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Universidad Nacional de Trujillo

REVIEW

Nutrients and foods associated with people's emotional state: Scientific advances and future perspectives

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Abstract

This review is scientific research that seeks to explore the relationship between the consumption of certain foods and the emotional state, determining the effects that these foods produce when consumed by individuals. The intake of specific foods containing certain functional properties may help enhance our emotional health. There are particular nutrients present in certain foods that play an important role in overall health, especially in brain function. The objective of this review study was to highlight double-blind studies in humans that demonstrate the effectiveness of nutrients present in foods that interact with neurotransmitters (melatonin, endorphins, serotonin, dopamine, and oxytocin), which affect people's mood and well-being. For this study, specialized journals and scientific articles published in the last five years were selected. The results show that there is a wide variety of foods that contribute to people's well-being when consumed, and that this is not exclusive to a particular group of foods. Thus, meat products, dairy products, fruits, vegetables, and seafood, among others, contain nutrients with functional properties associated with people's emotional state. Finally, future studies should incorporate other variables such as ethnic groups, race, age, and body type, which may affect the results obtained.

Keywords: foods; nutrients; neurotransmitters; depression; tryptophan.

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1. Introduction

Functional foods play an essential role in human emotions and can be used as a dietary strategy to improve individual' mood (Chen et al., 2024; de Oliveira, 2022; Manchón et al., 2021; Maran et al., 2017; Samoggia et al., 2020). Some studies have shown that, in addition to their nutritional value or calorie content, foods can also influence the mood of the individuals who consume them (Privitera et al., 2018). Therefore, it is crucial to investigate the relationship between mental health and nutrient intake through diet and supplementation at different stages of life. In particular, it is important to address this relationship in the prevention and management of psychiatric disorders in children and adolescents (Rucklidge et al., 2025), as well as in the promotion of well-being and the improvement of quality of life in adults and older adults, especially in populations with severe mental illnesses (Farland et al., 2025). The consumption of food should not only be for the pleasure of eating or sharing something we enjoy, but also for the contribution of certain nutrients or compounds present that can provide benefits to human health. Yılmaz & Gökmen (2020) conducted a review of neuroactive compounds naturally present in foods, classifying them as fermented and unfermented. The current review is an updated search for double-blind studies of certain nutrients present in foods classified by groups (meat, seafood, dairy, fruits, vegetables, among others) and associated with people's emotional state.

The mood of individuals can be influenced by environmental or personal factors (Nakayama et al., 2020; Ordóñez-Iriarte, 2020; Postigo-Zegarra et al., 2024), but it is our brain that acts on these factors through the synthesis of chemical substances: acetylcholine, norepinephrine, adrenaline, dopamine, serotonin, histamine, excitatory and inhibitory amino acids, glycine, among others (Fernández-Guarino & Bacci, 2025; Göthert, 2013; Joshi, 2021; O'Callaghan et al., 2021; Szczepanska et al., 2023). It has been demonstrated that certain components of food can enhance individuals´ mood, induce sleep, provoke greater joy and well-being, and alleviate symptoms of depression or stress (Clark et al., 2019; Fukuda, 2024; González-Fuentes et al., 2018). Recent in-vitro, animal and human studies have demonstrated the importance of certain chemical compounds in foods that help improve emotional states (Delam et al., 2023; Mesripour et al., 2022; Shabbir et al., 2022).

Although many works have reported on how certain compounds in foods may contribute to improving mood and decreasing certain mental illnesses (Alzheimers´s disease, panic attacks, anxiety, among others) (Kasmara et al., 2025; Matias et al., 2024; Perneczky et al., 2025); there is a lack of research related to studies in humans that confirm the certainty that these compounds truly exert the desired effect (Figure 1).

The aim of this review was to highlight double-blind studies in humans that demonstrate the effectiveness of these nutrients present in foods (meat, fruits and vegetables, seafood, and dairy products, among others) that interact with neurotransmitters (melatonin, endorphins, serotonin, dopamine, and oxytocin), which affect people's emotional state and well-being.

2. Nutrients associated with improving mood

Nutrients are substances present in the foods we consume that fulfil functions in the organism (Moura et al., 2018; Sun et al., 2023; Zhu et al., 2023). These nutrients provide energy for the cellular functioning of our daily activities (Archer et al., 2018; Chen & Liu, 2022). For example, walking, moving the arms, speaking, among other activities; in addition, they repair and renew the organism and regulate the chemical reactions that occur in the cells (Islam et al., 2023; van Lill, 2019).

During the growth stage, the size of our body increases by a few centimeters each year, and this is only possible if the necessary nutrients are provided, which are related to the division of cells and their increase in quantity (Hettiarachchi et al., 2024). Each nutrient plays essential roles in the human body, among the most notable are carbohydrates, lipids (fats), proteins, mineral salts, vitamins, among others (Beijers et al., 2022; Damiot et al., 2019; Semercioöz et al., 2020). However, some nutrients have particularly prominent roles associated with the improvement of emotional state; for instance, choline affects memory and plays a fundamental role in neurological development and brain function, being present in eggs, chicken, salmon, organ meats (liver), soybeans, quinoa, beans, wheat germ, oat bran, cauliflower, broccoli, almond and walnut (Blusztajn, 1995; Conway et al., 2024; Heras-Sola & Gallo-Vallejo, 2024; Tanaka-Kanegae et al., 2024; Zeisel & da Costa, 2009).

Another nutrient related to mood is tyrosine, which is produced from the hydroxylation of the essential amino acid phenylalanine (Proserpio et al., 2020; Wu et al., 2025). Its deficiency is associated with depression, discomfort, anxiety, overweight and obesity.

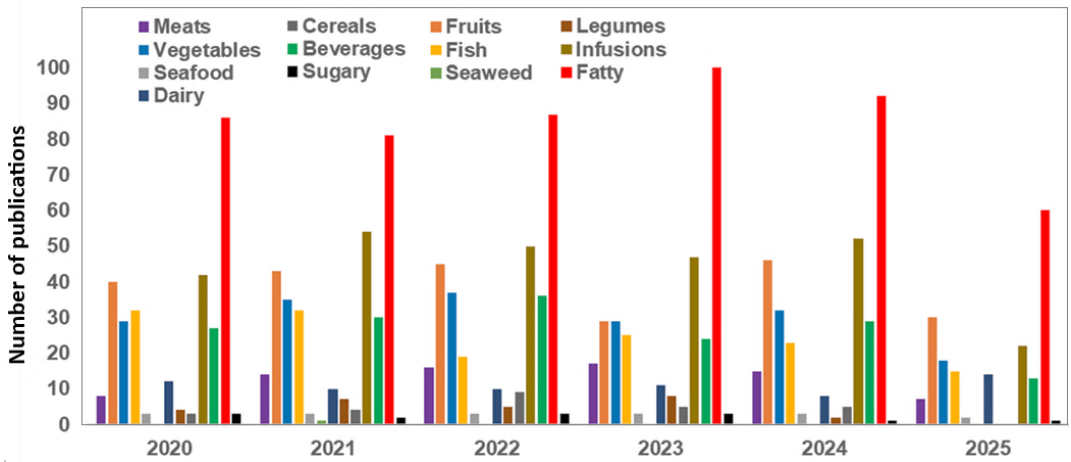

Figure 1. Articles published in the last five years on foods associated with the emotional state of people. The search was performed in the web of science by topic and year of publication, using the following keywords in English: TOPIC (mood) AND KEY (meats, fruits, vegetables, fish, seafood, algae, dairy, legumes, cereals, infusions, beverages, fatty, sugary).

Among the foods rich in tyrosine are dairy products, legumes, nuts, seeds, bananas, avocados, red meat, poultry, fish, and soy among others (Chen et al., 2021; Dinu & Apetrei, 2021; Durakoglugil et al., 2021; Franco et al., 2024; Jensen-Cody et al., 2022; Wu, 2020) Vitamin C is an essential water-soluble nutrient in certain foods. In the human body, it acts as an antioxidant and helps protect cells from damage caused by free radicals. It also plays a role in situations of stress, when anxiety increases and heart rate accelerates. Among the foods that contain the highest amounts of vitamin C are citrus fruits, vegetables, cauliflower, broccoli, cabbage, strawberries, kiwi, mango, bell peppers, and leafy greens (Kim et al., 2018; Richard et al., 2021; Son et al., 2018). Other nutrients, such as phosphorus, are present in fermented dairy products like yogurt and cheese, which contribute to the normal functioning of cell membranes (Rizzoli & Biver, 2024); docosahexaenoic acid, which helps to maintain normal brain function (Kyriacou et al., 2016); iodine, which is a mineral necessary for the formation of thyroid hormones, as well as for normal growth and brain development of the brain and nervous systems (Kelliher et al., 2024; Markhus et al., 2021); and the pantothenic acid (vitamin B5), which is an essential trace element required for the synthesis of coenzyme.

Folic acid contributes to normal psychological function; for instance, young individuals in India are unable to perform to their maximum potential due to nutritional deficiencies resulting from the lack of this nutrient. A study conducted over years involving 818 individuals aged over 59 years examined short-term memory, mental agility and verbal fluency; improvements were observed in all participants who consumed 800 µg (micrograms) of folic acid daily compared to those who took a placebo (Antony et al., 2022; Ebisch et al., 2007). It has previously been demonstrated that pantothenic acid is significantly reduced in multiple brain regions in both Alzheimer´s disease (AD) and Huntington´s disease (HD) (Scholefield et al., 2021); copper, magnesium, potassium, vitamin B2, vitamin B12, and niacin, which contribute to the normal functioning of the nervous system (Bourre, 2006; Zappelli et al., 2022); water is another essential nutrient that helps maintain normal physical and cognitive functions (Pan et al., 2022; Qayyum et al., 2024); finally, we can mention iron and zinc, which contribute to normal cognitive function (Hawley et al., 2022).

2.1. Nutrients that stimulate neurotransmitters

Some nutrients interact with neurotransmitters, which affect people´s mood. A nutrient-rich diet promotes good gut health, an organ capable of communicating with the brain through the microbiota that produces neurotransmitters, playing important roles in mood regulation (Buey et al., 2023; Lerner et al., 2017). There is an increasing number of studies suggesting that what we eat could influence individual' psychological well-being (Al-Sayed & Bieling, 2022; Bondarchuk et al., 2024; Heylen et al., 2015). For example, it had been demonstrated that calcium contributes to the normal functioning of neurotransmission (Boff et al., 2024; Davis et al., 2023; Legrain & Girard, 2003; Rupanagunta et al., 2023). Figure 2 shows chemical structure of these nutrients.

2.1.1. Tryptophan

A very important nutrient is tryptophan, which is an essential amino acid necessary for normal growth in humans; it is associated with a significant site of synthesis, uptake, and metabolism of the neurotransmitter 5-HT (serotonin), primary regulated by tryptophan hydroxylase (TPH) in the transport to unique 5-HT receptors (Badawy, 2015; Zhu, 2010). Clinical and preclinical studies have reported that the 5-HT signaling pathway may play a significant role in neonatal cardiovascular transition in new-borns (Archambault & Delaney, 2023). Tryptophan additionally acts in the production and maintenance of proteins (Wang et al., 2024). Some studies have reported that tryptophan reduces tension and anxiety, has a calming effect, influences, mood, acts as a sleep regulator, and is effective in combating stress and even preventing hypertension (Kanova & Kohout, 2021; Michelke et al., 2018; Summers et al., 2024). It is usually found in red and white meats, dairy products, eggs, nuts, almonds, kiwi, banana, brewer´s yeast, among others (Ano et al., 2019; Das et al., 2019; Elafify et al., 2022; Frank & Menden, 1994; Nimalaratne et al., 2011; USDA, 2022). For example, the production of this substance requires tryptophan, an essential amino acid whose metabolites play a key role in various physiological processes (Kanova & Kohout, 2021; Wang et al., 2024; Wang et al., 2024). These can be found in: eggs, pasta, rice, dairy products, cereals, chicken, turkey, and legumes (Chan et al., 2023; Choi et al., 2009; Mariussen & Fonnum, 2001).

Sugars are nutrients that affect the level of serotonin in the body; when blood levels are low, individuals typically crave any sweet items containing carbohydrates, flour, sugars or sweet milk. Other studies on foods such as plant-based and milk-based fermented products that have undergone lactic acid fermentation suggest that have the potential to improve the course of Alzheimer´s disease (Melini et al., 2019).

2.1.2. Melatonin

Melatonin is a molecule synthesized from the amino acid tryptophan, mainly synthesized in the pineal gland of mammals and regulated by a complex neural system (Andrani et al., 2024). This neurotransmitter contributes to maintaining a good mood and its presence prevents pathologies such as depression, which is also related to restorative rest. The concentration of serotonin in the brain, which is proportional to the concentration of tryptophan in plasma and brain (Kanova & Kohout, 2021), is converted into the molecule N-acetylserotonin, a precursor to melatonin. Therefore, it is important to have a diet rich in tryptophan so that the necessary and adequate amounts of serotonin and melatonin can be synthesized in the body. Additionally, melatonin serves to protect the liver from damage caused by free radicals (Chojnacki et al., 2014).

2.1.3. Endorphin

It is a neurotransmitter that is produced especially in the hypothalamus and the pituitary gland; it is a powerful natural stimulant that has the ability to change our mood. They act as analgesics and activate pleasure centers. For example, laughter decreases physical pain and strengthens the immune system; it influences brain chemistry (Asahina et al., 2003; Ceccarelli et al., 2004).

2.1.4. Serotonin

It is a brain neurotransmitter, known as the hormone of well-being, which regulates neuronal functions; it also controls emotions and cognitive functions, as it generates sensations of relaxation and satisfaction; it increases concentration and self-esteem (Azizi, 2022; Mustafa et al., 2020; Vicenzi et al., 2021; Yagishita, 2020). For example, altered maternal diet and prenatal exposure to air pollution (AP) affect the fetal brain, predisposing to postnatal neurobehavioral disorders after birth. Glucose transporters (GLUT) are key to facilitating neurotransmission; deficiency of the neuronal isoform GLUT3 culminates in autism spectrum disorders. Along with different neurotransmitters, serotonin (5-HT) and oxytocin (OXT) are crucial for the development of neuronal connectivity. The serotonin transporter (SERT) modulates synaptic levels of 5-HT, while the oxytocin receptor (OXTR) mediates the action of OXT (Ye et al., 2021).

2.1.5. Dopamine

It is present in various areas of the brain, crucial for the motor function of the organism (Kudrinskaya et al., 2024; Pinto et al., 2024). Dopamine stimulates the brain and produces pleasurable sensations (Kleinridders & Pothos, 2019; Weltens et al., 2016). On the other hand, it helps the pancreas release the appropriate amount of insulin after eating, coordinates the brain and body to produce voluntary movements (Hong et al., 2020). To increase their levels and stimulate the secretion of this neurotransmitter, it is necessary to consume foods rich in tyrosine: chocolate, watermelon, almonds, meat, green tea, dairy, blueberries, soy, among others (Qu et al., 2024; Wong et al., 2022; Zaru et al., 2013).

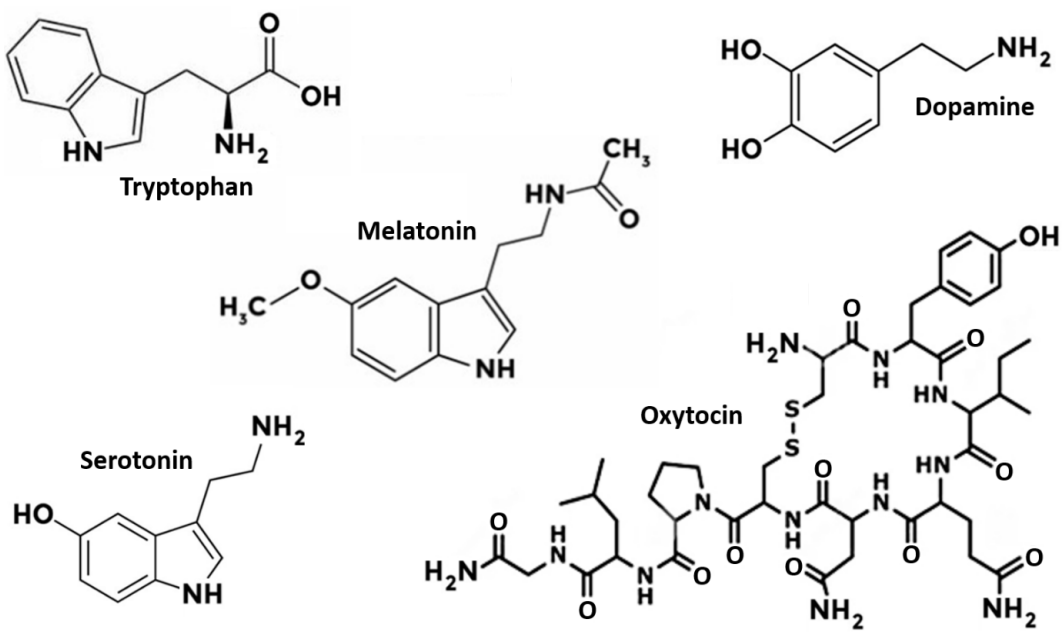

Figure 2. Chemical structure of some nutrients presents in foods that are associated with people's emotional state.

2.1.6. Oxytocin

It is produced in the cerebral hypothalamus, stored in the neurohypophysis, and released into the bloodstream (Huynh et al., 2013; Quattrocki & Friston, 2014). Regarding its function, oxytocin is remarkably versatile, acting both as a hormone and as a neurotransmitter (Li et al., 2025; Mobasher et al., 2021; Wilson & Goodson, 2016). This substance aids in feelings of relaxation, plays a significant role in childbirth, and by extension, in lactation, sexuality, social connection, and love (Baettig et al., 2020; Hagihara et al., 2023; Mitra, 2021). It is associated with the consumption of foods such as strawberries, almonds dark chocolate, bananas, chia seeds, lean meats, rosemary, parsley, thyme, mint, dill and blue fish, among other (Bafor et al., 2021; Sasaki et al., 2021).

3. Scientific evidence of foods that are associated with emotional states

Historically, it is recognized that good nutrition, a balanced diet, a healthy lifestyle, and a diet rich in antioxidants and polyunsaturated fatty acids contribute to maintaining a healthy emotional balance in individuals (Anwar et al., 2024; Huang et al., 2024; Mititelu et al., 2025; Qiu et al., 2025). According to studies, there are three individual components that affect food choice cognitive, behavioral and affective (Herman & Polivy, 1975; Pitre & Nicki, 1992). Regarding the affective component, the relationship between emotions and eating is not straightforward: emotional states can influence eating behavior and in turn, nutrition can modify emotions and moods (Gibson, 2006; Peña Fernández & Reidl Martínez, 2015). Although it has been demonstrated for decades that certain nutrients play a fundamental role in maintaining emotional balance, the foods containing these nutrients do not necessarily produce the desired equilibrium. However, recent studies have shown that the consumption of certain foods with functional and bioactive properties related to emotional state mechanisms can be used as supplements in the treatment of certain emotional pathologies. The initial studies to demonstrate when food can be used as a supplement to improve mood were conducted in experiments with mice and / or in vitro. In the last decade, various studies have been carried out. One of the methodologies used in recent years have been double-blinded studies in humans. In double-blind studies, a sample and a placebo (a sample that does not contain nutrients with functional and bioactive properties) are utilized. A double-blind (blinded or masked) study refers to the lack of knowledge of the intervention being received by the groups being studied, from the perspective of the participants in a study. Currently, with the emergence of complex multicenter studies, the participants are not only the patients and their physicians, but in addition to the patients and the treating clinicians, there are those who collect the data, those who determine whether the event under study occurred (event adjudicators), and those who analyze the data (Day & Altman, 2000; Letelier et al., 2004). Double-blind clinical trials in humans have become the most important methodology for scientifically demonstrating when food can be considered a supplement that helps individuals' emotional well-being.

3.1 Scientific evidence of meats and meat products associated with emotional state

Scientific studies have been reported related to the intake of meats and meat products associated with the emotional state of individuals (Figure 3). Pribic et al. (2020), in a randomized, crossover, double-blind pilot study involving healthy men without obesity, measured and evaluated brain activity using functional magnetic resonance imaging before and after each intake of a standards type of sausage high in animal fat (bologna) and a modified product based on a fat analogue derived from plants. Both diets were categorized as palatable, with improvements in mood and digestive well-being. Another randomized double-blind trial conducted by Chan et al. (2016), reported that the intake of chicken essence was beneficial for multiple organ systems, potentially enhancing attention and shot-term memory in extremely stressful conditions. However, another study measured dietary exposure in a cohort of individuals with mania and other psychiatric disorders, found that the consumption of cured, dry nitrate-cured meat was associated with main (Khambadkone et al., 2020). Table 1 reports scientific studies on meats and meat products associated with the emotional state of individuals.

3.2 Scientific evidence in fruits and vegetables associated with emotional state

Cross-sectional studies have reported on the relationship between emotional state and the intake of fruits and vegetables (Gardiner & Bryan, 2017; Smith et al., 2022; Takase et al., 2024). Those who consume these foods have a higher likelihood of being classified as very happy, suggesting a strong positive correlation between fruit and vegetable consumption and happiness; and perhaps also feeling of optimism. Many fruits and vegetables contain high levels of vitamin C (Conner et al., 2020), a positive factor in the production of dopamine, the neurotransmitter of joy (Figure 4).

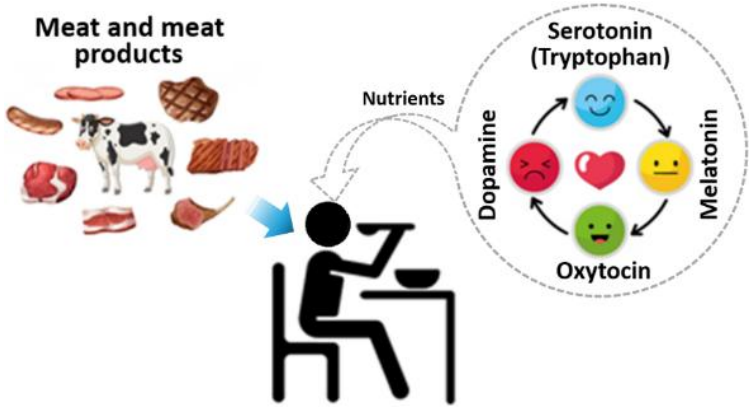

Figure 3. Consumption of meat and meat products associated with people's emotional state.

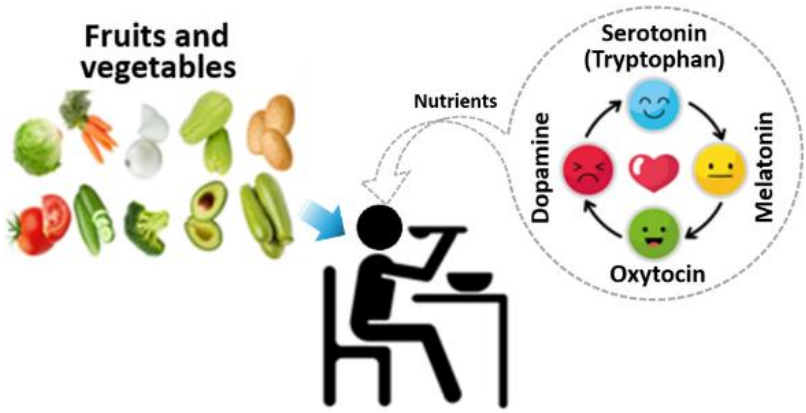

Figure 4. Fruits and vegetable consumption associated with people's emotional state.

Additionally, the antioxidants in fruits and vegetables reduce inflammation, which can lead to higher levels of overall well-being (Kim et al., 2017; Rower et al., 2017; Taylor et al., 2020). Thus, You et al. (2020), conducted a cross-sectional study with convenience sampling in selected community centers in the Klan Valley (Malaysia), where it was determined that the intake of high-quality traditional Asian vegetables is associated with better nutritional status, cognition, and mood among older adults. Additionally, another cross-sectional study reported that the intake of alpha-carotene, beta-carotene, beta-cryptoxanthin, lycopene, lutein with zeaxanthin, and total carotenoids may reduce depressive symptoms in adults (Ge et al., 2020). Table 2 presents 10 scientific studies that have documented the association between the intake of fruits and vegetables and emotional state.

3.3. Scientific evidence in seafood products associated with emotional states

Some scientific studies have reported that a diet rich in fish and seafood (omega-3 fatty acids, docosahexaenoic acid, and eicosapentaenoic acid) (Figure 5) not only provides essential nutrients but is also associated with greater emotional well-being, reducing stress and depression (Arena et al., 2024; Grosso et al., 2016; Hegarty & Parker, 2013; Kidd, 2007; Reksten et al., 2024). The consumption of omega-3 fatty acids found in fish and seafood improves cognitive function over time (Carrie et al., 2009; Hegarty & Parker, 2013; Hegarty & Parker, 2011; Psara et al., 2025), promotes the production of neurotransmitters such as serotonin and endorphins, which contribute to a feeling of well-being and happiness. Additionally, the high antioxidant content in these foods helps to reduce the production of cortisol, the stress hormone.

Furthermore, these foods are a natural source of tryptophan and vitamin D, which are essential for melatonin production. For example, a double-blind trial with fish oil supplements (omega-3 polyunsaturated fatty acids and supporting nutrients) reported an improvement in anxiety compared to the placebo group (Kelaiditis et al., 2021).

Table 3 reports on some scientific studies on seafood products associated with people's emotional state.

Table 1
Scientific studies on meats and meat products associated with the emotional state of individuals

Foods	Symptoms	Study	Methodology	Effect	Result	Reference
Sausage rich in animal fat (bologna) and modified low-fat product	Hedonic sensations (pleasure from food, digestive well-being and changes in mood state)	Randomized, crossover, double-blind pilot study	Eight healthy non-obese men ages between 25 and 32 years were selected. Two different types of bolognas were used. Palatability and postprandial sensations were measured on 10cm scales, and brain activity was evaluated through magnetic resonance imaging.	Both meals induced similar changes in brain connectivity: a decrease in activity in the frontal-parietal networks, basal ganglia and thalamus, occipital visual, sensorimotor, superior temporal, and default-mode networks, while an increase in activity was detected in the network associated with white matter.	Both meals were rated equally palatable and induced the same degree of homeostatic sensation (satiety, fullness) with a similar hedonic dimension (improvement of mood and digestive well-being).	(Pribic et al., 2020)
Mediterranean diet with fresh and lean pork meat	Mood	Clinical trial	A 24-week parallel cross-design compared a Mediterranean diet with 2-3 servings per week of fresh, lean pork (MedPork) to a low-fat control diet (LF). 35 participants aged between 45 and 80 years. Psychological well-being was measured through the SF-36 Health Survey, and mood was assessed using the Profile of Mood State (POMS).	A significant interaction was observed between Treatment-X-Visit-X-Period for the overall mood disturbance as measured by the Profile of Mood States.	The intervention with MedPork resulted in increased processing speed performance ($p = 0.01$) and in emotional role functioning ($p = 0.03$).	(Wade et al., 2019)
Chicken essence	Work-related	Randomized double-blind trial	102 participants, divided into two groups of 51. Participants who met the inclusion criteria were randomly administered BRAND chicken essence (BEC) or a placebo daily (70 ml) for two weeks.	No difference was observed in gender, education, and ISPJSS, BDI and BAI scores among the groups. However, the mean melatonin concentration of the BEC group, 16.9 ± 12.9 pg/mL, is higher than that of the control group, 12.6 ± 6.1 pg/mL, $P < 0.05$.	Chicken essence (EC) is beneficial for multiple organ systems and can enhance attention and short-term memory under extremely stress conditions.	(Chan et al., 2016)
Egg protein hydrolysate (EPH)	Mood and stress	Parallel, controlled, randomized, and double-blind design	The effects of low doses of EPH (0.5, 1 g) in a food matrix on cognition, mood, and stress, in 45 participants divided into three groups.	The effects of the interventions were measured after a multitasking cognitive stressor on blood biomarkers, self-reported mood states, attention performance, automatic parameters, and emotional reactivity responses through electroencephalographic recording.	Compared to the reference dose, the dose of 1g of EPH increased the bioavailability of tryptophan relative to both doses improved the variability parameters of heart rate associated with parasympathetic activation, while also exhibiting differences in the late neuronal response to negative and neutral emotions.	(Zahar et al., 2023)
Powdered fertilized egg (extract of young tissue; YTE)	Depression	Double blind in humans	Duration: 12 weeks 55 patients with depression ingest 3 capsules every morning and 2 every night. YTE: 1,680 mg YTE + Melissa officinalis: 1,680 mg + 600 mg of M. officinalis (120 mg per capsule) Placebo: Lactose	YTE raises the levels of steroid hormones in the adrenal glands, which decreases stress-related hormones such as cortisol.	The study indicates that powdered fertilized egg has an antidepressant effect and may serve as an alternative or a supplement to antidepressant medication.	(Solberg, 2011)

Cured dry nitrate meat (beef jerky sticks and turkey)	Mania in humans	Cohort of humans	We measured dietary exposure in a cohort of individuals with mania and other psychiatric disorders, as well as in control individuals without a psychiatric disorder. Feeding mice with meat preparations with added nitrate.	It causes hyperactivity, human mania, alterations in brain pathways, and human bipolar disorder.	The exposure to nitrite-treated meat products increases in a cohort of individuals with mania.	(Khambadkone et al., 2020)
Animal protein (beef, pork, veal, Lamb; organs, sausages, cured meats and cold cuts, poultry such as chicken and turkey)	Depression	Clinical survey	Health questionnaire, dietary intake of creatine, and covariates were obtained from 22,692 NHANES participants aged 20 years and older. The amounts of creatine in the diet consumed by the study participants ranged from 0 to 3.16 g/day, with an average of 0.54 g/day.	The intake of creatine in the diet correlates with the consumption of additional nutrients found in animal-derived proteins, which are also associated with a reduced risk of depression, including n-3 fatty acids.	These nutrients may function independently or in an additive/ synergistic manner with creatine to reduce the risk of depression.	(Bakian et al., 2020)
Lean red meat (beef, lambs or veal)	Cognitive deterioration and dementia	Randomized controlled trial	The study design is a randomized controlled trial of 48 weeks consisting of a 24-weeks consisting of a 24-week intervention follow-up. Men and women (n = 152) aged 65 years or older residing in the community will be randomly assigned. The primary outcome measures will be muscle mass size and strength, and cognitive function.	To improve muscle mass, size, strength, and cognitive function in older adults by increasing the average protein intake in the diet.	In summary, we believe that the findings of this study will provide the foundation for more specific guidelines on nutrition and exercise for the management and prevention of age-related changes in muscular and neural health, as well cognitive function in older adults consuming no more than 455 g of lean red meat.	(Daly et al., 2015)
Pollen and honey from bees	Hot flashes and other symptoms of menopause.	Randomized controlled trial	In this study, a total of 46 patients were recruited. Out of this total, 31 patients (67.4%; 31/46) completed both phases of the study, while 15 patients did not complete the second part of the study.	Flavonoids, which are found in honey and pollen, prevent breast cancers, supporting the use of both products in women experiencing menopausal issues.	This study provided evidence that honey and bee pollen can improve menopausal symptoms in breast cancer patients undergoing anti-hormonal treatment.	(Münstedt et al., 2015)
Chicken meat (hydrolyzed chicken extract)	Alzheimer, Parkinson	In vitro	HCE is a patented ingredient derived from chicken through enzymatic hydrolysis and compromises 91.38% proteins and peptides (4.23% free amino acids and 7.56% diketopiperazines or cyclic dipeptides), 1.64% lipids, 1% carbohydrates and 1.36% minerals. A dose equivalent of BC was used at 300 mg/kg HCE and a high dose of BC equal to 600 mg/kg HCE.	It exerts neuroprotective effects and is associated with the improvement of antioxidant enzyme activities.	We found that both supplementation with BC and HCE improved age-induced memory loss, alleviated neuroinflammation in the hippocampus and oxidative stress, followed by promoting hippocampal neurogenesis in mice. It also improved age-dependent morphological abnormalities and alleviated microgliosis and astrogliosis.	(Ni et al., 2021)

Table 2
Scientific studies on fruits and vegetables associated with the emotional state of individuals

Food	Symptoms	Study	Methodology	Effect	Result	Reference
Substitution with Montmorency sour cherry (CM)	Cognitive function and mood	Double-blind placebo-controlled	A period of 3 months in middle-aged adults (mean ± SD: 48 ± 6 years) were randomly assigned to receive 30 ml twice daily of MC (n= 25) or an equivalent amount of an isoenergetic placebo (n=25).	These data suggest an anti-fatigue effect of MC supplementation, as well as the ability to enhance sustained attention during periods of high cognitive demand; this may be related to changes in amino acid metabolism.	After 3 months, the MC resulted in a higher accuracy in digital surveillance (mean difference: 3, 95% CI: 0, 95% CI: 2.6, 95% CI: 4%) with a lower number of false alarms (mean difference: -1, 95% CI: -2, 95% CI: -0, 95% CI: 4) compared to the placebo.	(Kimble et al., 2022)
Cocoa extract rich in flavonoids	Fatigue and mood	Randomized, double-blind placebo-controlled study	Study in women aged 40 to 60 years. Randomized participants (n=60) into equal groups that received a drink containing cacao flavonoids (240 mg/200 mL/day) or a placebo for 8 weeks. Before and after the 8-week treatment, assessed participants´ scores on the Chalder Fatigue Scale (CFS)	The consumption of flavonoid-rich cocoa extract suppressed negative mood states and promoted positive mood states in healthy middle-aged women.	These results suggest that cocoa flavonoids could be a useful food that may improve variable mood states in middle-aged women and support their active lives.	(Murakami et al., 2023)
α-carotenoid and β-carotenoid (fruits and vegetables)	Depressive symptoms	Cross-sectional study	2762 women aged 42 to 52 years. The intake of α-carotenoids and β-carotenoids was inversely associated with CES-D scale scored in both the unadjusted linear regression model and the model adjusted for age, race/ ethnicity, total household income, and sex hormones-binding globulin (SHBG).	The intake of α-carotenoids and β-carotenoids may be inversely associated with depressive symptoms in middle-aged women.	The intakes of α-carotenoids and β-carotenoids were inversely associated with a high score on the CES-D scale (≥16) in both an unadjusted and adjusted logistic regression model accounting for age, race/ ethnicity, total family income, and sex hormone-binding globulin.	(Di & Yan, 2019)
Dried garlic powder	Mood	Double-blind controlled study	In total, there were 790 students. All participants were administered a single dose of 400 mg in tablet form daily for three consecutive cycles. The intervention group received 400 mg of Allium-S in tablets, while the control group received placebo tablets.	No serious side effects were observed in any of the groups.	After treatment with garlic for three consecutive cycles, the total score for the severity of premenstrual symptoms significantly decreased (P < 0.001) from 34.09 ± 7.31 to 11.21 ± 7.17.	(Jafari et al., 2021)
Coffee with apple extract	Mood	Randomized, double-blind, controlled cross-over trial.	46 healthy men and women, aged 18 to 49 years (mean age 23 years), who consumed: 1100 mg of coffee berry extract, 1100 mg of coffee berry extract plus 275 mg of apple extract, 100 mg of coffee berry extract, or 275 mg of apple extract, or placebo on four separate occasions.	Faster performance in peg and ball (executive function) was noted after 1100 mg of coffee berries plus apple extract, and accuracy in the Rapid Visual Information Processing (RVIP) task increased in the third of four repetitions following 1100 mg of coffee berries alone.	1100 mg of coffee Berry resulted in an increase in arousal. The absence of effects on mood when adding apple extract, and the possibility that the low dose of caffeine present in coffee berry acts synergistically with polyphenols.	(Jackson et al., 2022)
Fruits and vegetables	Depressive mood	Cohort study (Survey)	Directed to elderly individuals residing in the community (≥ 65 years) in Saitama Prefecture, Japan (September 2023, N=1004)	The frequency of consumption of raw fruits and vegetables was negate-vely associated with depressive mood (OR = 0.62; 95% CI = 0.40 – 0.97).	The result suggests the importance of frequent consumption of raw fruits and vegetables for better mental health in older adults.	(Takase et al., 2024)
Cooked waxy barley	Mood	Randomized comparative trial of parallel groups	27 healthy adult Japanese participants received a supplement of 100 g of cooked waxy barley (which contained 1.8 g of β-glucan) or g of cooked w weeks.	The attenuation of ITRS episodes was observed, with participants who received boiled waxy barley showing a better mood compared to the control group, as assessed by the POMS 2 questionnaire.	This study suggests that supplementation with cooked cereal barley containing β-(1,3/1,4)-glucan prevents or alleviates nasal symptoms of the upper respiratory tract and improves mood.	(Araki et al., 2024)

Freeze-dried blueberry	Mood, state of alertness	Double-blind	A parallel, placebo-controlled study in adults aged 50 to 75 years, with overweight and obesity. 138 eligible participants were randomly assigned to one of three treatment groups for 6 months.	Evidence that the benefits of blueberries are more likely in individuals experiencing higher cognitive loads.	The consumption of 1 cup of blueberries resulted in a trend towards a 4.2% improvement in percentage accuracy for image recognition (P = 0.10; q = 0.59).	(Curtis et al., 2024)
Powder from the fruit pod of Dichrostachys glomerata	Mood and quality of life in adults with overweight and mild obesity	Double-blind placebo-controlled trial	A double-blind placebo-controlled trial adhering to CONSORT guidelines was conducted with 56 adults (Mean [M] age = 44.50, M [body mass index] BMI = 31.66) who were randomly assigned to the Group D. glomerata (DG; 300 mg/d) or the Placebo Group (PG; rice protein, 300 mg/d) for a duration of 60 days.	It reduced food cravings, improved mood, and decreased anxiety and stress perception, resulting in an enhanced quality of life.	The potential of *D. glomerata* is a beneficial supplement for weight control and overall well-being.	(Hausenblas et al., 2024)
Standardized extract of Zea mays leaf (corn)	Sleep quality and overall well-being	Double-blind, placebo-controlled clinical trial	The participants (n = 45) (age range 19-73) consumed the supplement or placebo ~60 minutes before going to bed daily for a duration of 4 weeks.	In comparison to the baseline value, UP165 produced a moderate but statistically significant increase ($p \leq 0.05$) in total sleep time when administered to healthy subjects at a dosage of 500 mg/day.	Participants who received UP165 showed a statistically significant and dose-correlated reduction in salivary cortisol (up to 36%); an increase in deep sleep duration (up to 30 minutes); an increase in total sleep time (up to 10%); an improvement in sleep quality (up to 49%); and an enhanced Profile of Mood States (POMS) (36 – 58%).	(Talbott et al., 2023)
Olive oil	Bipolar disorder	Clinical in humans	30 patients, 4 months study. Identical gelatine capsules were obtained containing concentrated ω3 fatty acids ethyl esters or a placebo. Each ω3 fatty acid concentrate capsule contained 440 mg eicosapentaenoic acid (C20:5, ω3) and 240 mg of (C22:6, ω3), which was deodorized under vacuum and supplemented with tertbutylhydroquinon, 0.2 mg/g, and tocopherols, 2 mg/g, as antioxidants.	Omega- 3 fatty acids also exhibit mood-stabilizing properties in bipolar disorder.	Omega-3 fatty acids were well tolerated and improved the short-term course of the disease in this preliminary study of patients with bipolar disorder.	(Stoll et al., 1999)
Prebiotic dietary fiber (PDF) (gum Arabic and powdered carrot)		Cross-sectional, double-blind, randomized, placebo-controlled study	A 12-week intervention separated by 8 weeks of washout. In each intervention period, participants visited the study center at the beginning and again after 4, 8 and 12 weeks. Men and women could participate if they met the following inclusion criteria: age between 45 to 70 years, BMI of 25 to 30 kg/m^2, and no significant medical condition.	The intervention significantly increases daily positive affect (PA) and reduced daily negative affect (NA) in women, but not in men.	Studies demonstrate that an intervention with dietary fiber can positively alter mood in daily life.	(Hogenelst et al., 2025)
Fruits and vegetables	Mood	Intervention	83 participants (aged 65 years or older), identified as low consumers of fruits and vegetables (≥2 servings daily), were recruited to participate in a randomized study. The participants were randomly assigned to one of two diets (≥2 servings of fruits and vegetables per day or ≥5 servings of fruits and vegetables per day) for a total of 16 weeks. Fruits and vegetables were provided free of charge to the participants on a weekly basis.	There was a general trend towards a greater reduction in GHQ-28 scored (indicative of better mental health) in the group consuming ≥5 servings of fruits and vegetables per day compared to the group consuming ≤2 servings per day at week 16, although these findings were not statistically significant.	The results of the study showed that, in terms of adherence, participants in the group consuming ≥5 servings of fruits and vegetables per day had a significantly higher daily intake of fruit and vegetables at week 16 compared to those in the group consuming ≤2 servings of fruits and vegetables per day ($p < 0.001$).	(Rooney et al., 2012)

Table 3
Scientific studies on seafood products associated with the emotional state of individuals

Food	Symptoms	Study	Methodology	Effect	Result	Reference
Fish oil-based supplements (omega-3 polyunsaturated fatty acids and supporting nutrients)	Stress, anxiety and depression	Randomized, double-blind, placebo-controlled trial	A duration of 24 weeks that explores the efficacy of a multinutrient supplement with high EPA content in the management of severe and subclinical anxiety and depression in healthy university students aged 19 to 29.	The effects of a multinutrient supplement with high eicosapentaenoic acid content on validated measures of anxiety and depression in healthy university students with non-clinical levels of anxiety and depression.	The primary outcome is an improvement in anxiety compared to the placebo group, as assessed by the Generalized Anxiety Disorder-7 scale. Participants will be randomly assigned to an active treatment consisting of a daily dose of 1125 mg of eicosapentaenoic acid 441 mg of docosahexaenoic acid, 441 mg of docosahexaenoic acid, 330 mg of magnesium, and 7.5 mg of vitamin E, or placebo, for 24 weeks.	(Kelaiditis et al., 2021)
Extract of Brown algae	Postprandial cognitive function	Randomized, placebo-controlled, double-blind	The impact of a brown algae extract of postprandial cognitive function was examined in 60 healthy adults (N=30 per group). Computerized measurements of episodic memory, attention and subjective state were complete at baseline and 5 times at 40-minute intervals over a 3-hour period following lunch.	They provide the first evidence of the modulation of cognition with seaweed extract.	The marine algae produced significant improvements in accuracy in digital surveillance tasks (p = 0.035) and reaction time in elections (p = 0.043).	(Haskell-Ramsay et al., 2018)
Supplementation with carotenoids, omega-3 fatty acids (fish oil), and vitamin E.	Alzheimer (EA)	Randomized, double-blind, placebo-controlled clinical trail	Patients with mild to moderate AD consumed daily 1 g of fish oil (which included 500 mg of DHA, 150 mg of EPA), 22 mg of carotenoids (10 mg of lutein, 10 mg of meso-zeaxanthin, 2 mg of zeaxanthin), and 15 mg of vitamin E or placebo for 12 months in a randomized, double-blind, placebo-controlled clinical trial. The carotenoids ω-3 fatty acids, and vitamin E were quantified in blood.	The active group showed improvements in the severity of Alzheimer´s disease (i.e. memory and mood), with a statistically significant difference in the clinical characteristics of memory (p< 0.001).	The positive results demonstrated in his trial suggest that this combined dietary supplement of micronutrients should be considered in the comprehensive treatment of EA.	(Nolan et al., 2022)
Shrimp (processing waste (heads) of the shrimp)	Cortical spreading depression	Mice	The changes in the rate of depression in wean rat offspring born to mothers treated daily, either during gestation or lactation, with an ethanoic extract of carotenoids (30 µg/kg/day) prepared from shrimp waste were studied.	The carotenoids in shrimp protect the cerebral cortex of mice	The results suggest a protective action of shrimp carotenoids against the effects of ethanol on the spread of depression; this protective effect may be related to the antioxidant properties of these carotenoids.	(de Souza Bezerra et al., 2005)
Fish (fatty fish not canned; lean fish; smoked/ salted fish; fish in water)	Depression	Questionnaire	Cross-sectional analysis of the PREDIMED-Plus trail. The consumption of fish and seafood and the intake of PUFA ω-3 were evaluated using a validated food frequency questionnaire.	The moderate intake of total LC ω-3 PUFAs was associated with a lower prevalence of depression.	Moderate intake of fish and LC ω-3 PUFA, but not high intake, has been associated with lower probabilities of depression.	(Sánchez-Villegas et al., 2018)

Supplement with omega-3 fatty acids (intake coming solely from fish and al sources [fish and supplements]) supplements	Depression and Lifestyle	Randomized controlled clinical trial	Data was obtained simultaneously through a self-report questionnaire (N= 2982). Using polynomial regression, a non-linear relationship was found between depressed mood and the intake of n-3 fatty acids from fish, where the gradual decrease in depressed mood lessened as the intake of n-3 fatty acids increased. However, this relationship was attenuated when adjusting for age and IMD.	A non-linear relationship was found between depressed mood and the intake of n-3 fatty acids from fish, where the gradual decrease in depressed mood diminished as the intake of n-3. However, this relationship was attenuated when adjusting for age and IMD.	These findings suggest that higher intake of n-3 AGE from fish is associated with lower levels of depression; however, this association disappears after adjusting for age and social deprivation, and after including the intake of n-3 AGE from supplements.	(Appleton et al., 2007)
Fish	Depression	Cohort study in humans	From pregnancy to 31 of age HSCL-25 Depression Subscale Fish consumption over the past 6 months Members of the cohort include 2,721 men and 2,968 women.	Omega-3 fatty acids and depression.	A low frequency of fish consumption was statistically significantly associated with depression in women.	(Timonen et al., 2004)
Nutritional products with fibre, fish oils, and probiotics.	Perinatal depression and anxiety (PDA)	Unicentric feasibility study, partially randomized, placebo-controlled, and double-blind.	100 pregnant women with a history of depression or anxiety / ADHA will be recruited and randomized into of four groups, which may include the following: receiving a daily dose of both investigational products and dietary counselling to increase dietary fibre, receiving a daily dose of both investigational drugs only, receiving fish oil from the investigational product and a placebo, and a control group with no intervention.	The protective effects of specific nutrients and diets on major depressive disorder (MDD) have been demonstrated.	The evidence suggests that nutritional interventions involving fiber, fish oils, and probiotics may play a favorable role in neuropsychiareic outcomes during and after pregnancy.	(Gallant et al., 2024)
Microencapsulated tuna oil powder	Mood	Randomized, double-bind, placebo-controlled trial with a balanced cross-over design.	Twenty-nine healthy men (mean age = 52.8 years, SD = 5.3) were administered a powder (in a meal) containing 4.74 g of n-3 PUFA 9DHA 4020 mg; EPA 720 mg) or placebo in a random order on two different testing days separated by a washout period of 7 ± 3 days. Participants completed mood assessments f=before and after completing two batteries of cognitive tests at baseline and again 3.5-4.0 hours after consuming the active treatment or placebo.	Differential effects were observed for alertness (P=0.008) and stress (P=0.04) following the consumption of DHA-rich powder compared to placebo. Although alertness decreased upon completing the cognitive batteries, it was greater after the consumption of DHA-rich powder than after the placebo (P=0.006). Conversely, stress was lower after the consumption of DHA-rich powder compared to the placebo, although this difference approached significance only (P=0.05).	In general, the results of this pilot study demonstrate that a single high dose of n-3 PUFA may provide acute mood benefits following a high cognitive demand in healthy middle-aged men.	(Reddan et al., 2024)
Seaweeds (*Sargassum plagiophylum*)	Depression Induced by Alpha Interferon (IFAa)	Mice	*Sargassum plagiophylum* was extracted by maceration with a methanol-ethyl acetate solvent (1:1). The extract was evaporated and divided between hexane and methanol solvents. Male mice were used, and depression was	*S. plagiophylum* has antidepressant effects and can be used for neuronal protection as part of nutraceuticals.	*S. plagiophylum* has antidepressant effects; hexane extract may prevent depression, while methanol extract not only prevents but also treat IFNa-induced depression in mice.	(Mesripour et al., 2022)

			induced by SC injection of IFN alpha (16 X 10(-5) (UI)/kg) for 6 days. The animals were subjected to the forced swimming test (FST) following the locomotor test on day 7.			
Seaweed (*Sargassum fusiforme*)	Alzheimer	Mice	Males ix-month-old APPswePS1ΔE9 mice and wild-type C57BL/6J littermate controls received 24(S)-saringosterol (0.5 mg/ 25g body weight/day) (APPswePSΔE9 n=20; C57BL/6J=19) via oral gavage for 10 weeks. Cognition was assessed through object recognition and location tasks.	It contains 24 (S)-saringosterol, a preferential LXRβ, agonist, which prevent memory deterioration.	The administration of 24(S)-saringosterol prevented cognitive decline in APPswePS1ΔE9 mice regardless of its effects on Aβ burden and without adverse effects on liver fat content. The anti-inflammatory effects of 24(S)-saringosterol may contribute to the prevention of cognitive decline.	(Martens et al., 2022)
Brown Seaweed (*Ascophyllum nodosum*) (FRAN)	Alzheimer	Flies	Drosophila strains were utilized: OregonR +, ey-GAL4/CyO, elav c 155-GAL4, UAS-mito GFP, UAS-mcherry. Mito. OMM, UAS-Aβ 42/CyO, cultured at 28 ± 1°C in a DBO incubator. Flavonoid-rich Ascophyllum extract was employed against AD flies, as revealed by an LC-MS study. The validation of Aβ 42 expression was conducted through immunostaining and q-RT PCR. The ocular roughness of the AD flies was rated in a dose-dependent manner.	Effect on cellular apoptosis viability, longevity, mitochondrial dysfunction and oxidative stress.	The FRAN extract rich in flavonoids exhibits the highest neuroprotective activity against A beta (42) aggregation in the ocular tissue of Drosophila. The extract against A beta (42) induced neurotoxicity by altering various cellular and molecular events. Therefore, it could be considered a potent neuroprotective agent against A beta (42), showing great potential as a future therapeutic agent for the treatment of Alzheimer's disease.	(Chauhan et al., 2022)
Supplement with fish oil	Depressive mood	Randomized, double-blind, placebo-controlled trial	Individuals aged 65 years older living independently (n=302) were randomly assigned to consume 1800 mg/ day of EPA+ DHA, 400 mg/day of EPA+DHA, or placebo capsules for 26 weeks.	The plasma concentrations of EPA+DHA increased by 238% in the high-dose fish oil group and by 51% in the low-dose fish oil group, reflecting excellent compliance.	The mean changes in CES-D scores after 26 weeks were -0.2, 0.2 and -0.4 (p =0.87) in the high-dose fish oil, low-dose fish oil, and placebo groups, respectively. Treatment with 1800 mg or 400 mg of EPA + DHA did not differentially affect any of the measures of mental well-being after 13 or 26 weeks of intervention, compared to placebo.	(van de Rest et al., 2008)
Standardized extract of Green-lipped mussel oil (PCSO-524®)	Hyperactivity	Randomized, double-bind, placebo-controlled study.	PCSO-524® or an equivalent placebo was administered for 14 weeks to 144 participants (123 men and 21 women; mean age of 8.7 years) with high hyperactivity and inattention. Parental reports on behavioral issues, changes in cognition, and mood were evaluated.	Significant improvements were noted in the PCSO-524® group in full simple repeated measures ANCOVA regarding recognition memory between baseline and week 8 compared to placebo (p = 0.02, d= 0.56); this difference was not maintained at week 14.	The results indicate that PCSO-524 ® may be beneficial in reducing hyperactivity and inattention levels in a population of children with clinical and subclinical symptoms of ADHD.	(Kean et al., 2017)

3.4. Scientific evidence in diary and dairy products associated with emotional state

Dairy products are a source of vitamins, minerals and bioactive compounds that play a role in mood regulation processes (Villamil et al., 2020). Diary offers minerals such as calcium, phosphorus, potassium, magnesium and zinc. These minerals are associated with a protective function against stress and mood disorders. Additionally, dairy contains vitamins (A, D and B), proteins (beta- caseins A1 and A2) (Hockey et al., 2021) that are essential cofactors in the synthesis of neurotransmitters contributing to the feeling of well-being. Furthermore, dairy products are a source of high biological value proteins that provide essential amino acids such as tryptophan and phenylalanine, which acts as precursors to serotonin (Begdache et al., 2019; Taylor & Holscher, 2020; Thorning et al., 2016) (Figure 6). For instance, fermented yogurt contains bioactive compounds that may interact with the nervous system. For example, fermented yogurt contains bioactive compounds that can interact with the nervous system; it also acts as a hormonal receptor, activating and related to mood, such as serotonin. In addition to containing prebiotics, they provide probiotics capable of modifying the composition of the microbiota and metabolism (Rizzoli & Biver, 2024). Another study reported by Saidi et al. (2020), investigated the metabolite profile of Lighvan cheese (sheep's milk) during maturation to detect possible dietary neurotransmitters with beneficial effects on mood and health. Table 4 reports studies on diary and dairy products associated with people's emotional states.

4. Current and future challenges

Further research is needed regarding the intake of functional foods and their relationship with individuals' emotional states. An interdisciplinary approach involving experts in nutrition, psychology, technology, agriculture and food policy is required. The studies should delve deeper into how certain nutrients may relate to the gut microbiota, their connection with omega-3 fatty acids, antioxidants and how they contribute to emotional well-being. Future studies should incorporate additional variables such as ethnic groups, races, ages and body composition which may affect the results obtained. Table 5 shows the current and future challenges for each cluster analyzed.

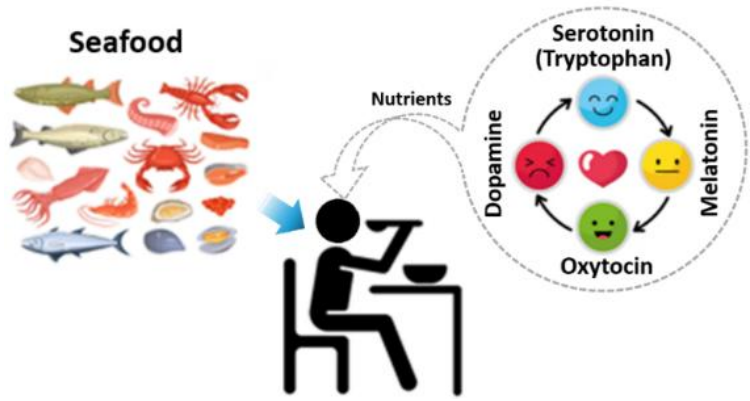

Figure 5. Consumption of seafood products associated with people's emotional state.

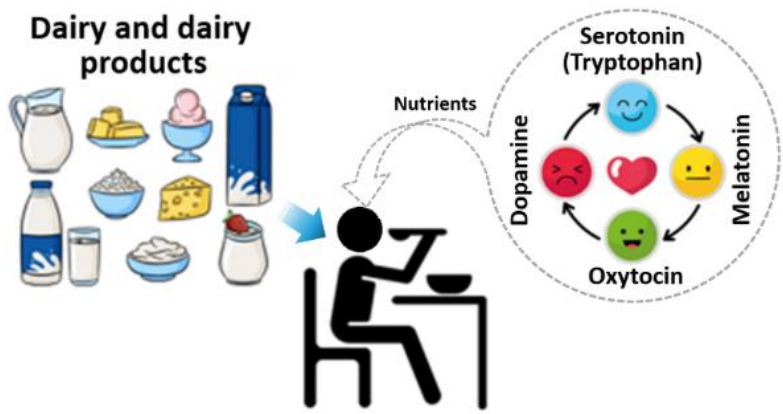

Figure 6. Consumption of dairy products and dairy products associated with people's emotional state.

Table 4
Studies on dairy and dairy products related to the emotional state of individuals

Food	Symptoms	Study	Methodology	Effect	Result	Reference
L.helveticus (Probiotic)	Mood	Randomized, double-blind, placebo-controlled clinical trial	Healthy Japanese nursing students (n=46) were randomized to receive heat-killed *L. helveticus* MCC1848 (5 billion/day) or placebo powder for four weeks.	The ingestion of heat-killed *L. helveticus* MCC1848 significantly improved the 'Positive Affect' of PANAS compared to the placebo.	The results indicate that heat-killed *L. helveticus* MCC 1848 is effective in improving positive mood.	(Mutoh et al., 2023)
Cultured milk beverage	Subthre-shold depression (SD)	Parallel, randomized, double-blind, placebo-controlled clinic trial	A total of 110 participants with irritable bowel syndrome (IBS) with normal mood (NM) and Depression Severity (DS) were randomly assigned to one of four intervention groups: IBS-NM with placebo, and IBS-DS with probiotics. Each participant was required to consume two bottles of cultures milk daily for 12 weeks.	The rate of adverse events (AE) was 18.2% (n = 20); placebo, 9 and probiotic, 11. Ninety percent of participants with AE experienced digestive symptoms, while 10% presented side effects unrelated to digestion.	Depress	(Sarkawi et al., 2024)
Milk: (Std GUM), (Reform GUM), Iso GUM and a standard glucose beverage (Glucose)	Cognitive perfor-mance	Cross-sectional, double-blind study	Thirty children aged 5 to 6 years participated in the study. The CDR system, a computerized cognitive assessment system, was used to evaluate various measures of attention and memory in the children at baseline (T = 0), and 60 (T = 1). 120 (T = 2), and 180 (T = 3) minutes after the intake of the test products.	Iso GUM conferred a beneficial effect on Reform GUM and glucose in the index of sensitivity of numerical working memory, with no differences observed between Iso GUM and Std GUM.	This study provides evidence that subtle changes in the formulations of growing-up milk, with relatively, can affect cognitive performance.	(Taib et al., 2012)
Fermented milk	Mood	Double-blind, randomized, crossover, placebo-controlled study	12 healthy office workers with sleep complaints participated in the study. The participants received fermented milk containing viable LcS (daily intake of 1x10^11 colony-forming units) and non-fermented placebo milk, each for a duration of 14 weeks.	Theta power in the EEG measured at rest or during an oddball auditory test in the afternoon, was significantly lower during the LcS period compared to the placebo period (p = 0.025 and 0.009, respectively). The change rate of theta power was associated with the change in attention score.	The results indicate that LcS may be effective in improving daytime performance, which is supported by observations of the indicators related to physiological state.	(Kikuchi-Hayakawa et al., 2023)
Dairy products (cheese, yogurt, milk, and labneh)	Insomnia, anxiety and depression	Questionnaire	Frequency of intake per day: 1 ounce of cream cheese (20 mg Ca), 1 cup (240 ml) of milk or yogurt (300 mg Ca), two tablespoons (2 oz) of labneh (100 mg Ca), calcium intake in mg/day.	The intake of dairy calcium and its relationship with insomnia.	The low intake of calcium in the diet, estimated from the consumption of dairy products, was very prevalent and associated with insomnia and depression among university students in Jordan.	(Alkhatatbeh et al., 2021)
Fermented milk with adzuki bean sprouts	Anxiety and mild depression	Rat	During the fermentation of milk, adzuki bean sprout refiners (20% weight/ volume) and monosodium glutamate (1.0% weight/volume) were added to fresh milk and sterilized at 121 °C for 5 minutes. Subsequently, Lactobacillus bulgaricus, *Streptococcus thermophiles*, and *Lactobacillus plantarum*	Effect of fermented milk from adzuki bean sprout enriched with gamma-aminobutyric acid (GABA) in depressive mice.	The fermented milk from adzuki bean sprouts enriched with GABA (241.30 ± 1.62 µg/mL) prepared with *Streptococcus thermophiles*, *Lactobacillus*, *bulgaricus*, and *Lactobacillus plantarum*, and Lb.	(Wu et al., 2021)

			15953 (strain CGMCC15953, which can transfer soybean isoflavones to aglycone form) along with strain Lb. brevis J1 were combined in a ratio of 1:1:3:1 to produce GABA-enriched fermented milk at 40 °C.		brevis J1 may reduce and possibly prevent mild symptoms similar to depression in mice.	
Commercial yogurt	Depression and cardiovascular disease	Clinical	24 healthy individuals participated in the study and were randomly assigned to the following four groups: control, yogurt, exercise and combination. The participants consumed yogurt and engaged in exercise for two weeks, and we examined the combined effects of yogurt and exercise on physiological biomarkers.	Yogurt containing probiotic microorganisms exerts beneficial physiological conditions such as cardiovascular disease (CVD) and depression.	A combination of yogurt and exercise resulted in greater increases in serotonin levels and reductions in triglyceride levels and high-sensitivity C-reactive protein, compared to those with yogurt or exercise alone; thus, this combination may have implications for the prevention of depression and cardiovascular diseases.	(Kim et al., 2018)
Prebiotics and yogurt	Depression	Clinical diagnostic	A total of 14,539 men and women (mean age: 37 years) who were who were initially free of depression were evaluated over a mean follow-up period of 9.3 years. Validated food frequency questionnaire was used at the beginning of the study and after 1 10-year follow-up to assess the intake of prebiotics (fructans and galactooligosaccharides) and yogurt consumption (< 0.5, ≥ 0.5 to < 3, ≥3 to < 7, and ≥7 servings/ week).	High consumption of fructans, GOS, and total prebiotics appeared to be associated with a lower risk of depression.	Our study suggests that high consumption of whole yogurt is associated with a lower risk of depression among women in the SUN cohort. No association was observed for prebiotics.	(Perez-Cornago et al., 2016)
Whey peptide (soy, rice, milk)	Mood and blood variables	Crossed, randomized, double-blind, placebo-controlled trial	A randomized, double-blind, placebo-controlled crossover trial was conducted with two doses of WPH (100 and 500 mg). Participants, aged between 20 and 59 years with fatigue, were assigned to two groups based on the doses of WPH received and the initial test meals established in each study.	A single intake of 500 mg of WPH, including 2.5 mg of the AJI-801 peptide, significantly improved the different indices related to depression	There were no significant differences in blood levels of ALC and FGF21 between the two groups. Regarding mood, the intake of 500 mg of WPH (including 2.5 mg of AJI-801) showed a significant improvement in depression/ low mood for the second edition of Profile of Mood States questionnaire and in the scores on the visual analogue scale for depression, compared to the placebo.	(Suzuki et al., 2024)
Peptides from fermented dairy products (whey cheese, yogurt)	Memory	Mice	To prepare peptide products, a 5% (w/v) whey protein solution (Daiichi Kasei, Tochigi, Japan) was dissolved in 0.05 M Tris buffer (pH 7.5) and enzymatically digested with different enzymes (0.125% (w/v), Table 1) at 50°C for 4 hours. The following enzymatic reaction, the sample were filtered through a 10 kDa membrane to remove undigested protein and enzymes.	The peptides containing Trp-Tyr (WY) from the whey protein improved memory.	The peptides containing WY in fermented dairy products increase monoamine levels by inhibiting the activity of monoamine oxidase B, which helps to prevent age-related cognitive decline.	(Ano et al., 2018)

The use of the co-occurrence graphs allows us to understand the gaps in understanding or areas that require more thorough investigation of this topic. The number of nodes along with their central or peripheral arrangement, enables visualization of the connection between concepts. Figure 7a shows how keywords from analyzed articles co-occur with each other. Figure 7b, existing topics related to foods that are associated with emotional states can be identified in chronological order, from the oldest to the most recent (2014 - 2024), which are distinguished into eight clusters.

Table 5
Current and future challenges by cluster, associated with food consumption and emotional state

Clúster Color	Current research's	References	Future research's
Red	Connects studies related to the role of arachidonic acid (ARA) and brain activity and its bipolar disorders, in relation to nutritional aspects (probiotics) to improve sleep quality and decrease stress.	(Basselin & Rapoport, 2008; Rapoport, 2014; Sabouri et al., 2022)	Simulation with validated mathematical models
Lead	Effects of the interaction between tryptophan and other nutrients on serotonin production. As well as the impact of omega-3 fatty acid intake on brain function and mental health in different populations and the relationship between the intake of antioxidant-rich foods and the reduction of oxidative stress in the brain. Also, the effects of melatonin on sleep regulation and mental health, and finally, the interaction between food intake and gut microbiota in neurotransmitter production.	(Cocchi & Traina, 2020; McNamara et al., 2009; Nobari et al., 2023; Tomczyk et al., 2024; Tung et al., 2023)	Conduct new studies in the search for new metabolites that could act as new markers of adaptive response to exercise when accompanied by Omega 3 supplementation.
Orange	Studies related to obesity, mental health, cognition, physical activity, and emotional state in individuals, considering the interaction between gut microbiota and the brain in chronic diseases.	(Collins et al., 2022; Fiscella & Andel, 2024; Guan et al., 2023; Kendig et al., 2021; Prats-Arimon et al., 2024)	Identify effective interventions, in addition to diet and exercise, to prevent and improve adverse effects.
Light Blue	Research into underlying mechanisms to see the medium- and long-term effects of personalized interventions on food intake linked to lifestyle and physical activity. How fish consumption in a balanced diet improves mood; its effects on immunity, food compounds, mood disorders, depression, nutrients, and probiotics.	(Bell et al., 2018; de Moraes et al., 2019; Kimia, 2020; Su et al., 2013)	Conduct collaborative studies and convergence of transdisciplinary fields in health
Purple	Related studies on the effects of consuming certain foods rich in complex carbohydrates, proteins, and healthy fats that can help improve physical performance and reduce oxidative stress. Likewise, foods rich in antioxidants, vitamins, and minerals can help strengthen the immune system and reduce inflammation. Bioactive compounds present in foods such as fruits, vegetables, and whole grains can influence brain function and mental health. Omega-3 fatty acids, particularly EPA and DHA, can help reduce stress and inflammation and improve mental health and mood.	(Claro-Cala et al., 2025; Kiecolt-Glaser, 2010; Matrisciano & Pinna, 2020; Wijesekara & Xu, 2025)	Conduct new research into functional foods and the bioactive compounds present in innovative food products designed to improve mood and cognitive function.
Yellow	Studies related to polyphenols present in foods that can aid cognitive function and reduce the risk of dementia, as well as some functional foods containing probiotics and Omega-3, which can help improve overall health and reduce the risk of chronic diseases.	(Fekete et al., 2025; Kurowska et al., 2023; Madireddy & Madireddy, 2021; Scuto et al., 2024; Smid et al., 2025; Wijesekara & Xu, 2025)	Innovations in artificial intelligence applied to microbiome research and genomic technologies can open up new opportunities for specific and effective applications of functional foods in population health.
Blue	Studies related to Omega-3 fatty acids, especially DHA and EPA, which can help reduce inflammation, improve mental and brain health in people with neurological disorders, and improve mood, depression, and anxiety.	(Almohmadi, 2024; Barros et al., 2014; Barroso-Hernández et al., 2022; Cardoso et al., 2016)	More studies are needed on the combination of omega-3 oils from different seafood products applied to human health.
Green	Studies related to green tea suggest that it may help reduce stress and improve emotional health due to its antioxidant and L-theanine content. Omega-3 fatty acids, vitamin D, and magnesium may help maintain emotional health and reduce the risk of mood disorders.	(Boyle et al., 2022; Noah et al., 2022; Pickering et al., 2023)	More studies are needed on Mg-Teadiola (a combination of Mg, B vitamins, rhodiola, and green tea (L-theanine), which may reduce pain perception, stress, and sleep disorders.

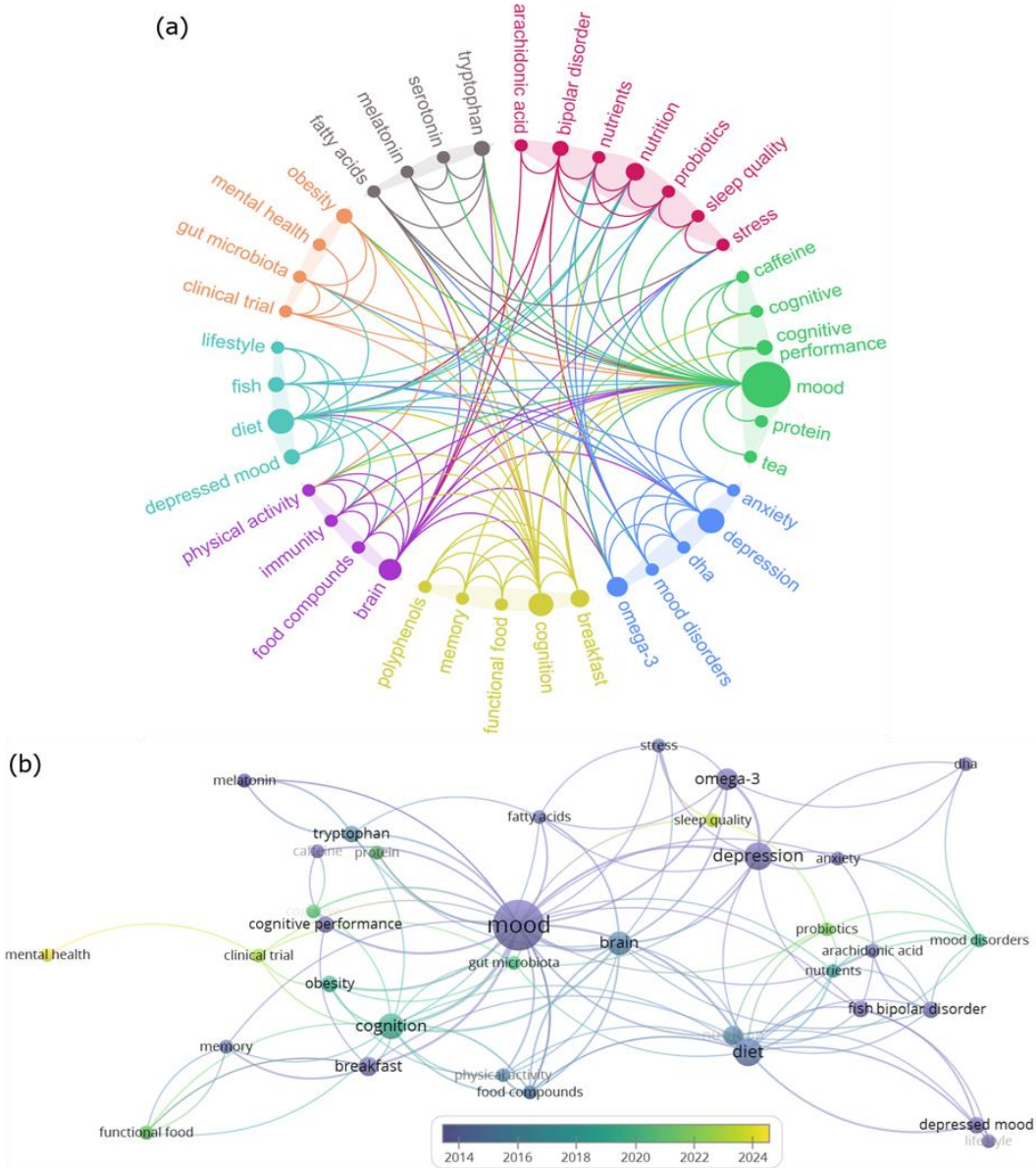

Figure 7. Co-occurrence analysis: (a) Visualization of networks and clusters, circular diagram designed with Scimago Graphica (https://www.graphica.app/); (b) Visualization of temporal overlap using VosViewer (https://www.vosviewer.com/). Scopus Data: KEY (meats OR fruits OR vegetables OR fish OR seaweed OR dairy OR infusions OR beverages OR fatty OR sugary OR foods) AND TITLE (mood).

5. Conclusions

There is evidence that the intake of certain foods containing specific functional properties can also help to enhance emotional health. Some nutrients and vitamins found in certain foods play an important role in overall health, particularly concerning cognitive function and the emotional state of individuals. These foods are fundamental in the transmission of neurotransmitters such as serotonin, dopamine, and norepinephrine, which are essential for emotional well-being. The relationship between the consumption of these foods and mood is clear and has been demonstrated through double-blind studies in humans, providing scientific evidence that what we eat has a direct impact on how we feel emotionally. Likewise, these investigations can be replicated in larger test populations, and if the effects persist during ongoing treatment or after its cessation. Research efforts should also focus on identifying patient groups that may experience greater benefits from functional food therapy. Furthermore, it highlights the value of considering dietary patterns in the design of interventions aimed at mental

health, both in the prevention and treatment of disorders throughout all stages of life. It also emphasizes urgency of improving the quality of the food we consume, which involves rethinking and transforming the way the food industry produces. Finally, the most important finding in this review was the large amount of scientific evidence from double-blind studies in humans, among others. Ultimately, these findings invite us to reflect on the necessity of updating public policies and strengthening research, with the aim of generating real changes that promote better mental health and greater well-being for the entire population.

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Conflicts of Interest

There are no conflicts of interest.

Contribution of the authors

T. Espinoza-Tellez, R. Quevedo-León, D. Izaguirre-Torres, L. M. Paucar-Menacho: research topic, bibliographic compilation, drafting of the initial and final drafts, review of initial and final drafts
T. Espinoza-Tellez, R. Quevedo-León, D. Izaguirre-Torres: review and supervision, article structure.
A. L. Huamani- Huamani y D. Izaguirre-Torres: literature review, journal selection
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