fail-Safe Number (FSN) were utilized to test for publication bias. A funnel plot is a scatter diagram in which each point represents a study, with the horizontal axis indicating the effect size and the vertical axis representing the standard error. Publication bias can be detected by checking the symmetry of the plot. The FSN test demonstrates the extent of publication bias through the additional research required to calculate the statistical significance of the converted meta-analysis results. Rosenthal (1979) suggests that no notable publication bias exists when FSN exceeds the critical value of $5k + 10$ (where k represents the number of effect sizes).

The research tool employed was CMA 3.0 (Comprehensive Meta-Analysis 3.0), a software program developed for data processing with funding from the National Institutes of Health in the United States. Excel 2007 and GraphPad Prism 9.5 were supplementary tools for organizing data and generating graphical representations.

3. Results

3.1. Literature inclusion and quality description

Fifty-nine articles meeting the meta-analysis criteria (28 in Chinese and 31 in English) were included in this study. Among these articles, 46 (78 %) were journal articles, while 13 (22 %) were degree theses. The literature spans 16 years, from 2008 to 2024, with most of them published in the past five years (83.1 %), 56 studies (94.9 %) were conducted after the implementation of the HC2030 (Fig. 2.). After aggregating the effect sizes of the same type in the same study, 68 effect sizes were obtained from 54,302 participants compared to previous 84 effect sizes. Due to some literature reporting the results of two indicators on mental health, the sum of the number of participants included in the positive and negative indicators of mental health is greater than the total number of participants in all studies.

By the methodology proposed by Zhang et al. (2019), each piece of literature was evaluated based on four criteria: how subjects were selected, the retention rate of subjects, the internal consistency reliability of measurement tools, and the publication level. The total score was 8 points, with higher scores indicating higher quality of literature. Two independent evaluators (YJM and ZJ) conducted the evaluation

Table 1

Summary of characteristics of studies included in the meta-analysis.

	Author	Year	sample size	Age	Economic region	Average age	Female proportion	Growth mindset measurement instrument	Mental health measurement instrument	Literature quality score
1	Li	2008	456	Ea	3	20.20	0.632	Other	SCL-90	5
2	Chan	2012	251	TC	4	12.68 ± 2.24	0.438	Other	SWLS, OHQ	3
3	Zeng	2016	1260	T	4	13.49 ± 3.20	0.478	GMI	PWB	7
4	Chu	2016	2023	T	6	13.24 ± 1.00	0.504	TIS	DASS-21	2
5	Hu	2018	624	Ea	1	19.85 ± 1.25	0.527	TIS TOP	CES-D	7
6	Li	2018	553	Ea	1	19.00 ± 2.16	0.785	TIS	DASS-21	6
7	Lan	2019	177	Ea	5	21.18 ± 1.62	0.700	TOI	PWB	7
8	Song	2019	595	Ea	2	NA	0.600	GMS	Other	7
9	Zeng	2019	471	Ad	6	39.61 ± 8.62	0.703	GMI	PERMA	5
10	Chen	2019	1384	Ad	6	34.35 ± 8.45	0.864	TIS	PERMA	4
11	Niu	2020	755	T	2	13.35 ± 1.02	0.506	TIS	CES-D	5
12	Diao	2020	1161	C	4	10.32 ± 1.42	0.458	TIS	SWLS	5
13	Lam	2020	374	Ea	4	19.95 ± 1.64	0.680	TIS	SWLS	5
14	Liu	2020	546	Ea	5	19.86 ± 1.32	0.811	TOE	SWLS	5
15	Zhu	2020	735	T	4	13.91 ± 1.26	0.480	Other	HWSC	4
			285	T	4	15.09 ± 2.75	0.450	Other	SWLS	4
16	Qu	2021	200	TC	4	10.89 ± 2.84	0.550	TIS	CD-RISC	5
		2021	200	Ad	4	39.60 ± 4.66	1.000	TIS	CD-RISC	5
17	Gong	2021	751	Ea	2	19.52 ± 1.15	0.688	TIS	PANAS	5
18	Zhao, Xiong	2021	1040	Ea	2	18–24	0.619	TOI	CPSS	7
19	Liu, Liu	2021	475	T	1	NA	0.410	TIS	SWLS PANAS	4
20	Wang	2021	942	T	5、4	14.41 ± 0.91	0.494	Other	MHC-SF	5
21	Liu	2021	783	T	3	13.74 ± 1.20	0.462	GMS	Other	4
22	Ju	2022	475	T	1	NA	0.587	GMS	Other	3
23	Su	2022	1148	T	4	NA	0.592	GMS	FBTAS	4
24	Liu	2022	402	T	3	NA	0.450	GMS	Other	4
25	Lai	2022	2543	TC	2	11.54 ± 1.84	0.490	GMI	GAD-7 CESD-10	4
26	Hu, Wang	2022	1961	T	4	16.97 ± 1.10	0.561	GMS	CES-D	4
27	Xiong	2022	752	T	2	13.25 ± 0.99	0.467	Other	SDS	4
28	Jia	2022	273	Ea	NA	21.33 ± 0.97	0.730	GMS	PSS OHQ STAI CD-RISC	6
29	Huang	2022	613	Ea	4	18.49 ± 0.85	0.688	Other	SWLS CES-D	5
30	Tao	2022	2505	Ea	3	18.38	0.725	TIS	SCL-90	7
31	Da	2022	942	Ad	NA	29.30 ± 10.63	0.602	Other	GAD-7	6
32	Chen	2022	443	T	6	15.40 ± 0.91	0.528	TOI	SWLS	5
33	Tang	2022	709	Ad	6	NA	0.907	TOP	CD-RISC	6
34	Zhang, Qi	2022	1564	T	NA	17.02 ± 1.05	0.514	Other	SQR-20	6
35	Gu	2022	773	Ea	NA	NA	0.517	Other	STAL-Form X	2
36	Kwok	2022	854	C	4	9.40 ± 1.01	0.489	TIS	PERMA	4
37	Huang	2022	1284	Ea	6	19.57 ± 0.82	0.759	TIS	DASS-21	3
38	Yu	2022	456	Ad	6	25–60	0.533	Other	PANAS	6
39	Zhang, Lin	2022	1614	Ea	6	NA	0.735	Other	Other	3

(continued on next page)

Table 1 (continued)

	Author	Year	sample size	Age	Economic region	Average age	Female proportion	Growth mindset measurement instrument	Mental health measurement instrument	Literature quality score
40	Hu, Liu	2022	1256	Ea	1	19.50 ± 1.45	0.521	TOI	Other	4
41	Ma	2022	1346	TC	5	12.51	0.516	TOI	SDQ	4
42	Li	2023	680	Ea	0	NA	0.488	GMS	PANAS PSS	5
43	Zuo	2023	893	T	3	NA	0.562	TIS	Other	6
44	Joo	2023	179	C	1	11.48 ± 1.12	0.508	TIS	YSR CBCL	4
45	Zhao, Zhang	2023	582	Ea	1、2	18.11 ± 0.65	0.696	TIS	SWLS PHQ-9	7
46	Xu	2023	2471	T	NA	17.26 ± 1.14	0.580	GMS	GES-D	5
47	He	2023	547	Ad	NA	27.32 ± 6.81	0.744	GMI	OWS	3
48	Zhao, Du	2023	600	Ad	4	40.45 ± 4.94	0.618	Other	CES-D DASS-21	3
49	Pan	2023	663	Ea	5	19.92	0.617	TOI	SWLS	5
50	Lee	2023	267	Ad	4	NA	0.652	TIS	SWLS	5
51	Huang	2023	1493	T	3	16.40 ± 0.99	0.669	Other	PROMIS SWLS	5
52	Peng	2023	759	T	4	NA	0.441	TIS	Other	5
53	Ma	2023	1741	TC	NA	12.62 ± 1.50	0.541	TOI	SDQ	3
54	Dong	2023	266	T	1	12–13	NA	TIS	Other	6
55	Song	2023	664	Ea, Ad	NA	NA	0.710	TIS	SWLS PANAS	2
56	Tang	2024	1229	Ea	3	NA	0.297	TIS	Other	6
57	Zhao	2024	838	T	6	15.93 ± 0.96	0.409	Other	Other	7
58	Chang	2024	1823	T	3	14.54 ± 1.71	0.532	TIS	SWLS	7
59	Jiang	2024	653	T	3	12–19	0.553	TIS	SDQ	5

Note: (1) C represents children, T represents adolescents, Ea represents early adulthood, mainly referring to college students; Ad represents adults; TC represents both children and teenagers; (2) According to the administrative division of China, 0 represents Northeast China, 1 represents North China, 2 represents Central China, 3 represents East China, 4 represents South China, 5 represents Northwest China, and 6 represents Southwest China; (3) NA indicates that the literature does not provide corresponding information. (4) The coded literature reports only the first author, while duplicate authors appearing in the same year report the first two authors; (5) The category “Other” encompasses measuring tools that cannot be classified within the same category as existing ones. Furthermore, each tool is used less than three times.

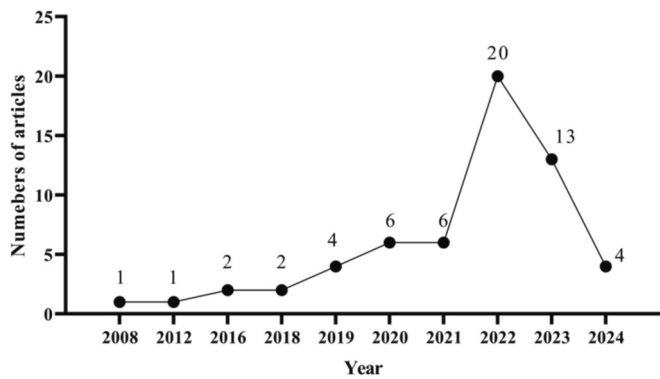


Fig. 2. Characteristics of different years included in the literature analysis.

process. The mean score for the assessment of literature quality was 4.8 points, which is above the theoretical average (4.0 points) and indicates that the quality of the literature is relatively high (Fig. 3.). Among the literature, ten articles scored lower than the theoretical average, and the correlation effect size accounted for approximately 20.24 % of the total effect size. It is recommended that the results of such articles be treated with concern.

3.2. Heterogeneity test

As shown in Table 2, the Q-value of the positive indicators is 2169.27, and the Q-value of the negative indicators is 929.33, which illustrates a significant heterogeneity in the effectiveness. The actual

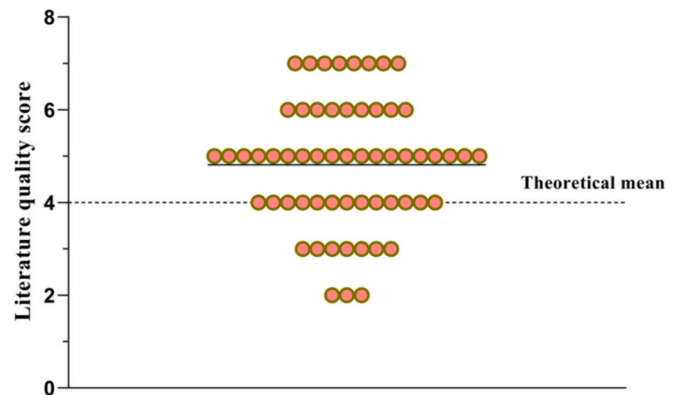


Fig. 3. Literature quality rating and feature distribution.

variation of the effect for the positive indicators accounts for 98.43 % of the total variation. In comparison, the actual variation of the effect for the negative indicators accounts for 96.56 % of the total variation. $I^2 \geq 75 \%$ indicates a high degree of heterogeneity. After calculating the correction value H of the Q effect quantity, it was found that the H value of the positive indicator was 7.99 and the H value of the negative indicator was 5.39; these values are all >1.5 , indicating a high degree of heterogeneity. Consequently, a random effects model was employed for analysis (Higgins et al., 2003).

Table 2
Analysis of the random effects model on the relationship between growth mindset and mental health.

Mental health	<i>k</i>	<i>n</i>	<i>r</i>	95%CI		Heterogeneity test			
				LL	UL	<i>Q</i>	<i>df</i>	<i>I</i> ²	<i>T</i> ²
Positive indicators	35	22,929	0.36	0.27	0.45	2169.27	34	98.43	0.09
Negative indicators	33	35,984	−0.25	−0.31	−0.20	929.33	32	96.56	0.03

3.3. Publication bias test

The funnel plot (Fig. 4.) shows that studies on mental health indicators are evenly distributed at both ends of the top. The shape of the plotted points resembles a symmetrical inverted funnel, suggesting no significant publication bias in the current set of included studies (Egger et al., 1997). The FSN test revealed that the FSN for positive and negative indicators of mental health were separately 11,360 (Z -value = 57.75, $p < 0.001$) and 7578 (Z -value = −45.28, $p < 0.001$). These results suggested that 11,360 studies on positive and 7578 on negative indicators would have to be added to refute the current meta-analysis results. The above results have demonstrated the absence of publication bias.

3.4. Main effect test

A random effects model was employed to conduct a main effects test on the relationship between growth mindset and mental health (see Table 2, and the specific situation of each study is shown in Fig. 5. and Fig. 6.). The results showed that the correlation coefficient between growth mindset and positive indicators of mental health was 0.36 [0.27, 0.45](excluding 0). The correlation coefficient was −0.25 [−0.31, −0.20](excluding 0) between growth mindset and negative mental health indicators. The main effects reached a statistically significant level. According to the criteria for evaluation proposed by Lipsey and Wilson (2001), the correlation coefficients are all between 0.1 and 0.4, indicating a moderate degree of correlation. Subsequently, a sensitivity analysis was conducted, and samples were removed one by one. It was

found that the effect size of growth mindset and positive indicators of mental health fluctuated between 0.339 and 0.373, and the effect size of negative indicators of mental health fluctuated between −0.261 and −0.238, with little difference from their respective main effect estimates, indicating that the main effect test results are stable.

3.5. Moderating effect test

The results of the heterogeneity test indicate significant heterogeneity among the literature included in the meta-analysis, and moderating effect analysis can be performed to identify the sources of heterogeneity. There are two types of moderating effect analysis: subgroup analysis, which is used when the moderating variable is categorical, and meta-regression analysis, which is used when the moderating variable is continuous.

3.5.1. Subgroup analysis

Subgroup analyses were conducted to examine the moderating effects of age characteristics, economic region, and measurement instruments on the relationship between growth mindsets and mental health among participants (Table 3 and Table 4). The results of subgroup analysis indicate that: (1) Age serves as a moderating factor in the relationship between growth mindsets and positive indicators of mental health, and the moderating effect is substantial at the age of children, adolescents, and adults ($Q_b = 13.362$, $p < 0.01$). The correlation between adult growth mindsets and positive indicators of mental health is also found to be most robust ($r = 0.482$). (2) Economic regions have a marginally significant moderating effect on the relationship between growth mindset and positive indicators of mental health ($Q_b = 2.980$, $p = 0.084$). The relationship between growth mindset and positive indicators of mental health in Southwest China ($r = 0.517$) is more closely related than that observed in South China ($r = 0.288$). (3) In addition, the TIS, GMS, GMI, and TOI scales exert a considerable moderating influence on growth mindset and positive indicators of mental health ($Q_b = 11.401$, $p < 0.05$). Among these, the effect size of growth mindset and positive indicators of mental health measured using the GMS scale ($r = 0.471$) is higher than that measured using the TIS, GMI, and TOI scales. Moreover, the GMS, TIS, and TOI scales also have a significant moderating effect on growth mindset and negative indicators of mental health. Similarly, the degree of correlation measured by the GMS scale is the highest ($r = −0.373$).

(Note: k represents the number of studies, and r represents the effect size. LL and UL represent the lower and upper limits of the 95 % confidence interval for r , and Q_b represents the Q -test for inter-group heterogeneity. To ensure the relative stability and accuracy of the research results, if the number of effect sizes included in each category of the moderating variable is < 2 , it will not be included in the analysis. Furthermore, unreported missing values will not be included in the analysis. Only significant values of the moderating effect are displayed. Details mentioned below the table4 apply here as well.)

3.5.2. Meta-regression analysis

Following the approach of Burnette et al. (2020), the restricted maximum likelihood estimation method and the Knapp Hartung test were selected in CMA software to conduct a meta-regression analysis on the relationship between growth mindset and mental health, using gender (the ratio of women to subject population as the gender criterion)

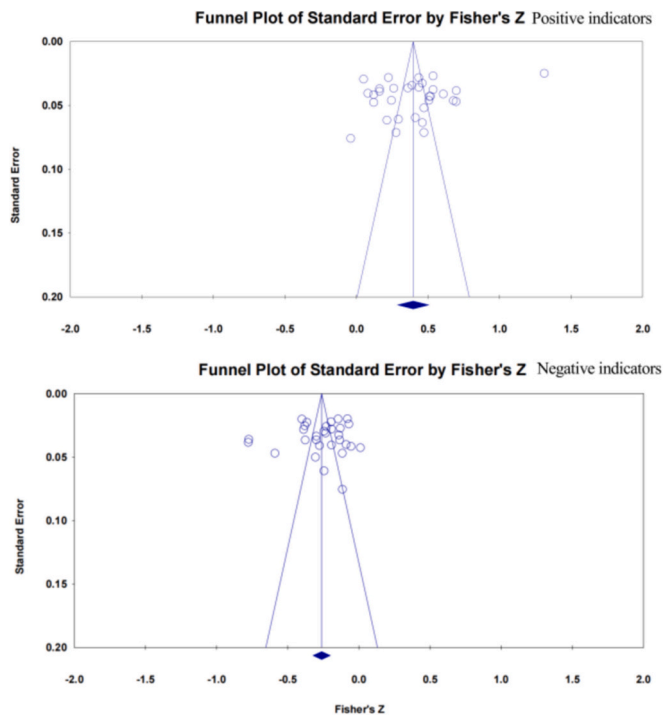


Fig. 4. Funnel plot of the relationship between growth mindset and mental health.

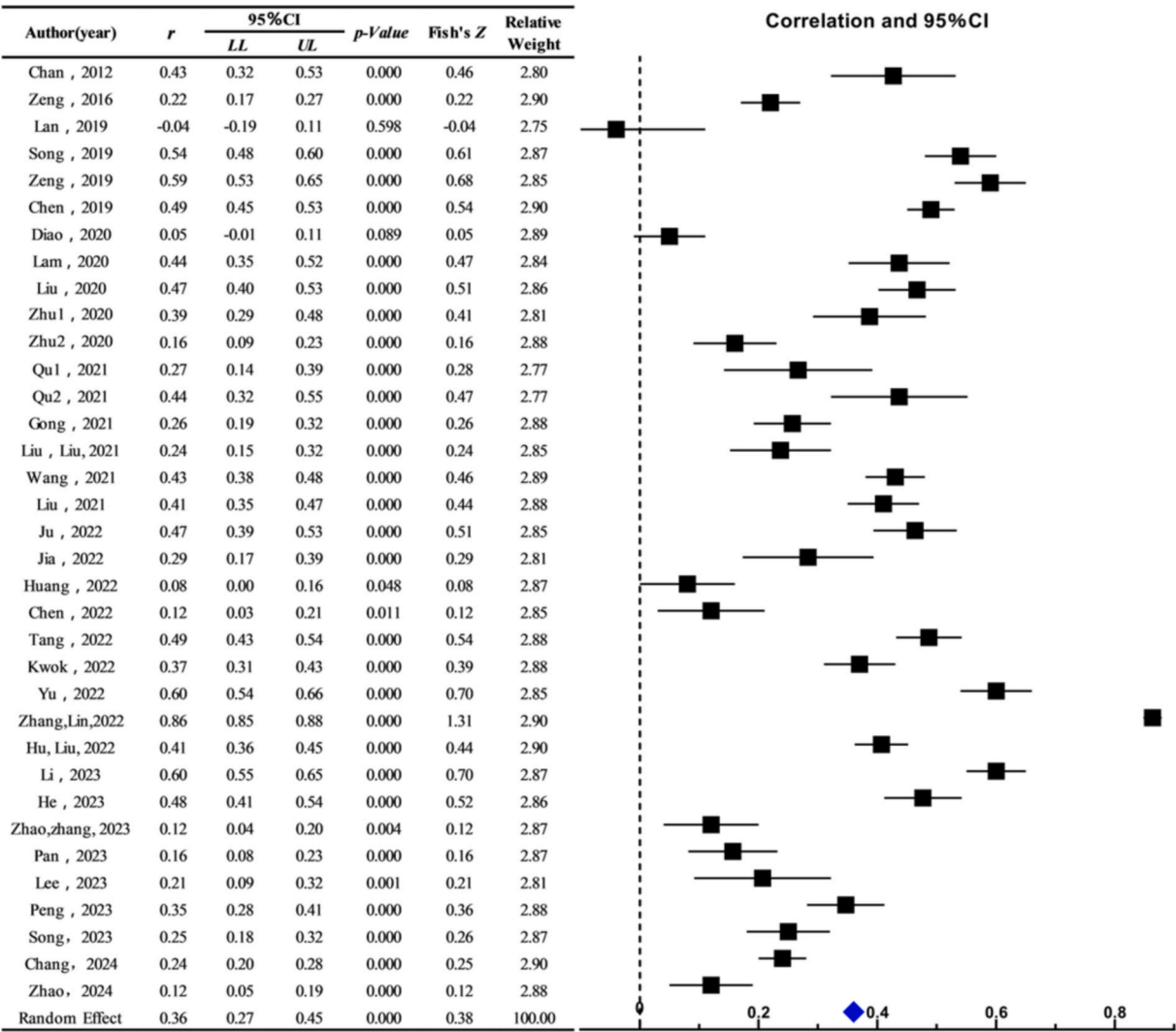


Fig. 5. Forest plot of individual study effects and overall effects (positive indicators)
(Note: The square in the graph represents each study's effect value *r*, and its area is proportional to the study's relative weight in the meta-analysis. The horizontal line across the square shows the effect value's 95 % confidence interval of the effect score, which is used to determine its accuracy. The diamond indicates the average effect value of the random effects model across all studies. The vertical dashed line passing through 0 means the effect value is zero. Details mentioned below the image apply here as well.)

as the independent variable. The study revealed that gender did not significantly influence the relationship between growth mindset and positive indicators of mental health ($F = 2.02, p > 0.05$). However, there was a marginal effect of gender on the relationship between a growth mindset and negative indicators of mental health ($F = 3.31, p = 0.079$) (Table 5). As the proportion of females increases, the effect of growth mindset on negative indicators of mental health weakens (Z-value gradually approaches 0 from negative) (see Fig. 7.), suggesting a decrease in the correlation between growth mindset and negative indicators of mental health in the female population.

4. Discussion

4.1. The Main effects of growth mindset and mental health

The results of this meta-analysis show that a moderately positive correlation is found between growth mindset and positive indicators of mental health ($r = 0.36, 95 \% CI [0.27, 0.45], p < 0.001$) and a moderately negative correlation between growth mindset and mental health ($r = -0.25, 95 \% CI [-0.31, -0.20], p < 0.001$). The results of this study align with those of previous Western research, indicating a

positive correlation between a growth mindset and positive indicators of mental health and a negative correlation between a growth mindset and negative indicators of mental health. Nevertheless, the correlation between Chinese people's growth mindsets and mental health is more robust than those in Western societies (Burnette et al., 2020; Burnette et al., 2023¹). The strong correlation between growth mindset and mental health provides evidence to support the feasibility of growth mindset education/intervention in China. Moreover, although the effect is relatively minor, it may have considerable consequences (Walton & Wilson, 2018; Walton & Yeager, 2020) when considered alongside the corresponding social environment, such as policy support and cultural atmosphere. Currently, preliminary practices of self-directed online growth mindset interventions have been implemented in Hong Kong with the objective of reducing anxiety(Zhu et al., 2023). This represents a opening endeavor to promote the implementation of growth mindset interventions in the context of a Healthy China.

4.2. Moderating effect test

This study examined the moderating effects of participants' age, gender, economic region, and measurement instruments on the

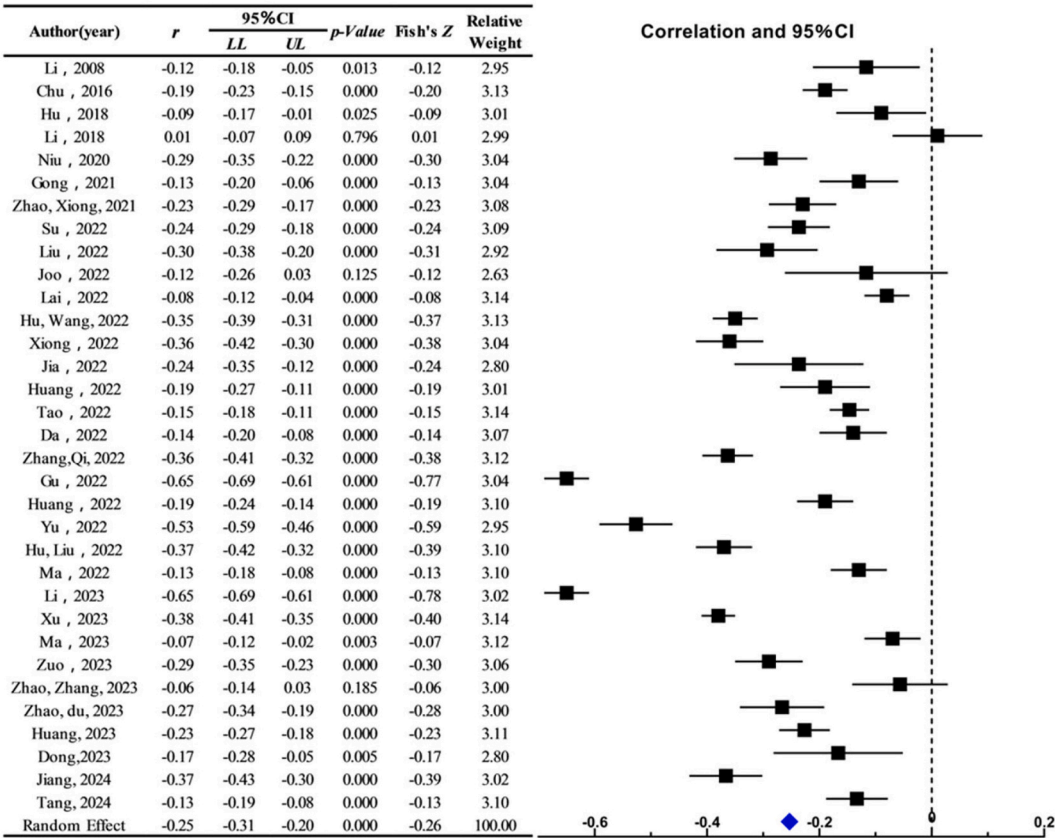


Fig. 6. Forest Plot of Individual Study Effects and Overall Effects (negative indicators).

Table 3
Testing the moderating effect of a growth mindset and positive indicators of mental health.

Moderator variable	Category	k	r	95%CI		Q _b	p
				LL	UL		
Age	Children	2	0.214	0.024	0.390	13.362	0.001
	Adolescent	11	0.289	0.211	0.364		
	Adults	7	0.482	0.396	0.560		
Economic regions	South China	12	0.288	0.106	0.452	2.980	0.084
	Southwest China	7	0.517	0.313	0.675		
Growth mindset measurement instrument	TIS	14	0.278	0.193	0.359	11.401	0.010
	GMS	5	0.471	0.345	0.580		
	GMI	3	0.438	0.269	0.581		
	TOI	4	0.176	0.008	0.335		

Table 4
Testing the moderating effect of a growth mindset and negative indicators of mental health.

Moderator variable	Category	k	r	95%CI		Q _b	p
				LL	UL		
Growth mindset measurement instrument	GMS	6	-0.373	-0.458	-0.282	11.653	0.003
	TIS	9	-0.176	-0.245	-0.105		
	TOI	4	-0.202	-0.316	-0.083		

relationship between growth mindset and mental health. Thus, a more comprehensive correlation between a growth mindset and mental health could be secured.

Age is a significant contributing factor moderating the relationship between growth mindset and positive indicators of mental health. However, contrary to the null hypothesis, this is specifically manifested in the increasing trend of the relationship between a growth mindset and positive indicators of mental health from children to adults in this study.

Chan et al. (2022)) and Ford et al. (2018)) suggested that a growth mindset may decrease with age, accompanied by an increase in psychological disorders. However, this result may be influenced by adolescent status, as their focus is entirely on groups under 18 years old (Ford et al., 2018). The analysis also revealed the strongest correlation between an adult's growth mindset and positive indicators of mental health. This may be related to the fact that adults have more growth mindset than adolescents (Chen et al., 2023; Rammstedt et al., 2024), or

Table 5
Meta-regression analysis of female proportion on growth mindset and mental health.

Mental health	Parameter	Estimated value	SE	t	95%CI		F	P
					LL	UL		
Positive indicators	Slope	0.41	0.27	1.42	−0.18	0.99	2.02	0.165
	Intercept	0.13	0.18	0.75	−0.23	0.50		
Negative indicators	Slope	0.57	0.31	1.82	−0.07	1.20	3.31	0.079
	Intercept	−0.59	0.18	−3.23	−0.96	−0.22		

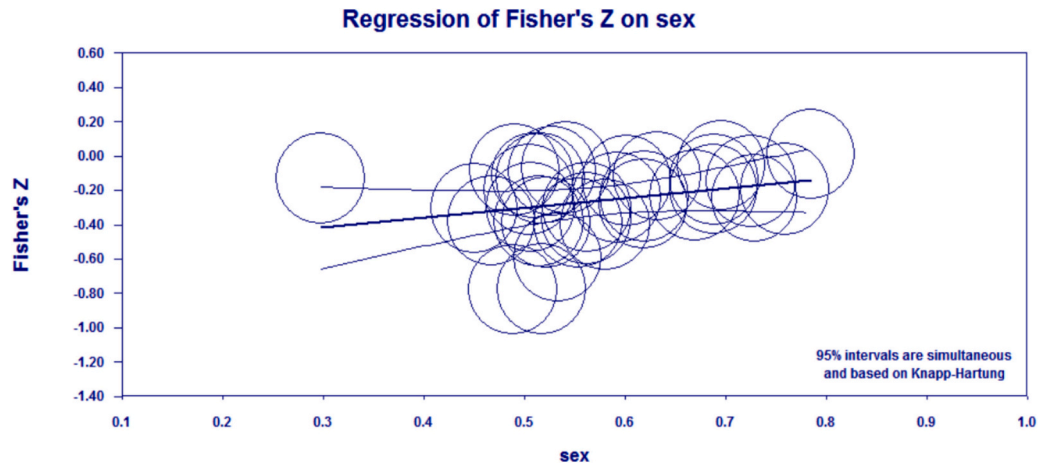


Fig. 7. Meta-regression of effect size on the proportion of females.

it may be due to the greater psychological maturity of adults (Fossas, 2019). Growth mindset may be more involved in the process of self-regulation in adults, helping them to develop a problem-solving behavior pattern (Burnette et al., 2013), strengthening the connection between adult growth mindset and positive indicators of mental health.

After testing the moderating effect of gender, the discovery is inconsistent with the null hypothesis. We found that as the proportion of women increased, the correlation between growth mindset and negative indicators of mental health decreased. This finding contradicts the hypothesis that vulnerability often moderates the effect of a growth mindset (Ji et al., 2024). Past research has shown that women are more susceptible to mental disorders compared to men (Hyde & Mezulis, 2020). Consequently, a stronger correlation between the growth mindset and women's mental health has been inferred. However, the results of this meta-analysis show that the relationship between growth mindset and negative indicators of mental health is weakened in the female-dominated group. Empirical studies in which the proportion of women is over 70 % have yielded similar results: the relationship between growth mindset and positive indicators of psychological health (happiness) has been weakened (Lan et al., 2019), while the relationship between growth mindset and negative indicators of psychological health (depression) has also been weakened (Li et al., 2018). However, the results for the group of all female participants yielded entirely different outcomes. There was a significant correlation between growth mindset and positive indicators of psychological health (psychological resilience)(Qu et al., 2021). We need to gain a deeper understanding of these heterogeneous results; it may be essential to integrate gender attributes with age, ethnic traits (culture), and economic regions of the subjects to facilitate a more comprehensive investigation. A meaningful interaction exists between mindset effects and individuals and contexts (Yeager & Dweck, 2020).

Economic region has a significant moderating effect on the relationship between growth mindset and mental health. The 2022 gross domestic product (GDP) data from the China National Bureau of Statistics (CNBS, 2024) shows that the GDP of South China (214,354.4 billion) is significantly higher than that of Southwest China (135,903.3

billion). The results of the meta-analysis are consistent with the hypothesis that in economically advantaged regions (South China), the correlation between growth mindsets and positive indicators for mental health is relatively low. The health belief model and protection motivation theory provide a framework for understanding this phenomenon: Individuals engage in changes of attitude and belief to maintain their health only when they perceive and evaluate the presence of threats in their environment (Lin et al., 2005). The likelihood of activating a growth mindset is greater in adverse and unfavorable environments. Previous studies have also shown that high socio-economic status (characterized by higher income and educational opportunities) correlates positively with an individual's happiness (Tan et al., 2020). All of the above suggests that it is necessary to consider the factors of economic development level to explore the relationship between a growth mindset and mental health.

The moderating effect of measurement instruments is significant and consistent with the hypothesis. Furthermore, the Chinese version of the GMS scale exhibits the most pronounced psychometric properties in the relationship between growth mindset and mental health. The GMS scale was revised by Jia (2018), and more items might be included, which can reflect a more comprehensive and proper level of growth mindset in individuals. This phenomenon indicates that for instrument providers, there is a need to focus on the field of mental health, adhering to the correspondence principle, and developing measurement instruments of growth mindset for research goals, which is the only way to capture the impact of growth mindset on mental health more fully (Chan et al., 2023; Zhu et al., 2022). We should also be based on the country of China and consider the characteristics of the user population (Chen et al., 2023).

5. Limitations and prospects

It should be noted that there this study has some limitations. The meta-analysis results cannot explain the causal-effect relationship between growth mindset and mental health. Thus, concerns are required when making inferences based on the meta-analysis. Future research

should conduct more longitudinal studies to clarify the causal relationship. Some information will inevitably be lost during the analysis due to the need for more data in the original literature. Moreover, the region of the subjects used in the analysis to estimate socioeconomic levels may be statistically biased. Additionally, data on the subjective economic status of the participants was not obtained in this analysis. Some scholars have proposed that there may be discrepancies in the patterns of objective and subjective economic status effects on the growth mindset (Zhao, Chen, et al., 2021). The moderating effects of gender, age, economic region, and measurement instruments have been tested and evaluated. Future research should examine further the function of these moderating variables and identify other potential moderating variables. For the growth mindset assessment, studies reporting growth mindset scores were selected. In the future, it may be considered to include a fixed mindset to have a more comprehensive understanding of “mindset”. In the assessment of mental health, it would be beneficial to include more items in future studies, such as suicidal ideation (Song et al., 2022; Zhu & Wong, 2022), hope (Zhao, Chen, et al., 2021), and sense of meaning in life (Zhao, Zhang, Li, & Wang, 2023), and so on. As research progresses, the relationship between growth mindset and mental health can be measured in different mindset domains (such as intelligence, personality, and emotion) (Burnette et al., 2020; Chan et al., 2023; Schleider et al., 2015).

6. Conclusion

The meta-analysis results indicate a significant positive relationship between a growth mindset and positive psychological indicators (happiness, psychological resilience, life satisfaction) and a significant negative relationship between a growth mindset and negative psychological indicators (anxiety, depression, stress). The relationship between a growth mindset and mental health is moderated by age, gender, economic region, and measurement instruments.

Ethics statement

This study (A Meta-Analysis of the Relationship Between Growth Mindset and Mental Health in Chinese Samples, ACTPSY-D-24-01202) has received ethical approval from the Scientific Research Ethics Committee of the School of Psychology at Northwest Normal University (Approval No. 2022064).

CRediT authorship contribution statement

Xiaoli Yang: Writing – review & editing, Supervision, Resources, Funding acquisition. **Jianmei Yang:** Writing – original draft, Software, Methodology. **Tingting Jia:** Software, Data curation. **Lin Wang:** Software, Formal analysis. **Jing Zhang:** Project administration, Data curation.

Declaration of competing interest

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work, there is no professional or other personal interest of any nature or kind in any product, service and/or company that could be construed as influencing the position presented in, or the review of, the manuscript entitled.

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Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Data availability

Data will be made available on request.

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