ABRAN ASSOCIAÇÃO BRASILEIRA DE NUTROLOGIA
International Journal of Nutrology
(Official Journal of the ABRAN - Brazilian Association of Nutrology)

REVIEW ARTICLE

DOI: 10.54448/ijn25309

Impacts of lifestyle change and precise nutrology on healthy longevity: a systematic review

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DOI: https://doi.org/10.54448/ijn25309
Received: 05-19-2025; Revised: 07-21-2025; Accepted: 07-28-2025; Published: 07-30-2025; IJN-id: e25309

Editor: Dr. Luis Alberto Moreno Aznar, MD, Ph.D.

Abstract

Introduction: Dietary restriction without malnutrition remains the most robust non-genetic intervention to date and can maximize life expectancy and health. It also increases life expectancy and protects against obesity, cancer, neurodegeneration, frailty, and a range of cardiometabolic conditions. **Objective:** It was to develop a systematic review of the impacts of adequate nutrition and lifestyle on healthy human longevity. **Methods:** The PRISMA Platform systematic review rules were followed. The search was carried out from May to June 2025 in the Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases. The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument. **Results and Conclusion:** A total of 134 articles were found, and 40 articles were evaluated in full, and 30 were included and developed in the present systematic review study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 28 studies with a high risk of bias and 24 studies that did not meet GRADE and AMSTAR-2. Most studies showed homogeneity in their results, with X^2=92.2%>50%. Innovative, and possibly holistic, food and diet-based intervention strategies for healthy aging include the adoption of regimes such as calorie and dietary restriction, as well as time-restricted eating. Chrononutrition denotes the link between circadian rhythms and nutrient-sensing pathways. Nutrients of interest for cognitive health include omega-3 polyunsaturated fatty acids, polyphenols, vitamin D, and B vitamins. Low concentrations of vitamin D have been linked to accelerated decline in cognition across ethnicities. Dietary regimens have been suggested as interventions to treat conditions such as hypertension, and dyslipidemia, the Mediterranean diet for metabolic syndrome and cardiovascular health, and the Okinawa diet for healthy aging. Certain amino acids are emerging as promising adjunctive treatments for mind-body balance, such as N-acetylcysteine. Multivitamins and multimineral supplements can improve life expectancy.

Keywords: Calorie restriction. Precise nutrition. Healthy longevity. Lifestyle.

Introduction

Dietary restriction without malnutrition remains the most robust non-genetic intervention to date, potentially maximizing life expectancy and health. It also increases life expectancy and protects against obesity, cancer, neurodegeneration, frailty, and a range of cardiometabolic conditions **[1]**.

In this context, genetic, environmental, and lifestyle factors can determine human life expectancy **[2]**. Nutrition is a key component that significantly affects our health, and several studies indicate that it also has the potential to increase life expectancy. In humans, certain healthy foods are associated with longer telomere lengths. Furthermore, a high intake of whole grains, vegetables, fruits, nuts, and coffee is associated with a reduced risk of all-cause mortality, while a high intake of red meat and especially

processed meat is positively related to all-cause mortality [3].

Mediterranean and high-quality diets are associated with a reduced risk of allcause mortality [4]. In this sense, preventive measures can radically change individuals' daily habits, including lifestyle behaviors [3,4]. For example, in the context of the COVID-19 pandemic, staying and working from home can affect diet, food choices, and access to food, thus reducing the possibilities and limiting physical activity [5,6]. Thus, sedentary lifestyles and obesity have been described as global public health problems [7-9].

In this sense, reduced physical activity and lower energy expenditure can negatively affect physical and mental health [10,11]. Furthermore, the pandemic situation is also associated with emotions such as fear, sadness, and anxiety, which have been shown to reduce sleep quality [11-13].

Sedentary behavior, anxiety, and boredom caused by home confinement can influence motivation to eat, change lifestyle patterns, reduce diet quality, and promote excessive consumption of high-calorie foods [14,15]. A healthy diet based on plant-based foods (vegetables and fruits), healthy fats, and low-fat, low-protein foods [13,17], along with adequate activity, is a key strategy for supporting the immune system and limiting seasonal and viral infections in the population [18,19].

In this context, dietary supplementation with coenzyme Q10 (ubiquinone), melatonin, vitamin C, vitamin D, minerals, short-chain fatty acids, and omega-3 fatty acids, protein and carbohydrate content, a Mediterranean diet, and a high-fiber diet may be beneficial in strengthening the immune response and reducing inflammatory processes and the worsening of comorbidities such as hypertension, diabetes, obesity, chronic lung disease, heart, liver, and kidney disease, tumors, clinically apparent immunodeficiencies, immunodeficiencies such as early type I interferon secretion, and pregnancy [20].

In this context, the role of nutrition in mental health is becoming increasingly recognized. Nutrition can be obtained from nutritional supplements such as polyunsaturated fatty acids (PUFAs), vitamins, minerals, antioxidants, amino acids, and pre-/probiotic supplements [21,22]. A large number of meta-analyses have emerged examining nutritional supplements in the treatment of mental disorders. The strongest scientific evidence was found for PUFAs (primarily eicosapentaenoic acid) as an adjunctive treatment for depression [22].

More recent evidence has suggested that PUFAs may also be beneficial for attention-deficit/hyperactivity disorder. Furthermore, folate supplements have been extensively researched as adjunctive treatments for depression and schizophrenia. There is also emerging evidence for N-acetylcysteine as a useful adjunctive treatment in mood disorders and schizophrenia. In this context, physicians should be informed of nutritional supplements with established efficacy for certain conditions, such as eicosapentaenoic acid in depression [22].

Therefore, the present study prepared a systematic review on the impacts of adequate nutrition and lifestyle on healthy human longevity.

Methods

Study Design

This study followed the international systematic review model, following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines. Available at: http://www.prisma-statement.org/?AspxAutoDetectCookieSupport=1. Accessed on: May 20, 2025. The AMSTAR-2 (Assessing the Methodological Quality of Systematic Reviews) methodological quality standards were also followed. Available at: https://amstar.ca/. Accessed on: May 20, 2025.

Data Sources and Search Strategy

The literature search process was conducted from May to June 2025 and was based on Web of Science, Scopus, Embase, PubMed, Lilacs, Ebsco, Scielo, and Google Scholar, covering scientific articles from various periods to the present day. The following descriptors (DeCS/MeSH Terms) were used "Calorie restriction. Precise nutrition. Healthy longevity. Lifestyle," and the Boolean "and" between MeSH terms and "or" between historical findings were used.

Study Quality and Risk of Bias

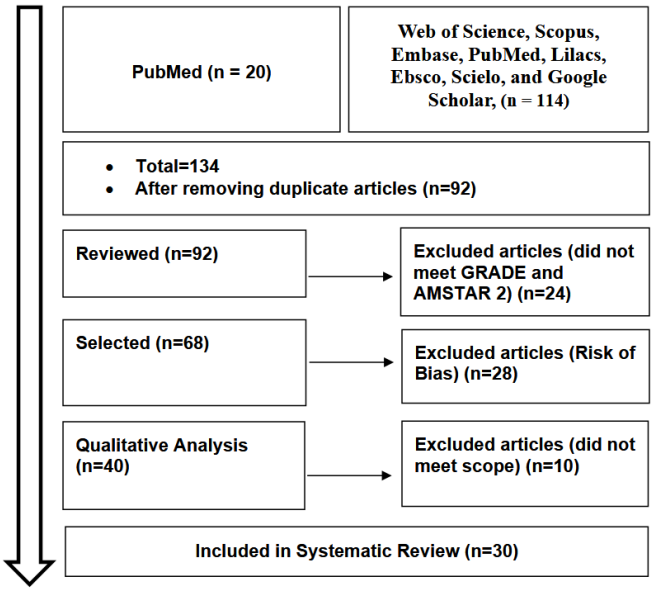
Quality was classified as high, moderate, low, or very low based on the risk of bias, clarity of comparisons, precision, and consistency of analyses. The most prominent articles were systematic reviews or meta-analyses of randomized controlled trials, followed by randomized clinical trials. Low-quality evidence was attributed to case reports, editorials, and brief communications, according to the GRADE instrument. Risk of bias was analyzed according to the Cochrane instrument by analyzing the funnel plot (sample size versus effect size), using Cohen's d test.

Results and Discussion

Summary of Findings

A total of 134 articles were found and submitted to eligibility analysis, with 30 final studies selected to comprise the results of this systematic review. The selected studies were of medium to high quality (Figure 1), considering the level of scientific evidence from studies such as meta-analysis, consensus, randomized clinical trials, prospective, and observational studies. Biases did not compromise the scientific basis of the studies. According to the GRADE instrument, most studies presented homogeneity in their results, with X^2=92.2%>50%. Considering the Cochrane risk of bias tool, the overall assessment resulted in 28 studies with a high risk of bias and 24 studies that did not meet the GRADE and AMSTAR-2 criteria.

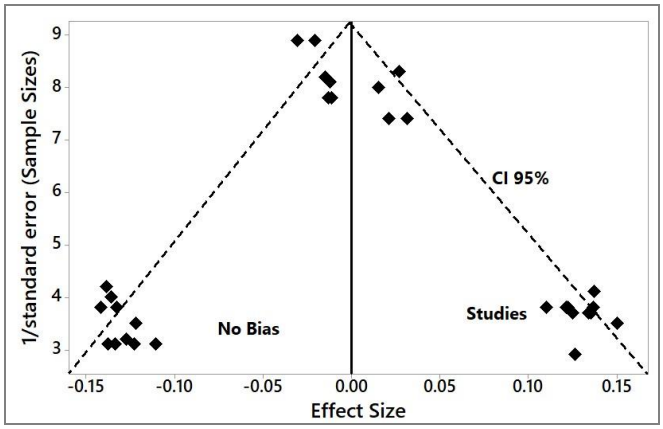
Figure 1. Flowchart showing the article selection process.



Source: Own Authorship.

Figure 2 presents the results of the risk of bias of the studies using the Funnel Plot, showing the calculation of the Effect Size (Magnitude of the difference) using Cohen's d Test. Precision (sample size) was determined indirectly by the inverse of the standard error (1/Standard Error). This graph showed symmetrical behavior, suggesting no significant risk of bias, either among studies with small sample sizes (lower precision), which are shown at the bottom of the graph, or among studies with large sample sizes, which are shown at the top.

Figure 2. The symmetrical funnel plot suggests no risk of bias among the small-sample-size studies shown at the bottom of the graph. High-confidence and high-recommendation studies are shown above the graph (n=30 studies).



Source: Own Authorship.

Main Outcomes – Precise Nutrition and Healthy Longevity

Nutrition is certainly one of the fundamental pillars of good and sustained health, stimulating various molecular pathways related to healthy aging and longevity. Similarly, individual nutrients or combinations of nutrients are being tested for their potential use as mimetics of caloric restriction, hormetins, and senolytics **[23]**.

Other innovative, and possibly holistic, nutrition- and diet-based intervention strategies for healthy aging include the adoption of regimens such as caloric and dietary restriction, as well as time-restricted feeding. Intermittent fasting, a regimen based on manipulating the timing of eating/fasting, is another promising intervention strategy for healthy aging. Chrononutrition, which denotes the link between circadian rhythms and nutrient-sensing pathways, is a new concept that illustrates how aligning meal timing with the cells' inherent molecular clocks works to preserve metabolic health **[23]**.

In the context of nutritional imbalance and its relationship with body and mind, nutrients of interest for cognitive health include polyunsaturated omega-3 fatty acids, polyphenols, vitamin D, and B vitamins **[22]**. A review by the Scientific Advisory Committee on Nutrition (SACN) (2018) **[24]** suggested that the evidence is insufficient and inconclusive to support the idea that individual nutrients (vitamins C, E, and B vitamins, omega-3s, polyphenols, flavonoids, and caffeine) could prevent cognitive decline.

It remains to be demonstrated whether these individual nutrients are beneficial in preventing cognitive decline. It is difficult and harmful to assume that a single nutrient can cure all diseases. Therefore, it is prudent to affirm the synergistic relationship of nutrients to influence physiological and cognitive function. For example, it is assumed that fish oils may

be beneficial for brain health due to their omega-3 composition, but the evidence for fish oil and omega-3s does not indicate that they would be useful for preserving cognitive health [24]. However, oily fish such as herring, mackerel, salmon, trout, and fresh tuna contain omega-3s as well as vitamin D, which may also maintain brain health and mediate cognitive decline. Low vitamin D concentrations have been associated with accelerated cognitive decline across ethnic groups. However, the efficacy of vitamin D supplements, rather than dietary intake or sunlight exposure, remains to be demonstrated [25].

Rather than individual nutrients, foods containing these nutrients for cognitive health could also benefit overall health, including fish, fruits, and vegetables [22]. Indeed, potentially shifting the focus to whole foods rather than individual nutrients would make recommendations more meaningful. In this scenario, dietary regimens have been suggested as interventions to treat conditions such as hypertension and dyslipidemia, the Mediterranean diet for metabolic syndrome and cardiovascular health, and the Okinawan diet for healthy aging [26,27].

The Mediterranean diet has been offered as a defense against health problems and as a means of promoting healthy aging and cognitive health [28]. It is characterized by high intakes of extra virgin olive oil, vegetables, including green leafy vegetables, fruits, whole grains, nuts, legumes, fish, dairy, red wine, and low intakes of eggs and confectionery. Numerous scores are available to measure adherence to the Mediterranean diet, but there is limited consensus on scoring criteria across studies, despite it being a useful tool for identifying dietary patterns [26].

Furthermore, greater adherence to the Mediterranean diet has been associated with a reduced risk of cognitive decline and Alzheimer's disease [27,28]. However, although the components of the Mediterranean diet are similar, the amounts and frequencies of consumption are inconsistent across studies, and mean adherence scores range from 23% to 88% [27]. Most studies utilize variations in eating frequency with different numbers of foods.

Also, certain amino acids are emerging as promising adjunctive treatments for mind-body balance. Although the evidence is still incipient, N-acetylcysteine in particular (at doses of 2000 mg/day or higher) has been indicated as potentially effective in reducing depressive symptoms and improving functional recovery in mixed psychiatric samples. Furthermore, significant reductions in total schizophrenia symptoms have been observed when using N-acetylcysteine as adjunctive treatment, although with substantial heterogeneity across studies, especially in study duration (indeed, N-acetylcysteine has a very late onset of action of about 6 months [30].

Besides, N-acetylcysteine acts as a precursor to glutathione, the main endogenous antioxidant, neutralizing cellular reactive oxygen and nitrogen. Glutathione production in astrocytes is limited by cysteine. Oral glutathione and L-cysteine are degraded by first-pass metabolism and do not increase brain glutathione levels, unlike oral N-acetylcysteine, which is more easily absorbed and has been shown to increase brain glutathione in animal models. Furthermore, N-acetylcysteine has been shown to increase dopamine release in animal models [30].

Although there are potential beneficial effects of nutritional supplements, this should not replace dietary improvements. Improving diet quality is associated with reduced all-cause mortality, whereas multivitamin and multimineral supplements can improve life expectancy [1-3]. The main ways to increase a healthy life expectancy include lifestyle modifications and pharmacological (or genetic) manipulations [1,2]. Adequate diet and calorie restriction are crucial for healthy aging [5]. One of the main goals of anti-aging medicine, however, is not only to extend life expectancy, but, in particular, to sustain a healthy life span for longer [6].

Consistent with this, essential nutrients such as defined vitamins, minerals (as micronutrients), essential and branched-chain amino acids, polyunsaturated fatty acids (PUFAs), probiotics, and plant metabolites such as polyphenols and terpenoids are widely recognized for preventing aging and promoting healthy aging. Their role is primarily to neutralize oxidative stress in the body, according to the free radical theory of aging [7-10]. Older adults increase their risk of atherosclerosis caused by chronic inflammation [11]. Natural compounds can increase life expectancy and improve health and quality of life, reducing the development of some age-related chronic diseases, such as diabetes, cancer, neurodegeneration, and cardiovascular disease [12].

The mechanisms by which oxidative stress causes aging-related degenerative phenomena must be separated from the fundamental role of ROS as signaling molecules, because they modulate and regulate important health and survival systems maintained by mitochondria and mitochondria-associated membranes that ensure the viability and healthy state of cells and tissues [13-15]. Antioxidants are involved in the prevention of age-related diseases such as atherosclerosis, neurodegenerative processes, cancer, diabetes, and skin wrinkles at the molecular level, having a beneficial effect on digestion and the

immune system, reducing the level of inflammatory and degenerative processes in the body **[14,15]**.

Conclusion

Innovative, and possibly holistic, food-based intervention strategies for healthy aging include adopting regimens such as calorie and dietary restriction, as well as time-restricted eating. Chrononutrition, which denotes the link between circadian rhythms and nutrient-sensing pathways, is a potential candidate for future research. Nutrients of interest for cognitive health include polyunsaturated omega-3 fatty acids, polyphenols, vitamin D, and B vitamins. Low vitamin D concentrations have been associated with accelerated cognitive decline across ethnic groups. Dietary regimens have been suggested as interventions for treating conditions such as hypertension and dyslipidemia, the Mediterranean diet for metabolic syndrome and cardiovascular health, and the Okinawa diet for healthy aging. Certain amino acids, such as N-acetylcysteine, are emerging as promising adjunctive treatments for mind-body balance. Multivitamin and multimineral supplements may improve life expectancy.

CRediT

Author contributions: **Conceptualization**; **Data curation**; **Formal Analysis**; **Investigation**; **Methodology**; **Project administration**; **Supervision**; **Writing - original draft**; and **Writing-review & editing-** Ronaldo Christofoletti.

Acknowledgment

Not applicable.

Ethical Approval

Not applicable.

Informed Consent

Not applicable.

Funding

Not applicable.

Data Sharing Statement

No additional data are available.

Conflict of Interest

The authors declare no conflict of interest.

Similarity Check

It was applied by Ithenticate®.

Application of Artificial Intelligence (AI)

Not applicable.

Peer Review Process

It was performed.

References

1. Green CL, Lamming DW, Fontana L. Molecular mechanisms of dietary restriction promoting health and longevity. Nat Rev Mol Cell Biol. 2022 Jan;23(1):56-73. doi: 10.1038/s41580-021-00411-4.
2. Ekmekcioglu C. Nutrition and longevity - From mechanisms to uncertainties. Crit Rev Food Sci Nutr. 2020;60(18):3063-3082. doi: 10.1080/10408398.2019.1676698.
3. Dominguez LJ, Di Bella G, Veronese N, Barbagallo M. Impact of Mediterranean Diet on Chronic Non-Communicable Diseases and Longevity. Nutrients. 2021 Jun 12;13(6):2028. doi: 10.3390/nu13062028.
4. Friedman SM. Lifestyle (Medicine) and Healthy Aging. Clin Geriatr Med. 2020 Nov;36(4):645-653. doi: 10.1016/j.cger.2020.06.007.
5. World Health Organization (WHO). The top 10 causes of death. Disponível em: http://www.who.int/mediacentre/factsheets/fs310/en/. Accessed in: March. 2023.
6. COVID-19 Map—Johns Hopkins Coronavirus Resource Center. Available online: https://coronavirus.jhu.edu/map.html. Accessed on 18 April 2023.
7. Decree of the Minister of Health of 20 March 2020 Regarding the Announcement of the State of the Epidemic in the Territory of the Republic of Poland. Available online: http://prawo.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20200000491 Accessed on 2 April 2023.
8. Giustino V, Parroco AM, Gennaro A, Musumeci G, Palma A, Battaglia G. Physical Activity Levels and Related Energy Expenditure during COVID-19 Quarantine among the Sicilian Active Population: A Cross-Sectional Online Survey Study. Sustainability 2020, 12, 4356.
9. Ammar A, Brach M, Trabelsi K, Chtourou H, Boukhris O, Masmoudi L, Bouaziz B, Bentlage E, How D, Ahmed M et al. Effects of COVID-19 Home Confinement on Eating Behaviour and

Physical Activity: Results of the ECLB-COVID19 International Online Survey. Nutrients 2020, 12, 1583.

10. Guthold R, Stevens GA, Riley LM, Bull FC. Worldwide trends in insufficient physical activity from 2001 to 2016: A pooled analysis of 358 population-based surveys with 1·9 million participants. Lancet Glob. Health 2018, 6, e1077–e1086.
11. Finkelstein EA, Khavjou OA, Thompson H, Trogdon JG, Pan L, Sherry B, Dietz W. Obesity and severe obesity forecasts through 2030. Am. J. Prev. Med. 2012, 42, 563–570.
12. Ravalli S, Musumeci, G. Coronavirus Outbreak in Italy: Physiological Benefits of Home-Based Exercise During Pandemic. J. Funct. Morphol. Kinesiol. 2020, 5, 31.
13. Naja F, Hamadeh, R. Nutrition amid the COVID-19 pandemic: A multi-level framework for action. Eur. J. Clin. Nutr. 2020, 1–5.
14. Zhang Y, Zhang, H.; Ma, X.; Di, Q. Mental Health Problems during the COVID-19 Pandemics and the Mitigation Effects of Exercise: A Longitudinal Study of College Students in China. Int. J. Environ. Res. Public Health 2020, 17, 3722.
15. Zabetakis, I.; Lordan, R.; Norton, C.; Tsoupras, A. COVID-19: The Inflammation Link and the Role of Nutrition in Potential Mitigation. Nutrients 2020, 12, 1466.
16. Martinez-Ferran M, de la Guía-Galipienso F, Sanchis-Gomar F, Pareja-Galeano H. Metabolic Impacts of Confinement during the COVID-19 Pandemic Due to Modified Diet and Physical Activity Habits. Nutrients 2020, 12, 1549.
17. World Health Organization Stay Physically Active during Self-Quarantine. Available online:http://www.euro.who.int/en/health-topics/healthemergencies/coronavirus-covid-19/technical-guidance/stay-physically-activeduring-self-quarantine. Accessed on 20 April 2023.
18. Chaput JP, Klingenberg L, Astrup A, Sjödin AM. Modern sedentary activities promote overconsumption of food in our current obesogenic environment. Obes. Rev. 2011, 12, e12–e20.
19. Scully M, Dixon H, Wakefield M. Association between commercial television exposure and fast-food consumption among adults. Public Health Nutr. 2009, 12, 105–110.
20. World Health Organization Food and Nutrition Tips during Self-Quarantine. Available online: https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/technicalguidance/food-and-nutrition-tipsduring-self-quarantine. Accessed on 15 April 2023.
21. Valdés-Ramos R, Martnez-Carrillo BE, Aranda-González II, Guadarrama AL, Pardo-Morales RV, Tlatempa P, Jarillo-Luna RA. Diet, exercise and gut mucosal immunity. Proc. Nutr. Soc. 2010, 69, 644–650.
22. Calder P, Carding S, Christopher G et al. A holistic approach to healthy ageing: how can people live longer, healthier lives? Journal of Human Nutrition and Dietetics. 2018, 31, 4, 439-450.
23. Rattan SIS, Kaur G. Nutrition, Food and Diet in Health and Longevity: We Eat What We Are. Nutrients. 2022 Dec 18;14(24):5376. doi: 10.3390/nu14245376.
24. Scientific Advisory Committee on Nutrition (2018) SACN Statement on Diet, Cognitive Impairment and Dementia. 2018. www.gov.uk/government/publications/sacn-statement-on-diet-cognitive-impairmentand-dementia. Accessed: 22 May 2023.
25. Dangour A, Andreeva V, Sydenham E et al. Omega 3 fatty acids and cognitive health in older people. British Journal of Nutrition. 2012, 107, Suppl 2, S152-S158.
26. Miller J, Harvey D, Beckett L et al (2015) Vitamin D status and rates of cognitive decline in a multiethnic cohort of older adults. JAMA Neurology. 72, 11, 1295-1303.
27. Davis C, Bryan J, Hodgson J et al (2015) Definition of the Mediterranean diet: a literature review. Nutrients. 7, 11, 9139-9153.
28. Willcox D, Scapagnini G, Willcox B (2014) Healthy aging diets other than the Mediterranean: a focus on the Okinawan diet. Mechanisms of Ageing and Development. 136-137, 148-162.
29. Petersson S, Philippou E (2016) Mediterranean diet, cognitive function, and dementia: a systematic review of the evidence. Advances in Nutrition. 7, 5, 889-904.
30. Fernandes BS, Dean OM, Dodd S et al. N-acetylcysteine in depressive symptoms and functionality: a systematic review and meta-analysis. J Clin Psychiatry 2016;77:e457-e66.