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REVIEW

The effects of gratitude interventions: a systematic review and meta-analysis

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ABSTRACT

Introduction: Gratitude has several implications. Over time, a logical relationship has been established between gratitude and well-being. In addition, researchers aimed to establish associations between gratitude and other factors of positive feelings using scientific methods. We conducted a systematic review and meta-analysis of interventions to develop gratitude and its benefits to human beings. **Objective:** This study aimed to evaluate and quantify the available scientific evidence on interventions to acquire knowledge on gratitude as a quantifiable causal factor of benefit to human beings. **Methods**: A systematic literature search was conducted to identify studies that investigated the effects of gratitude interventions. MEDLINE, Embase, and Central Cochrane databases were searched in addition to gray (Google Scholar) and manual search. Two authors independently evaluated the titles and abstracts, and selected the studies that met the inclusion criteria. The searches were conducted between January and July 2022. **Results:** Sixty-four randomized clinical trials were included. The meta-analysis demonstrated that patients who underwent gratitude interventions experienced greater feelings of gratitude, better mental health, and fewer symptoms of anxiety and depression. Moreover, they experienced other benefits such as a more positive mood and emotions. **Conclusion:** The results demonstrate that acts of gratitude can be used as a therapeutic complement for treating anxiety and depression and can increase positive feelings and emotions in the general population.
Prospero database registration: (www.crd.york.ac.uk/prospero) under the number CRD42021250799.

Keywords: Gratitude; Depression; Anxiety; Mental health; Emotions; Health facilities; Delivery of health care; Personnel satisfaction; Narration

INTRODUCTION

Gratitude is difficult to define. It has been conceptualized as an emotion, attitude, moral virtue, habit, personality trait, and coping response.[1] It appears to be related to personality traits as well as subjective and moral well-being.

Gratitude is a light expression not necessarily conditioned to good times, making it possible to maintain the feeling and feel good, even during negative experiences or most difficult moments.

In its definition, elements such as grace, presence, love, health, food, nature, beauty, and life have been recognized, which can be reflected in a state of fulfillment while enjoying and valuing the trajectory more than the result itself.

Logical relationship has been established between gratitude and well-being, with the idea that gratitude fosters positive feelings that contribute to

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a general sense of well-being. In addition, researchers have sought to establish other associations with factors of positive feelings using scientific methods.

Methods for measuring the level of gratitude, for diagnosis and prognostic impact, have been developed and validated through questionnaires administered in different ethnicities, languages, or countries, such as the Gratitude Questionnaire-Six-Item Form (GQ-6) of McCullough et al.[2] and the Gratitude Resentment and Appreciation Test (GRAT).[3] GQ-6 was correlated positively with optimism, life satisfaction, hope, spirituality/religiosity, forgiveness, empathy, and prosocial behavior, and negatively with depression, anxiety, materialism, and envy.[4]

Interventions to stimulate, develop, and acknowledge feelings of gratitude have been tested by evaluating their impact on beneficial outcomes through randomized clinical trials. These outcomes include those related to quality of life, well-being, health, aging, positive and/or negative feelings, and social behavior.

OBJECTIVE

To evaluate and quantify the scientific evidence on gratitude, we conducted a systematic review and meta-analysis of interventional studies on development of gratitude and its benefits to human beings.

METHODS

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[5] and the details of the protocol are registered in the International Prospective Register of Systematic Reviews (PROSPERO).[6]

We searched the MEDLINE, Embase, and Central Cochrane databases. In addition, gray (Google Scholar) and manual searches were conducted. The terms ("Grateful" OR "Gratitude" OR "Gratefulness") were searched in the titles, abstracts, and keywords. The searches were conducted between January and July 2022.

The eligibility criteria for the studies were as follows: (I) children, teenagers, adults, or older adults; (II) interventions to acquire the concept or practice of gratitude; (III) measures of association, correlation, or effect related to beneficial or harmful outcomes; (IV) randomized clinical trials; (V) no period restriction; (VI) languages: English, Spanish, Portuguese, or Italian; and (VII) full-text or abstract with relevant data is available.

Two authors independently evaluated the titles and abstracts of the studies identified in the search, and those meeting the inclusion criteria were selected for review. In cases of disagreement, a third author was consulted for resolving the issue.

The following data were extracted from the selected studies: name, year of publication, population, description of the intervention or exposure, measurement method or definition of the presence or absence of gratitude, outcome of benefit or harm, and length of follow-up.

The outcomes analyzed were directly related to the focus of the selected evidence and varied between gratitude development, life satisfaction, mental health, anxiety and depression symptoms, sleep-related outcomes, positive and negative affect, positive feelings, emotions, and attitudes, and negative feelings, emotions, and attitudes.

Mean score, standard deviation, and mean difference were used to express the outcomes. For categorical variables, the measures were absolute score, percentages, risk differences, and the score needed for positive or negative outcome. The level of significance was 95%. The measures to assess gratitude were related to the scores used.

The risk of bias was assessed using the Risk of Bias 2 (RoB 2)[7] tool for interventional studies and was classified as low, high, or very high.

For the meta-analysis, Review Manager (RevMan) Version 5.4[8] was used. Comparisons were presented in terms of mean difference (MD) and 95% confidence interval (CI). The inconsistency in the effects of the interventions was assessed using I^2. The random effects and fixed effects models were used if $I^2 > 50\%$ and $I^2 \leq 50\%$, respectively. We used a funnel plot for asymmetry to assess the possible publication bias.

The certainty of evidence was assessed using the GRADE Pro Guideline Development Tool[9] and was classified as high, moderate, low, or very low (Appendix A).

RESULTS

Study selection

A total of 5,522 articles were retrieved after the removal of duplicates. Of these, 1,365 titles and abstracts were selected and evaluated for eligibility, of which 242 were selected for full-text evaluation. Finally, 64 articles[1,10-72] met the eligibility criteria (Appendix B) and were included in the systematic review and 33 in the meta-analysis (Figure 1).

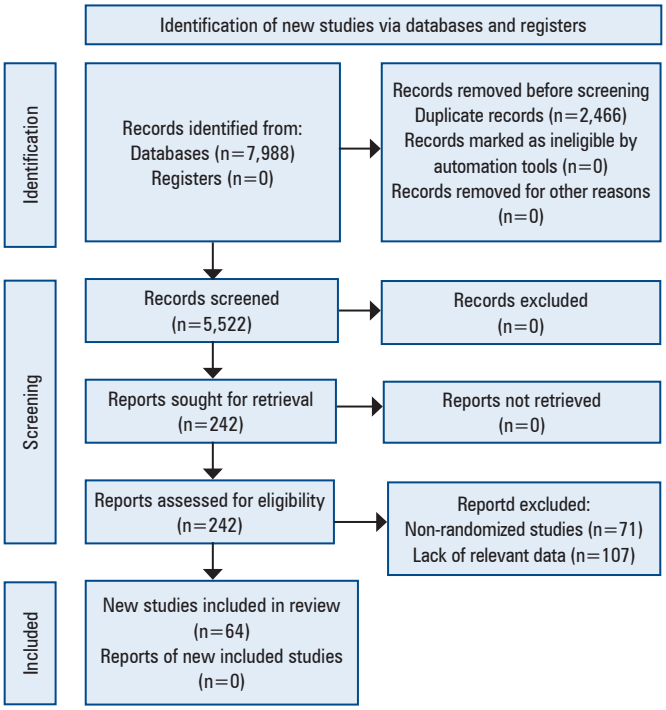


Figure 1. PRISMA flow diagram

Overview

The selected studies (Appendix B) were published between 2003 and 2021, had sample sizes from 23 to 1,337, and included children with depression, teenagers, adults, and older adults as participants. The gratitude interventions used in the studies varied between gratitude diaries, conversation programs, training, and visits, expression of gratitude to others (verbally or in writing), publishing pictures with captions of gratitude, and thinking of things that makes one feel grateful. The main interventions for the control groups in the selected articles were writing food or normal diaries, staying on a waiting list, thinking about or performing daily activities, not performing any activities, and completing questionnaires. Most studies were classified as having a high risk of bias (Appendix C).

Meta-analysis

Gratitude

Three different scores indicated greater gratitude in the groups that underwent gratitude interventions.

Thirteen articles involving 1,486 patients applied the GQ-6, and the meta-analysis showed that the score was 3.67% higher in participants who underwent gratitude intervention (MD= 1.54; 95%CI= 0.74, 2.35; p=0.0002; I^2=53%; random effects; certainty: very low) (Figure 2A). Four other articles reported the mean GQ-6 score, which was also superior in the gratitude group, with a 3.42% benefit (MD= 0.24; 95%IC= 0.11, 0.37; p=0.004; I^2=30%; fixed effect; certainty: low) (Figure 2B).

In addition to the GQ-6, the meta-analysis of nine articles (n=1,802) that applied a numerical gratitude scale ranging from 1 to 7 showed a 5.7% higher score for the group that underwent gratitude interventions (MD= 0.40; 95%CI= 0.17, 0.64; p=0.0008; I^2=81%, random effects; certainty: very low) (Figure 2C).

Satisfaction with life

Two studies (n=283) reported mean Satisfaction With Life Scale (SWLS) scores.[73] The analysis showed that there was greater satisfaction in patients who underwent gratitude interventions, with a 6.86% higher score (MD= 0.48; 95%CI= 0.21, 0.75; p=0.005; I^2=0%, fixed effect; certainty: low) (Figure 3).

Mental health

Mental health was assessed in three articles (n=483) using the Mental Health Continuum-Short Form (MHC-SF).[74] The results showed that the average score was 5.8% higher in patients who underwent gratitude interventions (MD= 0.29; 95%CI= 0.17, 0.41; p<0.00001; I^2=0%, fixed effect; certainty: low) (Figure 4).

Anxiety

The analysis of 579 patients in three articles showed that gratitude interventions led to fewer anxiety symptoms, with a 7.76% lower Generalized Anxiety Disorder (GAD-7)[75] score than that of the control group (MD= -1.63; 95%CI= -2.37, -0.89; p<0.0001; I^2=27%, fixed effect; certainty: low) (Figure 5).

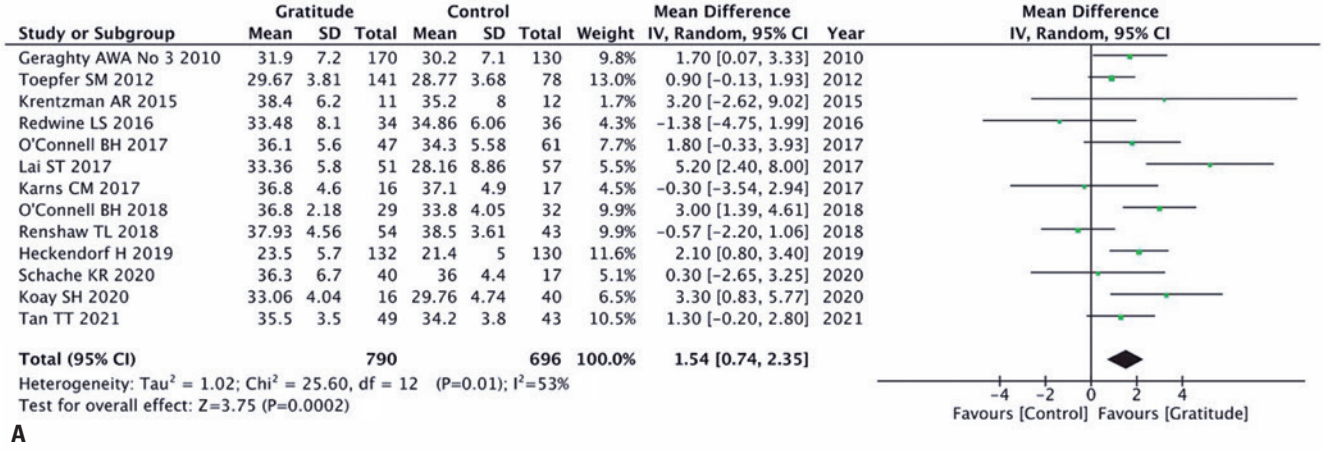
Depression

Depression symptoms (n=525) were assessed in three articles using the Patient Health Questionnaire-9 (PHQ-9).[76] Analysis of the results showed that patients who underwent gratitude interventions had fewer symptoms of depression with 6.89% lower score than that of the control group (MD= -1.86; 95%CI= -2.89, -0.83; p<0.0004; I^2=0%; fixed effect; certainty: low) (Figure 6).

Qualitative analysis

The qualitative outcomes of the selected articles demonstrated several benefits for the participants who underwent gratitude interventions.

Ducasse et al.[19] showed that the intervention group was more optimistic (p=0.01). Oishi et al.[49]



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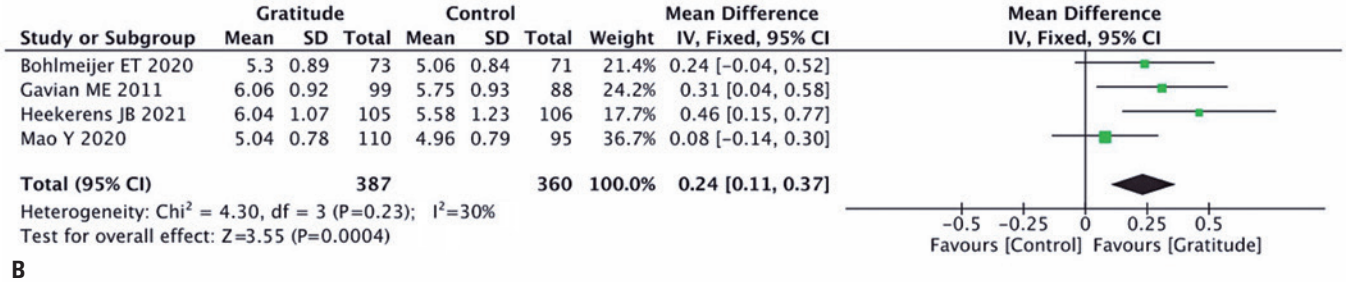

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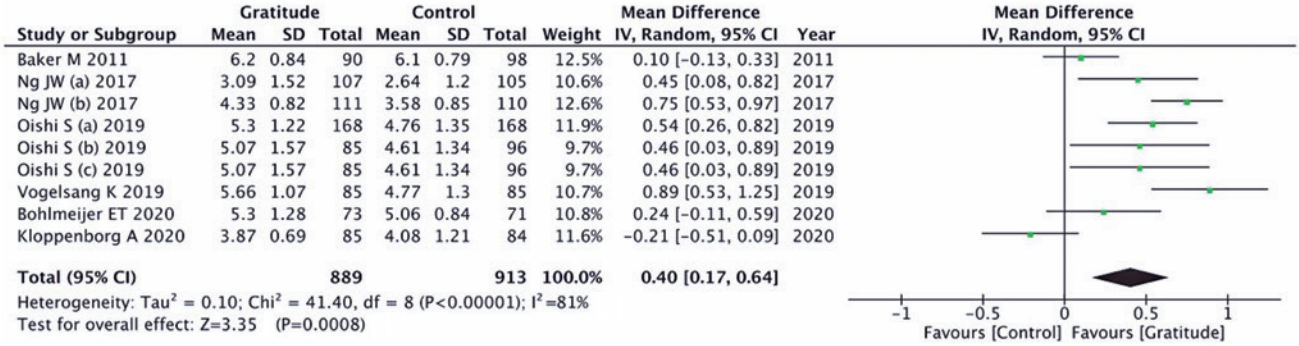
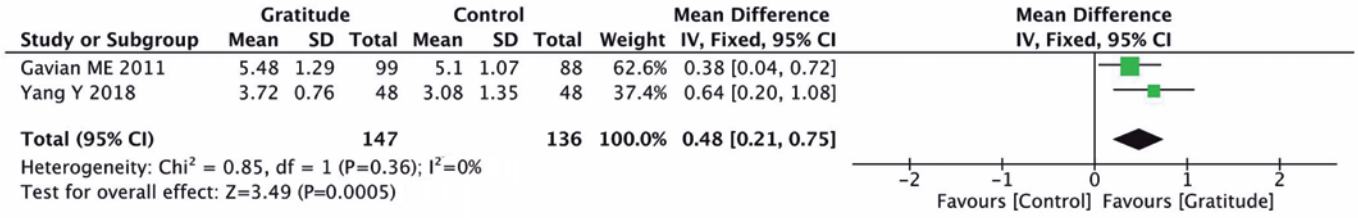


C

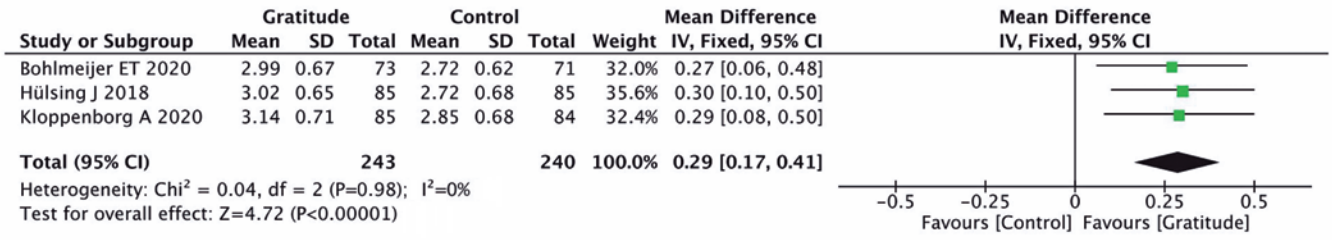
SD: standard deviation; IV: inverse variance; 95%CI: 95% confidence interval.

Figure 2. Gratitude forest plot. 2A) Total GQ-6; 2B) Mean GQ-6; 2C) Numerical gratitude scale ranging from 1 to 7



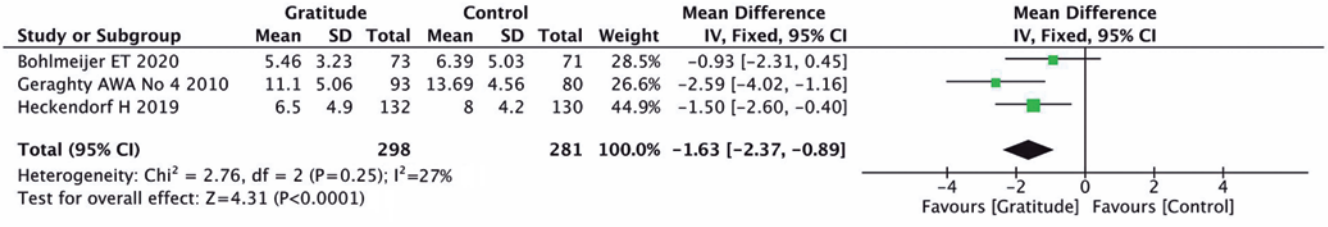
SD: standard deviation; IV: inverse variance; 95%CI: 95% confidence interval.

Figure 3. Satisfaction With Life Scale forest plot



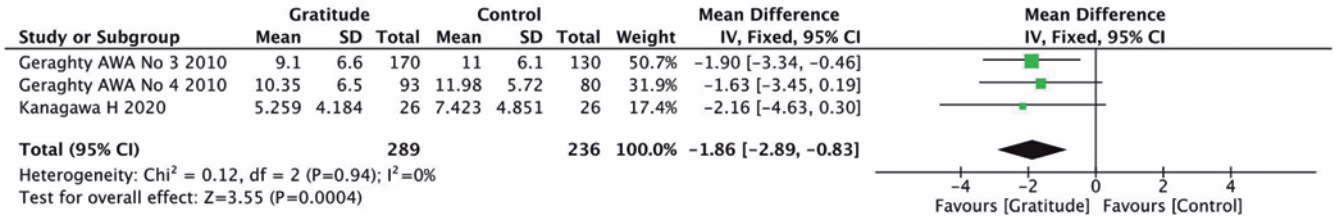
SD: standard deviation; IV: inverse variance; 95%CI: 95% confidence interval.

Figure 4. Mental Health Continuum - Short Form forest plot



SD: standard deviation; IV: inverse variance; 95%CI: 95% confidence interval.

Figure 5. Generalized Anxiety Disorder score forest plot



SD: standard deviation; IV: inverse variance; 95%CI: 95% confidence interval.

Figure 6. Patient Health Questionnaire-9 forest plot

(students with an average age of 20 years and 18 years: p=0.03 and p=0.05, respectively) and DeSteno et al.[18] (p<0.00001) showed that participants in the gratitude groups had greater appreciation. DeSteno et al.[18] found more positive emotions in the gratitude group (p<0.0001). Ng et al.[46] demonstrated greater positive mood in patients who underwent gratitude interventions. Finally, Grant et al.[23] reported that participants in the gratitude group exhibited more prosocial behaviors.

Heckendorf et al.[25] applied the Penn State Worry Questionnaire,[77] which assesses worry of participants, and demonstrated that those who underwent gratitude interventions had a lower score (p=0.009). Ducasse et al.[19] assessed psychological pain and reported lower scores in patients in the intervention group (p=0.05).

In the happiness outcome, two scores (Subjective Happiness Scale[78] and Authentic Happiness Inventory[79]) were not significantly different, while two numerical scales (1–5 and 1–7) showed benefits for the gratitude groups. When analyzing sleep-related outcomes, only the Insomnia Severity Index[80] showed a significant difference in favor of the gratitude group, whereas analysis of sleep quality and the Pittsburgh Sleep Quality Index[81] showed no difference. Moreover, there was no significant difference in any positive and negative affect scores (Implicit Positive and Negative Affect Test,[82] Scale of Positive and Negative Experience,[73] Positive Affect Negative Affect Scale,[83] and a numerical scale of 1–5), except in the Affect Balance Scale[84] reported by Yang et al.[72] that showed higher positive affect (p<0.0001) and lower negative affect (p=0.02) in the gratitude group.

DISCUSSION

This systematic review and meta-analysis demonstrated that participants who underwent gratitude interventions had greater feelings of gratitude (up to 4% higher scores), greater satisfaction with life (6.86% higher), better mental health (5.8% higher), and fewer symptoms of anxiety and depression (7.76% and 6.89% lower scores, respectively). Moreover, they had other benefits such as more positive moods and emotions, greater appreciation and optimism, more prosocial behavior, less worry, and less psychological pain.

The virtue of being grateful

Although the science of psychology began to pay attention to gratitude in terms of clinical research only approximately 20 years ago, gratitude is inborn to humans and is a source of emotional balance and well-being and impacts interpersonal relationships.

The exercise of gratitude is considered a strong therapeutic tool for positive psychology in obtaining responses that combat disorders and other issues related to depression and anxiety. In addition to being a psychotherapeutic instrument, gratitude is considered essential for forming the personality and character of an individual.

When expressing gratitude, people avoid pessimism, unhappiness, complaints of malaise and pain, toxic emotions such as anger, hurt, and fear, feelings of loneliness, isolation, and lack of engagement. A grateful individual focuses on positive practices of solidarity and attention to others and gains a sense of well-being in return.

However, being grateful, that is, expressing gratitude, is difficult for many people. They do not understand the importance of developing a thankful spirit. Psychotherapy and interventions of sensibilization and emotional education can assist these people in understanding the importance of "being grateful" and exercising this virtue.

As this occurs, positive changes in emotional health are experienced by the individual and perceived by others.

Gratitude: anxiety and depression

A relevant finding of this review was the improvement in anxiety and depression symptoms in patients who underwent gratitude interventions. Although it had a small effect compared to other therapies, such as medications, stimulating gratitude can complement other therapies in these patients.

Applicability

Gratitude intervention is accessible and easy to implement. Several applications offer functionalities for users to describe what makes them feel grateful, working as a diary or an intervention, as seen in the included articles. Stimulating the expression of gratitude toward another person verbally or in writing is another easily implemented practice. Additionally, as demonstrated by Koay et al.[38] posting pictures on social media with captions of gratitude could also be a way to express gratitude. Finally, encouraging the simple act of thinking about gratitude benefits people. This application can help in interventions not only for patients but also for the general population.

The increase in positive feelings can reverberate throughout a complex chain of neurotransmitters, capable of not only perpetuating a sense of well-being but also acting chemically in this regard.

This study identified the relationship between gratitude and reduction of anxiety and depression, which are relevant everyday emotional comorbidities that affect individuals' quality of life. Psychiatric illnesses tend to be chronic, require intensive treatment, and have other organic consequences. If practicing gratitude-a simple act that can be performed throughout the day at no cost-can minimize psychiatric illnesses, its implementation should be a priority. Quality of life is the macro subject of our concerns, and gratitude is the feeling that can favor living fully by increasing satisfaction with life, mental health, and obtaining positive feelings.

Participants

The selected articles included a wide range of participants such as patients with neuromuscular diseases, prisoners, children, adolescents, adults, and doctors. We consider this heterogeneity of the participants as a strong point of the review, as it shows the positive impacts of developing gratitude throughout life and in different contexts. For example, the emotional state and context of someone with a serious illness and those of college students differ significantly. Nevertheless, our results showed a clear benefit to the groups that underwent gratitude interventions, proving that gratitude can benefit people in different contexts, cultures, ages, professions, and health statuses.

Limitations

Although these results are relevant, they must be analyzed cautiously. The high heterogeneity between

the methodologies of the studies may have affected the results and the certainty of the evidence. There was great diversity among gratitude interventions. The lack of blinding, high loss of follow-up of the participants, and the analysis by protocol instead of intention-to-treat in some studies led to all outcomes being classified as having a high risk of bias and impacted the certainty of evidence.

Strengths

This systematic review adds unprecedented information to the literature. Despite the existence of several scores for quantifying subjective outcomes such as those related to emotions and feelings, statistical expression of the effect size and precision of these outcomes are still not routine, particularly in the form of meta-analyses. Quantifying outcomes and analyzing the certainty of evidence with proper tools are paramount for generating evidence. These findings highlight the importance of this study. This is the first systematic review and meta-analysis to compare the outcomes of gratitude interventions exclusively with control groups. This eliminated possible confounding factors, as opposed to the articles that included comparison groups that underwent hassle or happiness interventions. In addition, the principles of systematic reviews and meta-analyses aim to increase the power of conclusions by synthesizing results of several studies on the same outcome and increasing the ability (by increasing the number of samples analyzed) to identify effects, even if there is little benefit to individuals. Furthermore, by identifying the important outcomes measured by various studies, we were able to highlight not only the ways to measure them but also their specific clinical importance. Moreover, most of the articles in this review were retrieved from gray literature, usually not covered by other reviews, including some that were never included in any review. Finally, there was great diversity in participant characteristics, as articles included teenagers, physicians, college students, prisoners, older adults, patients with neuromuscular diseases, and children with depression (Appendix B). Including various types of populations in the analysis can be considered another advantage of systematic reviews and meta-analyses.

Future studies

Future studies must use an appropriate methodology to correct the biases that we found to have a greater level of certainty in evidence. It is necessary to have homogeneous methodologies with comparable interventions, blinding of evaluators and patients, and longer follow-ups. In addition, the scores and questionnaires used must be standardized. A major difficulty in this review was the great variability in the scores used in the studies. If future studies use a uniform methodology, the results will be more accurate and reliable. In terms of quality of life, it is necessary to remember the importance of balancing other components such as the body, mind, spirituality, relationships, purpose, and context, which will certainly be included in an ongoing research project through scientific models and systematic reviews.

CONCLUSION

This meta-analysis revealed that developing feelings and performing acts of gratitude are related to a greater sense of gratitude and satisfaction with life, better mental health, and fewer symptoms of anxiety and depression. Furthermore, qualitative analysis demonstrated other benefits such as more positive emotions and moods, greater appreciation and optimism, more prosocial behavior, less worry, and less psychological pain. The results demonstrate that developing feelings and performing acts of gratitude can be used as a therapeutic complement in treating anxiety and depression, and can increase positive feelings and emotions in the general population.

AUTHORS' CONTRIBUTION

Geyze Diniz: conceptualization, writing, review, editing, and supervision. Geyze Diniz and Ligia Korkes: conceptualization, writing-review and editing, and supervision. Luca Schiliró Tristão: methodology, curation, writing-original draft, review, and editing. Rosangela Pelegrini and Patrícia Lacerda Bellodi: writing-original draft, review, and editing. Patrícia Lacerda Bellodi: writing-original draft, review, and editing. Wanderley Marques Bernardo: methodology, curation, writing-original draft, review, editing, and supervision.

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REFERENCES

1. Emmons RA, McCullough ME. Counting blessings versus burdens: an experimental investigation of gratitude and subjective well-being in daily life. J Pers Soc Psychol. 2003;84(2):377-89.

2. Mccullough ME, Emmons RA, Tsang JA. The grateful disposition: a conceptual and empirical topography. J Pers Soc Psychol. 2002;82(1):112-27.
3. Watkins PC, Woodward K, Stone T, Kolts RL Gratitude and happiness: Development of a measure of gratitude and relationships with subjective well-being. Soc Behav Pers. 2003;31(5):431-51.
4. Sansone RA, Sansone LA. Gratitude and well being: the benefits of appreciation. Psychiatry (Edgmont). 2010;7(11):18-22.
5. Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 2009;6(7):e1000097.
6. University of York. Centre for Reviews and Dissemination. National Institute for Health and Care Research (NIHR). PROS- PERO: international prospective register of systematic reviews. York: University of York; [cited 2020 June 1]. Available from: https://www.crd.york.ac.uk/prospero/
7. Sterne JA, Savović J, Page MJ, Elbers RG, Blencowe NS, Boutron I, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ. 2019; 366:l4898.
8. The Cochrane Collaboration. Review Manager (RevMan). Version 5.4 [Computer program]. [cited 2020 June 1]. Available from: https://training.cochrane.org/online-learning/core-software-cochranereviews/revman
9. McMaster University. GRA- DEpro GDT: GRADEpro Guideline Development Tool [Soft-ware]. Canadá: McMaster University; 2020 [cited 2020 May 1]. Available from: https://gradepro.org
10. Antoine P, Andreotti E, Congard A. Positive psychology intervention for couples: a pilot study. Stress Health. 2020;36(2):179-90.
11. Baker M. It's good to be grateful: gratitude interventions at work [thesis]. Greenville (US): East Carolina University; 2020. Available from: https://thescholarship.ecu.edu/handle/10342/3525
12. Bartlett MY, Arpin SN. Gratitude and loneliness: enhancing health and well-being in older adults. Res Aging. 2019;41(8):772-93.
13. Bohlmeijer ET, Kraiss JT, Watkins P, Schotanus-Dijkstra M. Promoting Gratitude as a Resource for Sustainable Mental Health: Results of a 3-Armed Randomized Controlled Trial up to 6 Months Follow-up. J Happiness Stud. 2021;22(3):1011-32.
14. Cheng ST, Tsui PK, Lam JH. Improving mental health in health care practitioners: randomized controlled trial of a gratitude intervention. J Consult Clin Psychol. 2015;83(1):177-86.
15. Cunha LF, Pellanda LC, Reppold CT. Positive psychology and gratitude interventions: a randomized clinical trial. Front Psychol. 2019;10:584.
16. Datu JA, Valdez JP, McInerney DM, Cayubit RF. The effects of gratitude and kindness on life satisfaction, positive emotions, negative emotions, and COVID-19 anxiety: an online pilot experimental study. Appl Psychol Health Well-Being. 2022;14(2):347-61.
17. Dennis A, Ogden J, Hepper EG. Evaluating the impact of a time orientation intervention on well-being during the COVID-19 lockdown: past, present or future? J Posit Psychol. 2022;17(3):419-29.
18. DeSteno D, Li Y, Dickens L, Lerner JS. Gratitude: a tool for reducing economic impatience. Psychol Sci. 2014;25(6):1262-7.
19. Ducasse D, Dassa D, Courtet P, Brand-Arpon V, Walter A, Guillaume S, et al. Gratitude diary for the management of suicidal inpatients: A randomized controlled trial. Depress Anxiety. 2019;36(5):400-11.
20. Froh JJ, Kashdan TB, Ozimkowski KM, Miller N. Who benefits the most from a gratitude intervention in children and adolescents? Examining positive affect as a moderator. J Posit Psychol. 2009;4(5):408-22.
21. Gavian ME. The Effects of Relaxation and Gratitude Interventions on Stress Outcomes [dissertation]. Minneapolis (US): University of Minnesota; 2011 [cited 2020 July 1]. Available from: https://conservancy.umn.edu/handle/11299/117368
22. Geraghty AW. From Placebo to self-help: Investigating retention, outcome and mechanisms in self-directed gratitude interventions [dissertation]. Plymouth (UK): University of Plymouth; 2010 [cited 2020 July 1]. Available from: https://pearl.plymouth.ac.uk/handle/10026.1/771
23. Grant AM, Gino F. A little thanks goes a long way: explaining why gratitude expressions motivate prosocial behavior. J Pers Soc Psychol. 2010;98(6):946-55.
24. Gulliford L, Morgan B, Hemming E, Abbott J. Gratitude, self-monitoring and social intelligence: A prosocial relationship? Curr Psychol. 2019;38(4):1021-32.
25. Heckendorf H, Lehr D, Ebert DD, Freund H. Efficacy of an internet and app-based gratitude intervention in reducing repetitive negative thinking and mechanisms of change in the intervention's effect on anxiety and depression: results from a randomized controlled trial. Behav Res Ther. 2019;119:103415.
26. Heekerens JB, Eid M, Heinitz K, Merkle B. Cognitive-affective responses to online positive-psychological interventions: the effects of optimistic, grateful, and self-compassionate writing. Appl Psychol Health Well Being. 2022;14(4):1105-28.
27. Heintzelman SJ, Kushlev K, Lutes LD, Wirtz D, Kanippayoor JM, Leitner D, et al. ENHANCE: evidence for the efficacy of a comprehensive intervention program to promote subjective well-being. J Exp Psychol Appl. 2020;26(2):360-83.
28. Hirshberg MJ, Goldberg SB, Schaefer SM, Flook L, Findley D, Davidson RJ. Divergent effects of brief contemplative practices in response to an acute stressor: a randomized controlled trial of brief breath awareness, loving-kindness, gratitude or an attention control practice. PLoS One. 2018; 13(12):e0207765.
29. Ho HC, Mui M, Wan A, Ng YL, Stewart SM, Yew C, et al. Happy Family Kitchen II: a cluster randomized controlled trial of a community-based positive psychology family intervention for subjective happiness and health-related quality of life in Hong Kong. Trials. 2016;17(1):367.
30. Hülsing JM. The Impact of a Gratitude Intervention on Well-Being: a Randomized Controlled Trial [dissertation]. Enschede: Universiteit Twente; 2018 [cited 2020 July 1]. Available from: https://essay.utwente.nl/76653/
31. Hussong AM, Coffman JL, Thomas TE. Gratitude conversations: an experimental trial of an online parenting tool. J Posit Psychol. 2020;15(2):267-77.
32. Jackowska M, Brown J, Ronaldson A, Steptoe A. The impact of a brief gratitude intervention on subjective well-being, biology and sleep. J Health Psychol. 2016;21(10):2207-17.
33. Kanagawa H. Does self-help intervention help undergraduate students in Hong Kong to increase psychological well-being and reduce depression symptoms [dissertation]. Hong Kong: Hong Kong Shue Yan University; 2020 [cited 2020 Jul 1]. Available from: https://ra.lib.hksyu.edu.hk/jspui/handle/20.500.11861/5930
34. Karns CM, Moore WE 3rd, Mayr U. The cultivation of pure altruism via gratitude: a functional mri study of change with gratitude practice. Front Hum Neurosci. 2017;11:599.
35. Ki TP. Gratitude and Stress of Health Care Professionals in Hong Kong [thesis]. Hong Kong: University of Hong Kong; 2009 [cited 2020 July 1]. Available from: http://dspace.cityu.edu.hk/handle/2031/5812
36. Kini P, Wong J, McInnis S, Gabana N, Brown JW. The effects of gratitude expression on neural activity. Neuroimage. 2016;128:1-10.
37. Kloppenborg A. The mediating role of positive emotions, grateful mood, and positive relations in the relationship between gratitude exercises and mental well-being: a randomized controlled trial [thesis]. Enschede: University of Twente; 2020 [cited 2020 July 1]. Available from: https://essay.utwente.nl/82249/
38. Koay S, Ng A, Tham S, Tan C. Gratitude intervention on instagram: an experimental study. Psychol Stud (Mysore). 2020;65(2):168-73.
39. Kobayashi F. Effects of Gratitude Savoring toward One's Parents on Subjective Well-Being in Japanese Undergraduate Students. Comparative Culture J Miyazaki Intern College. 2016;21:15-36.
40. Krentzman AR, Mannella KA, Hassett AL, Barnett NP, Cranford JA, Brower KJ, et al. Feasibility, acceptability, and impact of a web-based gratitude exercise among individuals in outpatient treatment for alcohol use disorder. J Posit Psychol. 2015;10(6):477-88.
41. Kwok SY, Gu M. Parental Suicidal Ideation and Child Depressive Symptoms: The Roles of Optimism and Gratitude. J Soc Serv Res. 2020;46(4):586-95.
42. Lai ST. 'The Three Good Things' - The effects of gratitude practice on wellbeing: a randomised controlled trial. Health Psychol. 2017;26(1):10-8.

43. Mao Y, Zhao J, Xu Y, Xiang Y. How gratitude inhibits envy: from the perspective of positive psychology. PsyCh J. 2021;10(3):384-92.
44. Martínez-Martí ML, Avia MD, Hernández-Lloreda MJ. The effects of counting blessings on subjective well-being: a gratitude intervention in a Spanish sample. Span J Psychol. 2010;13(2):886-96.
45. Matvienko-Sikar K, Dockray S. Effects of a novel positive psychological intervention on prenatal stress and well-being: a pilot randomised controlled trial. Women Birth. 2017;30(2):e111-8.
46. Ng JW, Tong EM, Sim DL, Teo SW, Loy X, Giesbrecht T. Gratitude facilitates private conformity: A test of the social alignment hypothesis. Emotion. 2017;17(2):379-87.
47. O'Connell BH, O'Shea D, Gallagher S. Examining psychosocial pathways underlying gratitude interventions: a randomized controlled trial. J Happiness Stud. 2018;19(8):2421-44.
48. O'Connell BH, O'Shea D, Gallagher S. Feeling thanks and saying thanks: a randomized controlled trial examining if and how socially oriented gratitude journals work. J Clin Psychol. 2017;73(10):1280-300.
49. Oishi S, Koo M, Lim N, Suh EM. When Gratitude Evokes Indebtedness. Appl Psychol Health Well-Being. 2019;11(2):286-303.
50. O'Leary K, Dockray S. The effects of two novel gratitude and mindfulness interventions on well-being. J Altern Complement Med. 2015;21(4):243-5.
51. Osborn TL, Rodriguez M, Wasil AR, Venturo-Conerly KE, Gan J, Alemu RG, et al. Single-session digital intervention for adolescent depression, anxiety, and well-being: outcomes of a randomized controlled trial with Kenyan adolescents. J Consult Clin Psychol. 2020;88(7):657-68.
52. Otsuka Y. Improving well-being with a gratitude exercise in Japanese workers: a randomized controlled trial. Int J Psychol Couns. 2012;4(7):86-91.
53. Otto AK, Szczesny EC, Soriano EC, Laurenceau JP, Siegel SD. Effects of a randomized gratitude intervention on death-related fear of recurrence in breast cancer survivors. Health Psychol. 2016;35(12):1320-8.
54. Ouweneel E, Le Blanc PM, Schaufeli WB. On being grateful and kind: results of two randomized controlled trials on study-related emotions and academic engagement. J Psychol. 2014;148(1):37-60.
55. Owens RL, Patterson MM. Positive psychological interventions for children: a comparison of gratitude and best possible selves approaches. J Genet Psychol. 2013;174(4):403-28.
56. Proyer RT, Gander F, Wellenzohn S, Ruch W. Positive psychology interventions in people aged 50-79 years: long-term effects of placebo-controlled online interventions on well-being and depression. Aging Ment Health. 2014;18(8):997-1005.
57. Ramírez E, Ortega AR, Chamorro A, Colmenero JM. A program of positive intervention in the elderly: memories, gratitude and forgiveness. Aging Ment Health. 2014;18(4):463-70.
58. Redwine LS, Henry BL, Pung MA, Wilson K, Chinh K, Knight B, et al. Pilot Randomized Study of a Gratitude Journaling Intervention on Heart Rate Variability and Inflammatory Biomarkers in Patients with Stage B Heart Failure. Psychosom Med. 2016;78(6):667-76.
59. Renshaw TL, Hindman ML. Expressing gratitude via instant communication technology: a randomized controlled trial targeting college students' mental health. Ment Health Prev. 2017;7:37-44.
60. Riskin A, Bamberger P, Erez A, Riskin-Guez K, Riskin Y, Sela R, et al. Expressions of Gratitude and Medical Team Performance. Pediatrics. 2019;143(4):e20182043.
61. Roth RA, Suldo SM, Ferron JM. Improving Middle School Students' Subjective Well-Being: Efficacy of a Multicomponent Positive Psychology Intervention Targeting Small Groups of Youth. School Psych Rev. 2017;46(1):21-41.
62. Schache KR, Hofman PL, Serlachius AS. A pilot randomized controlled trial of a gratitude intervention for adolescents with Type 1 diabetes. Diabet Med. 2020;37(8):1352-6.
63. Shin M, Wong YJ, Yancura L, Hsu K. Thanks, mom and dad! An experimental study of gratitude letter writing for Asian and White American emerging adults. Couns Psychol Q. 2020;33(3):267-86.
64. Tan TT, Tan MP, Lam CL, Loh EC, Capelle DP, Zainuddin SI, et al. Mindful gratitude journaling: psychological distress, quality of life and suffering in advanced cancer: a randomised controlled trial. BMJ Support Palliat Care. 2021:bmjspcare-2021-003068.
65. Toepfer SM, Cichy K, Peters P. Letters of Gratitude: Further Evidence for Author Benefits. J Happiness Stud. 2012;13(1):187-201.
66. Tofangchi M, Kajbaf M, Ghamarani A. Effectiveness of gratitude training on happiness in mother of child with mental retardation. N Y Sci J. 2013;6(12):98-101.
67. Vayness J, Duong F, DeSteno D. Gratitude increases third-party punishment. Cogn Emotion. 2020;34(5):1020-7.
68. Vogelsang K. The Role of Specific Positive Emotions in enhancing Flourishing: A randomized controlled trial [thesis]. Enschede: University of Twente; 2019 [cited 2020 July 1]. Available from: https://essay.utwente.nl/79473/
69. Völler SL. Effects of a gratitude intervention on mental well-being: The mediating role of stress [thesis]. Enschede: University of Twente; 2018 [cited 2020 July 1]. Available from: https://essay.utwente.nl/76181/
70. Williams LA, Bartlett MY. Warm thanks: gratitude expression facilitates social affiliation in new relationships via perceived warmth. Emotion. 2015;15(1):1-5.
71. Wong YJ, Owen J, Gabana NT, Brown JW, McInnis S, Toth P, et al. Does gratitude writing improve the mental health of psychotherapy clients? Evidence from a randomized controlled trial. Psychother Res. 2018;28(2):192-202.
72. Yang Y, Zhao H, Aidi M, Kou Y. Three good deeds and three blessings: the kindness and gratitude interventions with Chinese prisoners. Crim Behav Ment Health. 2018;28(5):433-41.
73. Diener E, Wirtz D, Tov W, Kim-Prieto C, Choi D, Oishi S, et al. New Well-being Measures: Short Scales to Assess Flourishing and Positive and Negative Feelings. Soc Indic Res. 2010;97(2):143-56.
74. Keyes CL. The Subjective Well-Being of America's Youth: Toward a Comprehensive Assessment. Adolesc Fam Health. 2006;4(1):3-11.
75. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med. 2006;166(10):1092-7.
76. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001;16(9):606-13.
77. Meyer TJ, Miller ML, Metzger RL, Borkovec TD. Development and validation of the penn state worry questionnaire. Behav Res Ther. 1990;28(6):487-95.
78. Lyubomirsky S, Lepper HS. None. Soc Indic Res. 1999;46(2):137-55.
79. Seligman ME, Steen TA, Park N, Peterson C. Positive psychology progress: empirical validation of interventions. Am Psychol. 2005;60(5):410-21.
80. Bastien CH, Vallières A, Morin CM. Validation of the Insomnia Severity Index as an outcome measure for insomnia research. Sleep Med. 2001;2(4):297-307.
81. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989;28(2):193-213.
82. Quirin M, Kazén M, Kuhl J. When nonsense sounds happy or helpless: the Implicit Positive and Negative Affect Test (IPANAT). J Pers Soc Psychol. 2009;97(3):500-16.
83. Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: the PANAS scales. J Pers Soc Psychol. 1988;54(6):1063-70.
84. Bradburn NM. The structure of psychological well-being. Chicago: Walter de Gruyter; 1969. 318 p.

Appendix A. GRADEPro certainty of evidence table

Certainty assessment							Number of patients		Effect		Certainty
Number of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Gratitude	Control	Relative (95%CI)	Absolute (95%CI)	
GQ-6 total score											
13	Randomized trials	Very serious[a]	Serious[b]	Not serious	Not serious	None	790	696	-	MD 1.54 higher (0.74 higher to 2.35 higher)	⨁◯◯◯ Very low
GQ-6 mean score											
4	Randomized trials	Very serious[a]	Not serious	Not serious	Not serious	None	387	360	-	MD 0.24 higher (0.11 higher to 0.37 higher)	⨁⨁◯◯ Low
Gratitude (numerical scale 1–7)											
9	Randomized trials	Very serious[a]	Very serious[c]	Not serious	Not serious	None	889	913	-	MD 0.4 higher (0.17 higher to 0.64 higher)	⨁◯◯◯ Very low
SWLS mean score											
2	Randomized trials	Very serious[a]	Not serious	Not serious	Not serious	None	147	136	-	MD 0.48 higher (0.21 higher to 0.75 higher)	⨁⨁◯◯ Low
GAD-7											
3	Randomized trials	Very serious[a]	Not serious	Not serious	Not serious	None	298	281	-	MD 1.63 lower (2.37 lower to 0.89 lower)	⨁⨁◯◯ Low
MHC-SF											
3	Randomized trials	Very serious[a]	Not serious	Not serious	Not serious	None	243	240	-	MD 0.29 higher (0.17 higher to 0.41 higher)	⨁⨁◯◯ Low
PHQ-9											
3	Randomized trials	Very serious[a]	Not serious	Not serious	not serious	none	289	236	-	MD 1.86 lower (2.89 lower to 0.83 lower)	⨁⨁◯◯ Low

95%CI: 95% confidence interval; MD: mean difference; PHQ-9: Patient Health Questionnaire; MHC-SF: Mental Health Continuum-Short Form; GAD-7: Generalized Anxiety Disorder; SWLS: Satisfaction With Life Scale; GQ-6: Gratitude Questionnaire-Six-Item Form.

Explanations:

a. Studies did not blind participants or evaluators; losses >20%; protocol analysis.

b. I^2 between 50-75%.

c. I^2 >75%.

Appendix B. Study characteristics

Author	Population	Type of intervention	Intervention	Comparison	Outcomes	Follow-up
Emmons et al.[1]	Students (n=196)	Isolated	Gratitude intervention (n=65)	Hassles (n=64) and control (n=67)	Well-being; gratitude; physical symptoms; gratitude	9 weeks
	Students (n=157)	Isolated	Gratitude intervention (n=52)	Hassles (N=49) and control (n=56)	Health and prosocial behavior	2 weeks
	Patients with neuromuscular diseases (n=65)	Isolated	Gratitude intervention (n=33)	Control (n=32)	Affect; well-being; health behavior; daily activities	3 weeks
Antoine et al.[10]	Couples (n=76)	Combined	Positive psychology intervention (n=40)	Control (n=36)	Satisfaction (SWLS)	1 month
Baker et al.[11]	Workers (n=188)	Isolated	Gratitude intervention (n=90)	Control (n=98)	Gratitude (numeric scale); affect (PANAS); well-being (numeric scale); satisfaction; commitment	5 weeks
Bartlett et al.[12]	Adults with an average age of 73 years (n=42)	Isolated	Daily gratitude exercise (n=23)	Only surveys completions (n=19)	Gratitude (GQ-6); solitude (PANAS); subjective well-being; subjective health; symptoms; daily activities; general positivity	3 weeks
Bohlmeijer et al.[13]	People with moderate / low well-being and moderate depression and anxiety (n=217)	Isolated	Gratitude exercises (n=73)	Self-love act (n=73) Waiting list (n=71)	Well-being (MHC-SF); depression (CES-D); anxiety (GAD-7); gratitude (GQ-6, numeric scale)	6 months
Cheng et al.[14]	Health professionals (n=102)	Isolated	Gratitude diary (n=34)	Hassle diary (n=34) or no treatment (n=34)	Depression (CES-D); stress (PSS)	3 months
Cunha et al.[15]	Adults with an average age of 32 years (n=1,337)	Isolated	Gratitude stimulation (n=446)	Hassles (n=444) and neutral (n=447)	Affect (PANAS); depression (CES-D); happiness (SHS); satisfaction (SWLS)	4 weeks
Datu et al.[16]	Students (n=86)	Isolated	List 5 things you are grateful (n=43)	Weekly diary (n=43)	Positive and negative emotions; life satisfaction	3 weeks
Dennis et al.[17]	Participants during lockdown (n=216)	Isolated	Gratitude intervention (n=67)	Best possible self (n=73) Nostalgia (n=63) Control (n=58)	Affect (PANAS)	No follow-up
DeSteno et al.[18]	Adults with an average age of 19 years (n=75)	Isolated	Gratitude stimulation (n=25)	Induction of happiness (n=25) and neutral (n=25)	Gratitude and happiness	No follow-up
Ducasse et al.[19]	Patients hospitalized for suicidal attempt or ideation (n=201)	Isolated	Gratitude writing (n=101)	Food diary (n=100)	Psychological pain (numeric scale); severity and intensity of suicidal ideation (C-SSRS; SSI; numeric scale); hope and optimism; depression and anxiety (BDI)	1 weeks
Froh et al.[20]	Students (n=89)	Isolated	Gratitude intervention (n=44)	Control (n=45)	Gratitude (GAC); affect (PANAS)	2 months
Gavian et al.[21]	Students (n=271)	Isolated	Gratitude intervention (n=99)	Relaxation intervention (n=84) and control (n=88)	Gratitude (GQ-6); relaxation (SRSI); affect (PANAS); satisfaction (SWLS); stress (PCOSES-8, DSI); serenity (SS); depression (DASS-21); physical symptoms (CHIPS); events gravity (SES)	1 month
Geraghty et al.[22]	Participants (n=447)	Isolated	Gratitude diary (n=170)	Automatic thinking (n=147) Waiting list (n=130)	Loss of adhesion; depression (PHQ-9); automatic thinking (ATQ); satisfaction (SWLS); affect (PANAS); health control (MHLC); expectation	2 weeks
	Participants (n=247)	Isolated	Gratitude diary (n=93)	Worry (n=74) Waiting list (n=80)	Loss of adhesion; worry (PSWQ-PW); anxiety (GAD-7); depression (PHQ-9); hope (AHS); optimism (LOT -R); expectation; auto-control	2 weeks

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Appendix B. Study characteristics

Author	Population	Type of intervention	Intervention	Comparison	Outcomes	Follow-up
Grant et al.[23]	Students (n=69)	Isolated	Gratitude intervention (n=35)	Control (n=34)	Prosocial behavior, self-efficacy, social function, affect, gratitude	No follow-up
	Students (n=57)	Isolated	Gratitude intervention (n=29)	Control (n=28)		
	Fundraisers (n=41)	Isolated	Gratitude intervention (n=20)	Control (n=21)	Prosocial behavior, self-efficacy, social function	
	Students (n=79)	Isolated	Gratitude intervention (n=40)	Control (n=39)	Prosocial behavior, self-efficacy, social function, gratitude	
Gulliford et al.[24]	Participants (n=52)	Isolated	Gratitude intervention (n=25)	Pride (n= 25)	Gratitude (GRAT-S, MCGM)	No follow-up
Heckendorf et al.[25]	Adults with an average age of 42 years (n=262)	Isolated	Gratitude training based on smartphone usage and online (n=132)	Waiting list (n=130)	Negative thoughts (PTQ); depression (CES-D); anxiety (GAD-7); resilience (CD-RISC); insomnia (ISI); worry (PSWQ); social support (BSSS); gratitude (GQ-6); optimism (LOT-R); satisfaction (CSQ-I)	6 weeks; 3 and 6 months
Heekerens et al.[26]	Adults with an average age of 43 years (n=211)	Isolated	Letter of interpersonal gratitude (n=105)	Weekly diary (n=106)	Gratitude (GQ-6)	No follow-up
Heintzelman et al.[27]	Adults with an average age of 49 years (n=55)	Combined	Face-to-face ENHANCE (central self, experiential self, social self, reflection, person-activity adequacy and development of habits) (n=27)	Waiting list (n=28)	Subjective well-being (SWB); life satisfaction (SWLS and scales); life events (PNMT); psychological health (depression and stress)	3 months
	Adults with an average age of 43 years (n=100)	Combined	Online ENHANCE (n=50)	Waiting list (n=50)		
Hirshberg et al.[28]	Students (n=162)	Isolated	Gratitude stimulation (n=41)	Breathing exercise (n=34); stimulating kindness and love (n=42); no intervention (n=39)	Anxiety (ASI); gratitude (GQ-6); affect (IPANAT, PANAS); stress	No follow-up
Ho et al.[29]	Clusters (n=1,261)	Combined	Positive psychology intervention: joy, gratitude, flow, taste and listen (n=828)	Control (n=433)	Happiness (SHS), quality of life (SF-12v2)	12 weeks
		Combined			Family communication (FCS); health, happiness and family harmony	
Hülsing et al.[30]	Participants (n=170)	Isolated	Gratitude intervention (n=85)	Waiting list (n=85)	Gratitude (GRAT-S); well-being (MHC-SF)	12 weeks
Hussong et al.[31]	Parents with children between 6 and 9 years (n=104)	Isolated	Gratitude conversation program (n=53)	Waiting list (n=51)	Clarity and satisfaction; behavioral intentions; parental trust; knowledge consumption; socialization behaviors; children's gratitude; father-son gratitude and missed opportunities.	1 month
Jackowska et al.[32]	Women with sleep and emotional disorders (n=119)	Isolated	Gratitude writing (n=40)	Reporting of daily events (n=41) and no treatment (n=38)	Well-being (SWB; PESS; HADS; FS; RLOT); sleep (PSQI; quality)	3 weeks
Kanagawa et al.[33]	College students (n=79)	Isolated	Letter of interpersonal gratitude (n=26)	Setting self-help goals and planning intervention (n=26) Control (n=26)	Depression (PHQ-9)	4 weeks
Karns et al.[34]	Students (n=33)	Isolated	Gratitude intervention (n=16)	Control (n=17)	Gratitude (GQ-6); altruism (principles of care)	3 weeks
Ki et al.[35]	Health professionals (n=180)	Isolated	Gratitude intervention (n=90)	Hassle (n=90)	Stress (PSS); gratitude (GQ-6); affect (CAS); satisfaction (SWLS); depression (CES-D 10);	1 week
Kini et al.[36]	Psychotherapy patients (n=43)	Isolated	Gratitude diary (n=22)	Psychotherapy (n=21)	Gratitude (GQ-6; GAC3; BHM-20)	12 weeks
Kloppenborg et al.[37]	Participants (n=169)	Isolated	Gratitude intervention (n=85)	Waiting list (n=84)	Well-being (MHC-SF); gratitude (numeric scale)	6 weeks
Koay et al.[38]	College students (n=33)	Isolated	Post pictures with gratitude captions (n=16)	Control (n=17)	Gratitude (GQ-6); stress (PSS); satisfaction (SWLS)	1 week

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Appendix B. Study characteristics

Author	Population	Type of intervention	Intervention	Comparison	Outcomes	Follow-up
Kobayashi et al.[39]	College students (n=66)	Isolated	Think 3 things that make feel grateful to parents (n=22) Express gratitude to parents (n=22)	Control (n=22)	Happiness (SHS); satisfaction (SWLS)	1 week
Krentzman et al.[40]	Adults with alcohol abuse (n=23)	Isolated	Gratitude intervention (n=11)	Control (n=12)	Feasibility and acceptance; affect (PANAS); gratitude (GQ-6); cognition	8 and 14 weeks
Kwok et al.[41]	Children with depression (n=68)	Combined	Sessions of gratitude and hope (n=34)	Control (n=34)	Gratitude (GQ-6); depression (HADS); satisfaction (SWLS)	8 weeks
Lai et al.[42]	Participants (n=108)	Isolated	Gratitude diary (n=51)	Control (n=57)	Gratitude (GQ-6, GAC); affect (PANAS)	3 weeks
Mao et al.[43]	Students (n=205)	Isolated	High-gratitude priming (n=110)	Control (n=95)	Gratitude (GQ-6)	No follow-up
Martínez-Martí et al.[44]	Students (n=105)	Isolated	Gratitude intervention (n=41)	Hassle report (n=30) and no intervention (n=34)	Gratitude, affect, well-being, physical symptoms, pain, sleep, relationship quality, perception of the needs of others	2 weeks
Matvienko-Sikar et al.[45]	Pregnant women in prenatal care (n=46)	Combined	Gratitude diary and reflection audio (n=32)	Control (n=14)	Stress (PDQ and EPDS); gratitude (GDP); reflection (MAAS)	4.5 weeks
Ng et al.[46]	Adults with an average age of 20 years (n=212)	Isolated	Gratitude stimulation (n=107)	Control (n=105)	Gratitude and humor	No follow-up
	Adults with an average age of 31 years (n=331)	Isolated	Gratitude stimulation (n=111)	Stimulus of joy (n=110); without stimulation (n=110)	Gratitude, affect, and conformity	
O'Connell et al.[47]	College students (n=91)	Isolated	Gratitude diary (N=29) Interpersonal gratitude diary (n=30)	Control diary (n=32)	Gratitude (GQ-6); satisfaction (SWLS)	1 month
O'Connell et al.[48]	Adults with an average age of 22 years (n=192)	Isolated	Gratitude writing (n=47); writing and expressing gratitude (n=40)	Control (n=61)	Life satisfaction (SWLS); affect (SPANE); depression (CES-D 10); Gratitude (GQ-6); satisfaction in the relationship and expression of gratitude in relationships	1 or 3 months
Oishi et al.[49]	Students with an average age of 22 years (n=336)	Isolated	Gratitude writing (n=168)	No gratitude writing (n=168)	Happiness; satisfaction; pleasure; gratitude; appreciation; sadness; anger; indebtedness; shame and guilt	No follow-up
	Students with an average age of 20 years (n=218)	Isolated	Gratitude writing (n=101)	No gratitude writing (n=117)		
	Students with an average age of 18 years (n=181)	Isolated	Gratitude writing (n=85)	No writing (n=96)		
O'Leary et al.[50]	Women (n=61)	Isolated	Gratitude intervention (n=29)	Reflection intervention (n=22); waiting list (n=10)	Stress (PSS); depression (EDS); happiness (SHS)	5 weeks
Osborn et al.[51]	Students (mean age: 15 years) (n=103)	Combined	Shamiri-Digital (n=50)	Study abilities (n=53)	Depression (PHQ-8); anxiety (GAD-7); well-being (SWEM-WBS); happiness and optimism (EPOCH); viability and acceptance	2 weeks
Otsuka et al.[52]	Workers (n=76)	Isolated	Gratitude intervention (n=38)	Control (n=38)	Gratitude; affect (PANAS); life satisfaction (SWLS); happiness (SHS) and well-being	4 weeks
Otto et al.[53]	Patients with treated breast cancer (n=67)	Isolated	Gratitude stimulation (n=34)	Control (n=33)	Gratitude, positive affect, goal seeking, fear of recurrence and death	1 and 3 months
Ouweneel et al.[54]	Students with an average age of 21 years (n=50)	Isolated	Gratitude intervention (n=25)	Daily experience (n=25)	Emotions (JAWS); commitment (UWES–S)	5 weeks

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Appendix B. Study characteristics

Author	Population	Type of intervention	Intervention	Comparison	Outcomes	Follow-up
Owens et al.[55]	Children aged 5 to 11 years (n=62)	Isolated	Gratitude intervention (n=22)	Best condition (n=23); Daily (n=17)	Affect (PANAS-C); satisfaction (BMSLSS); self-esteem (PCS-C)	1 weeks
Proyer et al.[56]	Women (n=163)	Isolated	Gratitude visits (n=30)	3 good things (n=44); 3 funny things (n=20); strengths (n=35); control (n=34)	Happiness (AHI); depression (CES-D)	6 meses
Ramírez et al.[57]	Elderly (n=56)	Combined	Program based on forgiveness, gratitude, and life review (n=28)	Control (n=28)	Anxiety (STAI); depression (Beck Depression Inventory, BDI); memory (AMT); cognition (MEC); satisfaction (LSS); happiness (SHS)	4 months
Redwine et al.[58]	Heart failure patients (n=70)	Isolated	Gratitude diary (n=34)	Usual care (n=36)	Gratitude (CQ-6); exercise activities (LTEQ)	8 weeks
Renshaw et al.[59]	College students (n=97)	Isolated	Gratitude thoughts (n=54)	Control (n=43)	Gratitude (GQ-6); satisfaction (SWLS); happiness (SHS); affect (PANAS)	2 weeks
Riskin et al.[60]	43 teams of neonatal ICU workers (n=163)	Isolated	Expression of gratitude by physicians and mothers (n=40), only mothers (n=42), only physicians (n=43)	Neutral expression (n=38)	Team performance (diagnosis, treatment, sharing)	No follow-up
Roth et al.[61]	Children (n=42)	Combined	Positive psychology intervention (n=21)	Control (n=21)	Satisfaction (BMSLSS); affect (PANAS)	10 weeks + 2 months
Schache et al.[62]	Teenagers with *diabetes mellitus* type 1 (n=80)	Isolated	Daily gratitude record (n=40)	Usual care (n=40)	Stress (DSQY); depression (CESDSC); quality of life (DQLYS); self-care (SCIRV); gratitude (GQ-6)	12 weeks
Shin et al.[63]	Participants (n=630)	Isolated	Letters of gratitude to parents (n=305)	Control (n=325)	Affect (PANAS); Gratitude (GAC)	2 weeks
Tan et al.[64]	Adults with stage III or IV cancer (n=92)	Isolated	Gratitude diary (n=49)	Control diary (n=43)	Gratitude (GQ-6)	1 week
Toepfer et al.[65]	Participants (n=219)	Isolated	Gratitude intervention (n=141)	Control (n=78)	Gratitude (GQ-6); satisfaction (SWLS); happiness (SHS); depression (CES-10)	4 weeks
Tofangchi et al.[66]	Participants (n=32)	Isolated	Gratitude intervention (n=16)	Control (n=16)	Happiness (OHQ)	40 days
Vayness et al.[67]	People with an average age of 19 years (n=96)	Isolated	Induction of gratitude emotion (n=32)	Induction of happiness (n=32) and neutral (n=32)	Happiness and gratitude	No follow-up
	Workers with an average age of 35 years (n=143)	Isolated	Induction of gratitude emotion (n=64)	Induction of happiness (n=42) and neutral (n=37)	Happiness and gratitude	No follow-up
Vogelsang et al.[68]	Participants (n=169)	Isolated	Gratitude intervention (n=85)	Control (n=84)	Gratitude (numeric scale)	6 weeks
Völler et al.[69]	Participants (n=118)	Isolated	Gratitude intervention (n=51)	Control (n=67)	Stress (PSS); well-being (MHC-SF)	12 weeks
Williams et al.[70]	Students (n=70)	Isolated	Gratitude expression (n=30)	Control (n=40)	Appreciation; interpersonal warmth; capacity of expression; affiliation intention	No follow-up
Wong et al.[71]	Psychotherapy patients (n=293)	Isolated	3 sessions of gratitude writing (n=127)	Expression writing (n=91); psychotherapy only (n=75)	Well-being, psychological symptoms, life function (BHM-20 and GMH); negative and positive emotions (LIWC)	12 weeks
Yang et al.[72]	Chinese prisoners (n=144)	Isolated	Gratitude intervention (n=48)	Kindness intervention (n=48); no intervention (n=48)	Affect (ABS); satisfaction (SWLS); well-being (IWB); subjective vitality (RFS)	6 weeks

Appendix C. Risk of bias summary for the included studies

Author	Randomization	Allocation Concealment	Double blinding	Evaluators blinding	Losses (<20%)	Prognostic characteristics	Appropriate outcomes	ITT	Sample calculation	Early interruption
Emmons et al.[1]	?	?	-	?	?	?	+	?	?	?
Antoine et al.[10]	?	?	-	?	+	+	+	+	-	+
Baker et al.[11]	?	?	-	?	?	?	+	?	-	?
Bartlett et al.[12]	-	-	+	?	?	?	+	?	?	+
Bohlmeijer et al.[13]	+	+	-	?	-	+	+	-	+	+
Cheng et al.[14]	+	+	-	?	+	+	+	+	+	+
Cunha et al.[15]	+	+	-	?	-	?	+	-	+	+
Datu et al.[16]	-	-	-	?	+	-	+	-	-	+
Dennis et al.[17]	+	+	-	?	+	+	+	+	+	+
DeSteno et al.[18]	?	?	-	?	?	?	+	?	?	?
Ducasse et al.[19]	+	+	-	+	+	+	+	-		
Froh et al.[20]	?	?	-	?	?	+	+	?	-	?
Gavian et al.[21]	+	+	-	?	+	+	+	-	+	?
Geraghty et al.[22]	+	+	-	?	-	?	+	-	-	?
Grant et al.[23]	?	?	-	?	?	?	+	?	?	?
Gulliford et al.[24]	?	?	-	?	-	-	+	-	-	+
Heckendorf et al.[25]	+	+	-	?	-	+	+	+	+	+
Heekerens et al.[26]	+	+	-	?	+	-	+	+	-	+
Heintzelman et al.[27]	?	?	-	?	-	?	+	+	+	+
Hirshberg et al.[28]	+	+	-	?	+	+	+	-	+	+
Ho et al.[29]	+	+	-	?	?	+	+	?	-	+
Hülsing et al.[30]	?	?	-	?	-	+	+	-	-	+
Hussong et al.[31]	?	?	-	?		?	+	?	?	+
Jackowska et al.[32]	+	+	-	?	?	+	+	?	-	+
Kanagawa et al.[33]	?	?	-	?	+	+	+	+	+	+
Karns et al.[34]	?	?	-	?	+	+	+	?	-	+
Ki et al.[35]	?	?	-	?	?	?	+	?	-	?
Kini et al.[36]	?	?	-	?	?	+	+	?	-	+
Kloppenborg et al.[37]	+	+	-	?	+	+	+	+	+	+
Koay et al.[38]	?	?	-	?	+	-	+	+	-	+
Kobayashi et al.[39]	?	?	-	?	+	-	+	+	-	+
Krentzman et al.[40]	?	?	-	?	?	?	+	?	?	?
Kwok et al.[41]	?	?	-	?	+	+	+	+	-	+
Lai et al.[42]	?	?	-	?	+	+	+	+	-	+
Mao et al.[43]	?	?	-	?	+	-	+	+	+	+
Martínez-Martí et al.[44]	?	?	-	?	?	?	+	?	?	?
Matvienko-Sikar et al.[45]	+	+	-	?	-	+	+	-	+	+
Ng et al.[46]	?	?	-	?	?	?	+	?	+	+
O'Connell et al.[47]	+	+	-	?	-	+	+	+	+	+
O'Connell et al.[48]	+	+	+	?	+	+	+	-	-	+
Oishi et al.[49]	?	?	-	?	?	?	+	?	+	+
O'Leary et al.[50]	?	?	-	?	?	?	+	?	?	?
Osborn et al.[51]	+	+	-	?	+	+	+	+	-	+
Otsuka et al.[52]	?	?	-	?	?	?	+	?	-	
Otto et al.[53]	?	?	-	?	?	?	+	?	-	+
Ouweneel et al.[54]	?	?	-	?	?	+	+	?	?	?
Owens et al.[55]	?	?	-	?	?	?	+	?	?	?
Proyer et al.[56]	?	?	-	?	?	+	+	?	+	?

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Appendix C. Risk of bias summary for the included studies

Author	Randomization	Allocation Concealment	Double blinding	Evaluators blinding	Losses (<20%)	Prognostic characteristics	Appropriate outcomes	ITT	Sample calculation	Early interruption
Ramírez et al.[57]	?	?	-	?	?	?	+	?	?	?
Redwine et al.[58]	+	+	-	?	-	+	+	-	+	+
Renshaw et al.[59]	+	+	-	?	?	+	+	?	?	+
Riskin et al.[60]	+	?	-	?	?	+	-	?	+	+
Roth et al.[61]	+	+	-	?	+	+	+	+	?	+
Schache et al.[62]	+	+	-	?	-	+	+	+	+	+
Shin et al.[63]	?	?	-	?	+	+	+	-	?	+
Tan et al.[64]	+	+	-	?	+	+	+	+	+	+
Toepfer et al.[65]	?	?	-	?	?	?	+	?	-	?
Tofangchi et al.[66]	?	?	-	?	?	?	-	?	-	?
Vayness et al.[67]	?	?	-	?	-	?	+	-	+	+
Vogelsang et al.[68]	+	+	-	?	-	+	+	-	?	+
Völler et al.[69]	?	?	-	?	+	+	+	+	?	+
Williams et al.[70]	?	?	-	?	?	?	+	?	?	?
Wong et al.[71]	?	?	-	?	-	?	+	+	-	+
Yang et al.[72]	-	-	-	?	?	+	+	?	-	+

Note. +: High risk; –: Low risk; ?: Unclear risk; ITT: intention-to-treat analysis.