EGAS MONIZ SCHOOL of HEALTH & SCIENCE | INSTITUTO UNIVERSITÁRIO EGAS MONIZ

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MESTRADO EM PSICOLOGIA CLÍNICA E DA SAÚDE

Integrated literature review on the relationship between cognitive bias and depression and anxiety in adults

Trabalho submetido por

Paul Poincheval

para a obtenção do grau de mestrado em psicologia

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Sob a coordenação de :
Orientador Prof.ª Doutora **Patrícia Gouveia**
Co-orientador Prof.ª Doutora **Marta Sofia Reis**

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Resumo

A psicologia cognitiva trata dos processos mentais e do seu impacto no conhecimento e no comportamento dos indivíduos. A investigação científica é o instrumento privilegiado para observar e avaliar estes processos. Este estudo tem como principal objetivo apresentar o estado da arte da investigação recente sobre a relação entre os enviesamentos cognitivos e as perturbações ansiosas e depressivas. Foram analisados 24 artigos publicados entre 2020 e 2024, com o intuito de determinar qual a intervenção psicológica, baseada na modificação dos vieses cognitivos, se evidencia mais eficaz para uma população adulta que sofre de sintomas depressivos ou de ansiedade. Os resultados apontam para a existência de fatores desconhecidos, quer na interação entre os vieses cognitivos, quer simplesmente na avaliação de certos vieses difíceis de medir. A TCC de grupo baseada em imagens evidenciou-se tão eficaz como a TCC verbal individual na modificação dos vieses analisados. A TCC em grupo baseada em imagens tem a enorme vantagem de exigir menos tempo por parte do terapeuta para obter um resultado semelhante ao da TCC verbal. A intervenção da CBM através da Internet ainda apresenta muitas incertezas e contradições na literatura. Concluímos que é necessária mais investigação sobre o papel dos enviesamentos cognitivos nos sintomas depressivos e de ansiedade, bem como sobre a eficácia das psicoterapias existentes, uma vez que ainda existem zonas cinzentas nestes domínios. Além disso, a TCC é também uma terapia eficaz que beneficiaria se continuasse a desenvolver novas formas ou se fosse combinada com outra abordagem.

Palavras-chave: *Ansiedade, Modificação dos vieses cognitivos, Depressão, Modificação dos vieses de atenção, Modificação dos vieses de interpretação*

Abstract

Cognitive psychology deals with mental processes and their impact on the knowledge and behaviour of individuals. Scientific research is the privileged instrument for observing and evaluating these processes. The main objective of this study is to present the state of the art of recent research on the relationship between cognitive biases and anxiety and depressive disorders. Twenty-four studies published between 2020 and 2024 were analysed in order to determine which psychological intervention, based on modifying cognitive biases, is most effective for an adult population suffering from depressive or anxiety symptoms. The results point to the existence of unknown factors, either in the interaction between cognitive biases or simply in the assessment of certain biases that are difficult to measure. Imagery-based group CBT proved to be as effective as individual verbal CBT in modifying the biases analysed. Image-based group CBT had a huge advantage in requiring less therapist time to achieve a result similar to verbal CBT. The intervention of CBM via the Internet still presents many uncertainties and contradictions in the literature. In conclusion, there is a need for further research into the role of cognitive biases in depressive and anxiety symptoms, as well as into the effectiveness of existing psychotherapies, as there are still grey areas in these areas. Moreover, CBT is also an effective therapy which would benefit from continuing to develop new forms or being combined with another approach.

Keywords: *Anxiety, Cognitive bias modification, Depression, Attention bias modification, Interpretation bias modification*

Résumé

La psychologie cognitive aborde les processus mentaux et leurs impacts sur les connaissances et les comportements des individus. La recherche scientifique est l'outil privilégié pour observer et évaluer ces processus. L'objet de cette étude à travers une revue de littérature est de présenter l'état de la recherche récente sur le lien entre les biais cognitifs et les troubles anxieux et dépressifs. Vingt-quatre études parues entre 2020 et 2024 vont composer cette revue de littérature. L'objectif principal de cette dissertation est de déterminer quelle intervention psychologique basée sur la modification des biais cognitifs, est la plus efficace pour une population adulte souffrant de symptomatologie dépressive ou anxieuse. Cette revue est composée de quatre parties: la première où nous observons que d'un point de vue scientifique plus précis on voit qu'il reste encore des inconnues, que ce soit dans l'interaction entre biais cognitifs ou même simplement dans l'évaluation de certains biais difficiles à mesurer. Dans la seconde, nous expliquons que la TCC de groupe par imagerie avait la même efficacité que la TCC verbale individuelle, donc que la TCC de groupe basé sur l'imagerie nécessite moins de temps de thérapeute par patient pour obtenir un résultat similaire. Troisièmement, l'intervention CBM diffusée par internet donne des résultats globalement positifs pour les états anxieux et dépressifs ainsi que cliniques et non cliniques, même s'il existe encore beaucoup d'incertitudes et de contradictions au niveau de la littérature. Quatrièmement, nous observons que la remédiation cognitive à des effets intéressants sur les troubles dépressifs ainsi que sur un grand panel des compétences cognitives évalués. Pour conclure, il y a une nécessité de poursuivre les recherches sur le rôle des biais cognitifs sur la symptomatologie dépressive et anxieuse, ainsi que sur l'efficacité des psychothérapies existantes, car il reste encore aujourd'hui des zones d'ombres sur ces aspects. De plus, La TCC est aussi une thérapie efficace qui y gagnerait à continuer de développer de nouvelles formes ou à être associée avec une autre approche.

Mots-clés: *Anxiété, Modification des biais cognitifs, Dépression, Modification des biais d'attention, Modification des biais d'interprétation*

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List of acronyms

CBM: Cognitive Bias Modification

CBM-A: Cognitive Bias Modification - Attention

CBM-I: Cognitive Bias Modification - Interpretation

DSM-V: Diagnostic and Statistical Manual of Mental Disorders

CDE: Characteristic depressive episode

RC: Cognitive remediation

SAD: Social anxiety disorder

CBT: Cognitive and behavioural therapy

OCD: Obsessive-compulsive disorder

Glossary

AMELI: It is a medical service of the French Assurance Maladie which carries out a public service mission.

INSERM: It is a French public scientific research organisation dedicated to human health.

Introduction

"The researcher's objective is to produce knowledge by empirically validating hypotheses derived from clinical material or theoretical conceptions" (Fernandez & Pedinielli, 2006). The point of scientific rigour is to give the most objective value possible to a piece of data, to validate or not an impression in the field. In psychology, the scientific approach makes it possible to assess, with as little bias as possible, which clinical (psycho-therapeutic) interventions are best adapted to helping people in difficulty. Anxiety and depressive disorders have a major impact on quality of life. Of all the mental health disorders assessed, Mergl et al. (2007) found that the prevalence of depressive disorders was 22.8%, and Ansseau et al. (2004) obtained a prevalence of mood disorders of 31%, including 14% major depressive disorder, and almost 20% anxiety disorders. Roca et al. (2009) found that 36% of people with mental health problems had a mood disorder and 25% an anxiety disorder. Serrano-Blanco et al. (2009) found that 45% of respondents said they had had at least one mental disorder in their lifetime, 30% in the last 12 months. These outcomes also showed the high rate of comorbidity between mood disorders and anxiety disorders.

These figures reveal a high prevalence of these disorders and therefore a major health issue. In this sense, there is a challenge to develop effective, cost-effective psychological interventions with good dissemination (Hallion et al., 2024). Cognitive psychotherapy researchers have continued to focus on the care of these disorders. They continue to explore in greater detail the benefit of the most commonly used psychotherapies to treat depressive and anxiety disorders, such as cognitive behavioural therapy (CBT), cognitive bias modification (CBM) and cognitive remediation (CR). Int this sense, the aim of this narrative review is to detect which therapies are most effective, or which therapies can be improved to treat people better. Some authors are now suggesting that greater attention to other proceeds may be beneficial. Either procedures that are more accessible to people with these disorders, or that complement existing therapies, making them more effective.

In sum, this review pretend to analyse the studies evaluating the effectiveness of cognitive psychotherapies on anxiety and depressive disorders, in order to provide a critical analysis of the effectiveness and failings of these interventions.

Depressive and Anxiety disorders

Depressive disorders are characterised by severe and/or persistent sadness over time. This sadness leads to impairment in daily functioning and often a loss of interest or pleasure in activities that normally bring pleasure (American Psychiatric Association, 2013). Care and support for this disorders can take two complementary forms: 1) pharmaceutical treatment (antidepressants) and 2) psychotherapy (American Psychiatric Association, 2013).

The role of pharmaceutical treatment is to reduce the symptoms of depression, and it is prescribed for moderate to severe depressive episodes (Ameli, 2024). Pharmaceutical treatment may be combined with psychotherapy. The exact cause of this disorders is unknown but is probably multifactorial. There are several theories on this subject (American Psychiatric Association, 2013). Beck's cognitive theory (Clark & Beck, 1999) is one of the main ones, and will be presented later in this review.

According to the DSM-V (American Psychiatric Association, 2013), depressive disorders have a broad and varied symptomatology. In addition to a sad mood and loss of interest, the most common symptoms include regular insomnia, psychomotor slowing, reduced libido, daily fatigue, low self-esteem, reduced attention span and dark thoughts, such as suicidal ideation. People suffering from depression are at greater risk of developing excessive behaviour towards alcohol or illicit products (American Psychiatric Association, 2013).

Depressive disorders can take many forms (American Psychiatric Association, 2013). *Major Depressive Disorder* is a depressive disorder in which a sufficient number of symptoms are present for at least 2 consecutive weeks and modify the functioning of the person affected; *Persistent depressive disorder* is a depressive disorder in which the depressed mood has been present very regularly for at least 2 years; *Premenstrual Dysphoric Disorder* is a depressive disorder in which a significant drop in mood is directly induced by the premenstrual cycle. Mood generally improves in the first few days after the onset of menstruation, then stabilises. Symptoms must be present during most of the cycles of the past year in order to be diagnosed; and *Disruptive disorder* with emotional dysregulation is a depressive disorder characterised by recurrent outbursts of anger that are out of proportion in intensity and/or duration to the situation that provoked the anger.

In conclusion, depression is a very common mental disorder worldwide, affecting around 5% of the world's adult population (World Health Organization: WHO, 2023). In 2021

in France, according to the "Santé publique France" (Santé Publique France, 2024), 12.5% of adults up to the age of 85 have experienced a characteristic depressive episode (CDE) in the past year. This prevalence will increase between 2017 and 2021 for the adult population as a whole, with the greatest increase observed among young adults (18-24 years), with a 9% rise over this period (from 11.7% in 2017 to 20.8% in 2021). The Covid-19 health crisis during this period should be linked to this increase, given the major impact of this period on the mental health of the French, European and global population (Santé Publique France, 2024).

According to the DSM-V (American Psychiatric Association, 2013), anxiety disorders are defined by intense fear or anxiety. Most anxiety disorders differ from ordinary anxiety in that the fear and anxiety persist over time. In general, these symptoms must last at least 6 months in order to be diagnosed. The main ways of treating anxiety disorders are pharmaceutical treatments, psychotherapy, relaxation techniques or psycho-education.

The various anxiety disorders are differentiated according to the object or situation which causes fear or anxiety: *Specific phobia* is a disorder manifested by a strong, irrational and long-lasting fear of one or several specific situations.

This leads the patient to adopt adaptive behaviours to avoid these situations. The idea itself of finding themselves in these situations can cause excessive anxiety for people who suffer from specific phobias. *Agoraphobia* is a heightened fear of the following situations: public transportation, open or closed areas, crowds, being alone outside the home. This fear is based on the fact that they don't think they can get out of these situations. People suffering from agoraphobia are highly averse to such situations and avoid them as much as possible, which can significantly impact their daily functioning. The anxiety that they feel is often much greater than the actual danger of the situation. *Social anxiety or social phobia* is an anxiety disorder characterised by the fear or anxiety of one or several social situations. These situations may involve social interaction, observation of others, or a performance situation. These situations are either avoided (avoidance behaviour) or experienced with a high degree of anxiety. The anxiety of people with these disorders stems from the fear of being judged or humiliated by others. *Panic disorder* is an anxiety disorder characterised by the intense, unexpected and frequent appearance of a fear or uneasiness that reaches a climax very quickly. The cause of the fear is often unknown. Some symptoms are very common, such as increased heart rate, sweating, trembling, nausea, chest discomfort, hot flushes, fear of losing self-control, derealisation, depersonalisation or even fear of dying. *Generalised anxiety*

disorder is characterised by excessive anxiety about several activities or situations. This anxiety is often uncontrollable and occurs frequently, through various worries that may change over time (e.g., work, school, money, health, etc.). Generalised anxiety disorder presents several central symptoms such as agitation, tiredness, difficulty of concentration or irritability. And *separation anxiety disorder* is defined as a persistent, strong and inadequate fear of being separated from one of their attachment figures. It is a disorder that almost exclusively affects children. The disorder may result from a traumatic experience (e.g., death of a parent, divorce, moving house). The child often develops somatic pains, has recurring nightmares, usually refuses to leave the house or sleep without their parents present, etc. This disorder involves clinically significant distress in several aspects of life (school, social, family, etc.) (Feriante et al., 2023).

Anxiety is a disorder that affects 4% of the world's population. Its affects about 300 million people. Although depressive disorders are the most frequently mentioned, it's not the mental disorder that affects the most people in the world, it's anxiety (World Health Organisation: WHO, 2023). In France, according to the French health insurance website AMELI, anxiety disorders affect around 15-20% of the population at some point in their lives. Moreover, this disorder is twice as prevalent for women as for men. The most common anxiety disorder in France is specific phobia (Ameli, 2023).

Considering the worldwide prevalence of anxiety and depressive disorders, the impact of these disorders on people's lives and those around them, the co-morbidities that exist between these two disorders (Capdevielle, 2009) and other disorders such as bipolar disorder (Cazard & Ferreri, 2013) and substance-related disorders (Richa et al., 2008), anxiety disorders and depressive disorders can be considered substantive.

Comorbidity in Anxiety and Depressive Disorders

Feinstein (1970) defines the principle of comorbidity as "any additional co-existing condition". This can be explained as the presence of at least two mental illnesses or disorders in the same person (Philippe, 2020). The scientific literature demonstrates a high degree of comorbidity between depressive and anxiety disorders (Inserm 2021*;* Roca et al., 2009; Mergl et al., 2007). In fact, between 33% and 85% of people suffering from a depressive disorder have a comorbid anxiety disorder (Capdevielle, 2009). On the other hand, 50% to 90% of people who suffer from an anxiety disorder have a comorbid depressive disorder (62% for people with generalised anxiety disorder) (Capdevielle, 2009).

According to the French national institute for health and medical research (Inserm 2021), both pathologies are predictive of each other and their combination worsens a patient's clinical condition. A large proportion of patients who suffer from anxiety disorders are susceptible to develop some depressive symptoms. Moreover, depression is associated with a higher severity of anxiety disorder. and that this comorbidity complicates the management of these anxiety disorders. Furthermore, Philippe (2020) shows that the CBT approach appears to be adequate for reducing the symptoms of comorbid disorders (depressive disorder and anxiety disorder), and that there is no interference with this therapy due to a patient's multiple and simultaneous pathologies. To achieve this, it's recommended to focus on the main disorder despite the presence of comorbidity.

Beck's cognitive theory

For Clark and Beck (1999), Beck's cognitive theory suggests that people create unconscious, autonomic cognitive schemas, which are influenced by repeated interactions with a stressful and anxiety-provoking environment. These schemas are used as a framework to interpret experiences and are responsible for automatic thoughts, which can be positive but are often negative in people with depression (Beck & Haigh, 2014). Beck and Haigh (2014) stated, psychological disorders are not caused by the environment itself, but rather by the individual's dysfunctional thinking in the context of the situation.

The cognitive triad, for Clark and Beck (2010) is a group of automatic schemas consisting of a negative self-perception, a pessimistic view of the world and uncertainty about the future. These factors reinforce each other, reinforcing negative emotions and contributing to mental disorders, particularly depressive disorders.

Cognitive bias is a key concept in this theory, defined by Moritz and Woodward (2007) as a systematic tendency in the way a person processes information. Individuals are disposed to interpret ambiguous situations either negatively or positively. A negative interpretation will reinforce inappropriate thought schemas.

However, the identification of cognitive biases differs from one theory to another, and the cognitive biases of Beck's theory, as modified by MacLeod (MacLeod & Mathews, 2005), correspond to the categories most frequently used in scientific research.

Categories of cognitive bias

More specifically, cognitive biases are tendencies for individuals to process information in a certain way (Kahneman et al., 1982). This definition makes clear that cognitive biases are not necessarily dysfunctional. Cognitive biases can be considered as strategies that ignore part of the information for cognitive economy or to make faster decisions. They can have a neutral, negative or positive valence, and can also be weak, moderate or strong. This research is based on the 3 categories of cognitive bias used by Mathews and Max Leod (2005), who were inspired by Clark and Beck (1999). This categorisation is the most frequently used in scientific research. The categories of cognitive bias include: attentional biases, interpretation biases and memory biases.

Attentional biases are tendencies to pay attention to some types of information rather than others (Clark & Beck, 1999). For example, a person who is anxious at work will tend to be very vigilant to the body language and facial expressions of their superior. This person will tend to observe more negative signs of disapproval than a non-anxious person (Clark & Beck, 1999). In this situation the fact that they focus on these aspects can make them less effective in her work or simply unhappiest in their daily life.

Interpretation biases are tendencies to interpret or infer emotionally ambiguous information according to a certain valence (Lee et al., 2016). For example, an anxious person will interpret ambiguous information as negative. If this person sends a message that does not receive an immediate response, they will tend to interpret it negatively, such as: "he doesn't reply because he doesn't like me". On the other hand, a person who tends to interpret ambiguous information positively is more likely to think something like: "he must be busy, he'll reply when he has time" (Lee et al., 2016).

Memory biases are tendencies to retrieve information from memory with a similar valence to that at the time of encoding (Alemán et al., 1999). These biases often influence the way people remember past events. For example, a person who has had a motorcycle accident may recall all his motorcycle memories since the accident with a negative valence, whereas most of these memories could be positive (Alemán et al., 1999).

The Link Between Cognitive Theory and Anxiety and Depression Biases

Beck's cognitive theory provides a particular understanding of the mechanisms of depression and anxiety. Clark and Beck (1999) explain that people suffering from depression tend to

develop more negative thinking and less positive thinking when faced with ambiguous situations. According to Clark and Beck (2010), the cognitive schemas of the triad include negative interpretations of the self, the world and the future, which, by becoming automatic, accentuate the feeling of powerlessness and despair that characterises depression.

Clark and Beck (2010) demonstrate that cognitive biases play an essential role in the emergence and persistence of this anxiety disorder. More specifically, the recurrent biases in anxiety disorders are catastrophization, overgeneralisation and personalisation. Mathews and MacLeod (2005), report that anxious individuals are more likely to interpret ambiguous information as threatening, while Bar-Haim et al. (2007) find that these individuals have an attentional bias towards negative information. These intellectual prejudices lead to a state of hypervigilance which exhausts the individual and increases their anxiety (Mathews & MacLeod, 2005).

Leung et al. (2022) set about establishing whether different biases are associated with each other and whether one of these biases has a specific influence on the others. Leung et al. (2022) explain that there is a significant link between the different cognitive biases, mainly between interpretation bias and memory bias. These findings are in accordance with Matthews and MacLeod (2005) who explain that attention, interpretation and memory biases are not completely independent.

Nieto et al. (2020) also contributed to a deeper understanding of Beck's cognitive theory. They focused on two categories of bias: catastrophization bias and interpretation bias. According to Nieto et al. (2020), people with depressive symptoms have more negative expectations of the future than healthy people (catastrophism) and have a greater tendency to interpret ambiguous scenarios negatively (interpretation bias).

Leung et al. (2022) and Nieto et al. (2020) recommend continuing research in this area, as empirical evidence is needed to validate the hypothesis that specific cognitive biases are present in depression. For example, overgeneralization and selective abstraction biases have not been studied due to the lack of empirical data, whereas from a theoretical point of view, these two biases are considered to contribute to depression. In this sense, this remains a grey area. With regard to interpretation biases, it is not yet possible to determine exactly which biases have the greatest influence on depression.

Cognitive Pathways: From Theoretical Model to Clinical Intervention in Depression and Anxiety

Cognitive theoretical models have influenced a number of interventions known as cognitive psychotherapies. Cognitive and behavioural therapy (CBT), cognitive remediation (CR) and the Cognitive bias modification (CBM) are among these cognitive psychotherapies. These are the three most studied and used interventions, Hofmann et al. (2012) explained that CBT was widely used for many mental disorders and that the results obtained were conclusive. Jones & Sharpe (2017) explained that CBM is effective, particularly for anxiety disorders in adults and that this intervention should be used more widely. Kim et al. (2018) confirm that cognitive remediation is effective for several disorders, such as schizophrenia, depressive disorders and even bipolar disorders.

Cognitive and behavioral therapy (CBT) intervention

Hofmann et al. (2012) and Carpenter et al. (2018) meta-analyses, concluded that CBT is generally effective for many anxiety disorders. Indeed, these studies observed a significant symptom improvement, with effect sizes ranging from moderate to strong for generalized anxiety disorder, panic disorder, social anxiety and even obsessive-compulsive disorder (Carpenter et al., 2018; Hofmann et al., 2012). CBT also appears to be effective for social phobia disorders. In fact, when cognitive restructuring and exposure techniques are used, CBT achieves significant improvements in social phobia symptoms (Rapee et al., 2009). Moreover, CBT also works for people suffering from social anxiety who are not sensitive to antidepressants (Yoshinaga et al., 2019). Finally, CBT, as a complement to standard care, significantly improves symptoms of social anxiety and generalized anxiety for at least one year (Yoshinaga et al., 2019).

Mayo-Wilson et al. (2014) meta-analyses observed that individual CBT is the most effective treatment for social anxiety. On the other hand, McEvoy (2007) has observed that group CBT obtains good results on a population with social anxiety disorder, and sometimes with better results than individual CBT (McEvoy et al., 2014). According to Mayo-Wilson et al. (2014) CBT for anxiety disorders has a greater effect than the most used medicinal treatments.

CBT is also an interesting therapy for depressive disorders. Indeed, García and Maldonado (2022) and Hofmann et al. (2012) report significant results for CBT in reducing

anxiety disorders, Hofmann et al. (2012) find these results with moderate and strong effect sizes. According to Santoft et al. (2019) this is also true for people with moderate symptoms. Moreover, for García and Maldonado (2022) the effects are significant in both the short and long term, whether the intervention is individual, group or telephone (Santoft et al., 2019; Cuijpers et al., 2019).

CBT can also help patients suffering from several disorders simultaneously, including anxiety and depression. According to Norton et al. (2021) and Pearl and Norton (2016), CBT has also proved effective in treating anxiety in patients suffering from both depressive and anxiety disorders. Another vantage is that CBT is effective in treating several diagnoses at once (CBTtransdiagnostic). This therapy treats the primary disorder as well as comorbid disorders (Norton et al., 2021).

To conclude, whatever the modality of its implementation, the CBT (multigroup, individual or transdiagnostic), has proved its effectiveness with these patients suffering from both anxiety disorders and depression. These effects are valid regardless of the strength of the symptoms, and the effects are also observed over a relatively long period of time.

Bouvet (2020), in "Introduction aux thérapies comportementales et cognitives", explains that CBT is based on two theoretical currents: Beck's cognitive theory, which is presented above, and learning theories: Pavlovian conditioning (Pavlov & Anrep, 1927), Skinner's operant conditioning (Skinner, 1990) from which the concept of positive and negative reinforcement is derived, and Bandura's social learning (Bandura, 1977).

The aim of CBT is to modify maladaptive behavior, dysfunctional thoughts, and maladaptive emotions. According to Bouvet (2020), a behavior, thought or emotion is said to be maladaptive or dysfunctional when it interferes with a person's ability to lead an ordinary life. For example, the fear of crowds on public transportation in a big city, is a maladaptive fear. Because not taking public transport can prevent a person from working. Or checking dozens of times a day, that you have locked all the doors in your house before leaving, is an inappropriate behavior (Bouvet, 2020).

Bouvet (2020) explains that each situation generates a stimulus that leads to cognitions (thoughts), behaviours and emotions that influence each other. When these are inappropriate, they generate mental disorders. The idea is therefore to modify these items to reduce and then eliminate the disorder.

According to Bouvet (2020) there are various CBT techniques: the behavioral method to modify inappropriate behavior. The exposure technique, the most used, which involves the patient gradually exposing themselves to their fear, after prior preparation (psychoeducation) and a precise, structured therapeutic approach. In this case, if the maladaptive behavior is a fear-avoidance behavior, progressive exposure to this fear will have the effect of stopping the maladaptive behavior by stopping the avoidance. According to Lambrey et al. (2020), this has the effect of desensitizing the patient to the critical situation.

The cognitive method aims to identify, evaluate, and modify dysfunctional automatic thinking. The most used tool for this method is the Beck column. This tool generally consists of a table with 5 columns: the first, concerns the problem situation; the second concerns the dysfunctional or automatic thoughts that the situation caused; and the third column concerns the emotions felt during the problem situation. The psychotherapist will then test the rationality of the thoughts that have been written down, generally using the Socratic interview to question the initial thought and multiply the perspectives, widening the field of thought, asking for clarification on the foundations of the thought, and decentering the situation. Following this discussion, the idea is to come up with alternative thoughts to the initial ones and to note them down in the fourth column. In the fifth column, the aim is to note the emotions felt with these new alternative thoughts (Bouvet, 2020).

Bouvet (2020) believes that this leads the patient to consider new and more appropriate ways of thinking, which should gradually replace dysfunctional automatic thoughts. This will help to reduce anxiety and/or depressive symptoms. This technique is also known as cognitive restructuring.

Bouvet (2020) believes that mindfulness meditation uses this emotional method. This emotional method is based on the permanent and intense fixation of attention on an external object (breathing, a sound, a positive memory, etc.). During these moments of mediation, attention will inevitably be drawn to other things, and the idea is to observe the thoughts that attract this attention, then redirect it towards the initial object. This allows the patient to distance themselves from their cognitions, and thus to be able to observe and analyze them, in what is known as metacognition. In the long term, this work enables them to analyze their own thoughts, including erroneous ones, and gradually modify their relationship with them.

Bouvet (2020) also considers that the aim of these three methods is to make patients autonomous, whether it be to modify their behavior or thoughts, or to distance themselves

from them. The role of psychoeducation is important here, so that the patient understands the tools proposed to him and that these tools become his own.

Cognitive remediation intervention

Passerieux and Bazin (2010) trace the first steps in cognitive remediation back to the 1970s, in a context of improving the cognitive performance of schizophrenic patients. It was during this period that researchers observed that the cognitive deficit of a schizophrenic patient, considered to be a systematic sign of schizophrenia, was not irreversible. According to Koh et al (1976), when effective memory strategies are used, their memory deficits diminish. Cognitive remediation has subsequently been extended to other disorders, such as substance use disorders (Nardo et al., 2021), psychotic disorders (Cella et al., 2020), bipolar disorders (Ott et al., 2020), etc.

Baudon-Vanesse (2018) in *Remédiation cognitive, une approche entre la psychothérapie et la rééducation*, defines the term cognitive remediation (CR) as a set of treatments and interventions focusing on cognitive processes. Sometimes the terms cognitive re-education or cognitive rehabilitation are also used. The idea is to intervene on dysfunctional cognitive functions identified at an early stage. Cognitive remediation uses a variety of playful methods to improve these cognitive functions (attention, memory, language, metacognition, social skills). The tools are accompanied by reflective questioning by the psychotherapist, using meta-cognition to help patients become aware of their difficulties and the impact of these difficulties on their daily lives. The aim of cognitive remediation is therefore to help patients improve their social and professional integration and, more generally, to improve the quality of life of patients and those around them (Baudon-Vanesse, 2018).

For Soumet-Leman et al. (2016), this intervention produces excellent results for depressed populations. Legemaat et al. (2021), for their part, specify these results for a short-term effect. Their results also show a strong improvement in emotion management and cognitive and metacognitive skills. According to Soumet-Leman et al. (2016), cognitive remediation is less relevant for subjects who are also anxious, because they may have difficulty transferring the skills acquired in cognitive remediation into their daily lives. Sociali et al. (2022) explain that cognitive remediation should only be considered as an adjunctive treatment to support subjects with depressive symptoms, giving priority to a more global and structuring intervention (such as cognitive-behavioral therapy). This intervention

would work better with the younger population. Furthermore, for Choi and Medalia (2005) participants who did not continue with regular and close follow-up of cognitive remediation, there was no significant improvement in their cognitive skills.

The effectiveness of cognitive remediation therefore depends on the patient's compliance with the therapy. This is a blind spot in the scientific literature on cognitive remediation for people with a depressive disorder. People with this disorder tend to lose interest in their activities, so compliance with psychotherapy can be more difficult than for other disorders. Moreover, participants who drop out of a study are not usually included in the results, they are only reflected in the study's attrition rate. In the context of the study of depressive disorders, this can be a shortcoming that can considerably alter the conclusions of certain studies (Baudon-Vanesse, 2018).

Cognitive bias modification intervention

According to Hallion and Ruscio (2011), cognitive bias modification (CBM) is a fully computerized intervention that aims to modify cognitive biases. This intervention uses a repeated measures procedure or cognitive training exercises to retrain and modify interpretation biases (CBM-I) or attentional biases (CBM-A) when faced with ambiguous stimuli (Beard, 2011). The basic principle being that if certain disorders are the consequence of maladaptive or missing cognitive biases, modifying these biases should reduce or even eliminate these disorders (Beck's cognitive theory). Jones and Sharpe (2017) research into the effectiveness of CBM showed promising results for adult populations. The authors concluded that this intervention could reduce depressive and anxiety symptoms.

In addition, the practical, inexpensive, and rapid nature of this intervention makes it one of the central subjects of recent scientific studies in cognitive psychology. However, for Chen et al. (2020), evidence is still lacking on several aspects, such as long-term effects.

In summary, current research says about this procedure that Hallion and Ruscio (2011) found a stronger average effect of CBM in biases interpretation (CBM-I) than for attentional biases (CBM-A). For CBM-A alone, MacLeod and Mathews (2012) explain that procedures to modify cognitive biases with attentional biases emerged by MacLeod and McLaughlin (1995) and by MacLeod et al. (2002). The CBM-A intervention that has been most used is a version with an attentional probe exercise, in which stimuli (negative, neutral,

or positive) appear alternately to train the user to avoid certain (negative) stimuli and seek out others (positive). Stimuli can be words or images, for example. By this CBM-A probe approach, Hakamata et al. (2010) has obtained good results in modifying the attentional selectivity of anxiety patients. MacLeod and Mathews (2012) point out that these results do not mean that the CBM-A intervention would have such a significant impact in a natural context (outside the laboratory).

It was therefore necessary to observe whether this intervention could have a significant long-term impact. Yang et al. (2016) showed greater long-term improvements in depressive symptomatology and a greater reduction in attentional biases in a CBM-A intervention than in the control group. They also obtained a greater reduction in the self-reported depression and anxiety scores of participants who received CBM-A than those in the control group. They also observed a decrease in depressive symptomatology, as well as during the 3-month follow-up of CBM-A. 4 months after CBM-A follow-up, most of participants remained asymptomatic (Yang et al., 2015). It is important to point out that the sample size for these two studies was small and unrepresentative, so the results cannot be generalized. However, the encouraging results of these studies suggest further research in this area. The results support this hypothesis, but there is still a lack of longitudinal studies with a consistent sample size.

Regarding CBM-I, MacLeod and Mathews (2012) explain that in the cognitive bias modification intervention targeting interpretive biases (CBM-I), each series first presents ambiguous stimuli, after which the participant must make a decision that should be induced by one or other of the stimuli. The intervention is designed to enable the participant to favor a certain style of interpretation (in this case, positive and reassuring interpretations). For example, in the first CBM-I intervention, Grey and Mathews (2000) first presented homographs, generally with a positive and negative, or neutral and negative, or positive and neutral meaning.

Williams et al. (2013) found that a combined internet-based CBM-I and CBT approach reduced interpretation bias for patients who have a major depressive episode. This combined intervention produced results on global anxiety and repeated negative thoughts. Moreover, 65% of the participants showed a clinically significant change after the combined intervention, whereas only 27% of these participants showed a significant change after CBM-I alone. However, this study does not have a control group, which therefore limits the

generalizability of the study. Joormann et al. (2015) conducted a study with a control group. This study indicates that CBM-I has a positive impact on participants with depressive symptomatology, mainly those who had been trained to interpret ambiguous situations more positively.

This review article analyses studies on the relationship between cognitive biases and depression and anxiety in adults, assessing the effectiveness of cognitive psychotherapies on anxiety and depressive disorders, to provide a critical analysis of the effectiveness of these interventions. The propose is to provide an overview of current knowledge in the field of psychotherapies for these disorders and also identifie recent research directions. This literature review is also intended as a starting point for those beginning to conduct research in this area.

Methodology

The aim of this literature review is to determine which psychological intervention, based on the modification of cognitive biases strategies, is the most effective for an adult population suffering from depressive or anxious symptoms.

Building search chains

The Semantic Scholar search engine, which lists scientific studies freely available on the Internet, was used to reference these studies. For the searches, it's used different combinations of keywords: 1) "cognitive bias" OR "attention bias" OR "interpretation bias" OR "memory bias"; 2) "depression" OR "depressive disorder" OR "major depressive disorder" OR "depressive symptoms"; 3) "anxiety" OR "anxiety disorder" OR "social anxiety" OR "generalised anxiety disorder" OR "anxiety symptoms"; 4) "systematic review" OR "meta-analysis" OR "Literature review"; 5) "CBM" OR "cognitive bias modification"; 6) “CBT” OR “cognitive behavioral therapy”; 7) “CB” OR “cognitive remediation”, and 8) “cognitive theory”.

For each of the 8 keyword groups, Publication deadlines were added to sort the studies from 2020 to 2024. After this initial broad selection, the selection continued based on study titles. Studies that met the criteria but did not correspond to the research topic were excluded. For example, some studies dealt with anxiety and another variable (such as

attention disorders or insomnia), and they were not retained, as this review only deals with anxiety and depressive disorders. Another example is the population: some studies focus only on adult women or men; to avoid confounding these studies are also removed. In other cases, small sample sizes (under five) were prohibitive, such as studies aimed at reducing anxiety or depression in people with cancer. Furthermore, this dissertation is a literature review and not a systematic review, so there is no obligation to select all the studies. With this in mind some studies were removed from the selection because they were redundant with the others, or because their research angle was not relevant to incorporate. At the end of this process, the selection contained twenty-two studies.

Inclusion and exclusion criteria

Inclusion criteria: research on an adult population, presence of one or more of the preceding keywords, study written from 2020 onwards.

Exclusion criteria: child population, adolescent population, study written before 2020, exclusively older people, exclusively male people, exclusively female people.

Disentangling Cognitive Mechanisms: The Effectiveness of Interventions in Treating Cognitive Biases

The presentation of the studies has been divided into three parts. The first, analyses the effectiveness of new forms of cognitive behavioral therapy (CBT), based on mental imagery, online functioning and the use of therapeutic yoga as a complement to CBT. The second part evaluates a recent intervention: Cognitive Bias Modification (CBM) and its impact on reducing depressive and anxiety symptoms. The third part analyses studies evaluating the effectiveness of CBM intervention for depressive and anxious populations. Studies using CBM for other mental disorders are also examined. Finally, the third part analyses studies evaluating the effectiveness of cognitive remediation (CR) on a population suffering from major depression.

The Cognitive behavioural therapy (CBT) and its New Approaches

According to Andrews et al. (2018), CBT achieves good results for anxious populations, as do García and Maldonado (2022) for depressive populations. Research on this intervention continues, in order to find new, more effective forms of CBT, or possible positive interactions with other interventions, or on topics that have not yet been explored.

For the CBT intervention, a study conducted by Mahardika and Hidayat (2020) with the aim of analyzing the different interventions aimed at reducing anxiety showed that CBT is effective in reducing anxiety symptoms but also the symptoms of other disorders such as depressive symptoms. This review is based on 18 studies dating from 2008 to 2018. The aim in presenting this study is to compare the effectiveness of CBT with the other interventions studied, and to highlight its strengths and weaknesses. Of the 18 studies, 8 evaluated the reduction of anxiety through CBT. As with conventional CBT, the tools most often used in these studies were psychoeducation, progressive exposure and work to identify cognitive biases. The study also notes that the benefits of this intervention are both short-term and long-term. The researchers explain that the other key points of CBT are its relatively short duration (6 to 8 sessions) and its adaptability, as it can be administered to a fairly wide audience under a variety of conditions (individual, group, online, etc.). In summary, the authors argue that CBT is the preferred intervention to reduce susceptibility to anxiety and other disorders such as depression; these are things that other authors have already noted (Mayo-Wilson et al., 2014; McEvoy et al., 2014; Andrews et al., 2018).

Another important point to emerge from this study is that conventional interventions are gradually being replaced by computerized, online interventions, as these offer financial and time advantages. However, as far as these new online interventions are concerned, their effectiveness will be analyzed in the second part.

Authors Biagianti et al. (2023) and Prasad et al. (2023) present complementary results. They add to the existing literature new evidence of the effectiveness of online CBT on anxiety and depressive disorders and the development of a deep learning tool to help professionals provide better support for patients. Internet-based cognitive behavioral therapy (iCBT) is a new form of CBT. They report that 50% of people using iCBT show an improvement in symptomatology (Prasad et al., 2023).

Biagianti et al. (2023), use of iCBT to treat adults suffering from anxiety and depressive disorders. This systematic review is composed of 35 randomized controlled experiments. 25 were based on iCBT, 6 on mobile applications and 2 used both iCBT and mobile applications (mCBT). The results indicate that digital CBT interventions showed a significant difference when compared to a wait-list control group. On the other hand, when compared with an active control group, the differences were not significant. The positive results were greater when the interventions were combined with other treatments.

Biagianti et al. (2023), underline this difference in results between the two types of control groups, indicating that obtaining smaller effect sizes in active control groups than in passive control groups is a trend regularly found in the scientific literature on psychotherapies. Following this observation, the author supports the importance of designing RCTs with control groups that are closer to clinical reality, with rather active control groups. It should also be noted that there is a significant difference between the results of iCBT, which showed very interesting effects with medium and large effect sizes, and those of mCBT, which achieved poorer results. Biagianti et al. (2023) explain this difference by the difficulty of translating a therapy created for face-to-face use into a mobile interface where patient engagement can be quite different. The small sample size (six) of the mCBT interventions may also explain this result. Biagianti et al. (2023) also showed that the presence of a clinician during the follow-up to the intervention made it possible to obtain greater commitment from the participants and a better clinical outcome, especially for severe depression. The estimated long-term effects of the intervention appear to be good, although too few of the studies in this review have also assessed them over more than one year. As a limitation, the authors argue that the studies were extremely heterogeneous (methodology and population) and that too many self-evaluation measures were used, both of which could lead to numerous research biases.

Prasad et al. (2023), develop deep learning that can predict a patient's improvement during therapy. This will have the advantage of giving clinicians live information to adapt the interventions that patients receive in real time, thus improving the effectiveness of the intervention. Their researchers developed this system based on data from 45,876 patients collected on the SilverCloud platform. The information considered the depressive symptom score, the anxiety symptom score and the degree of interaction with the programme. Prasad et al. (2023), show that the model developed in this study is capable of predicting clinical improvement in patients with an accuracy of 87% for depressive symptoms and 79% for anxiety symptoms. With these results, the researchers argue that the results obtained are good and robust for predicting clinical improvement in patients, and that this predictor should therefore be able to play an important role in improving real-time patient support. However, this study has a number of limitations: the lack of precise demographic data, a drop-out rate that is not perfectly assessed and the potential unreliability of the index of the degree of patient interaction with the programme, which is not always directly linked with patient engagement.

Also, Prasad et al. (2023) indicate that digital interventions based on CBT, including iCBT, have already shown sufficient predictions of effectiveness to be considered as relevant tools for treating anxiety and depressive disorders. Already in 2021, Patterson et al. (2021) evaluated that iCBT was reliable to CBT, so it's consistent that positive results are found with iCBT. The authors develop the idea that iCBT is already a highly effective risk prevention tool in view of its ease of use and accessibility. They note an interest in primary prevention, before a pathology sets in, and secondary prevention, when symptoms are still mild. This observation is also valid when the methodological limitations of this research are taken into account. Nevertheless, Biagianti et al. (2023) explain that use of digital interventions is limited in the field of healthcare, for two main reasons.

First, professionals need to be made aware of these new tools, as there is often a time lag between the design of a therapy and its democratization. Secondly, the inequality of digital technology access is an important point to take into account: a population that doesn't have access to digital technology or doesn't know how to use it will not be able to benefit from it, such as the elderly.

In addition to iCBT, another form of CBT exists, this time a group intervention called group mental imagery CBT. There are three main contributions to iCBT intervention. McEvoy et al. (2020) investigated the effectiveness of group imagery CBT versus verbal CBT (more commonly used) in a population with social anxiety disorder (SAD). The 107 participants diagnosed with SAD were separated into two groups (verbal CBT or imagery CBT) and assessed after one and then six months. All participants received 12 weekly two-hour sessions, followed by regular follow-up for one month after therapy. The results showed no significant difference between the two forms of CBT. However, both treatments had very significant positive effects in most of patients, who were in remission after receiving CBT. This study appears to have a high scientific value thanks to its methodology, with sufficient sampling, double-blind evaluations and treatment carried out over a long period (six months). The researchers expected to obtain better results with the imagery technique than with the verbal technique. They explained this expectation as a mental image would have a greater emotional valence than a verbalized thought and therefore it would be easier to have an emotional impact on the participants with mental imagery. This emotional impact would have made it easier to identify and modify the erroneous thoughts of patients with social anxiety disorder and therefore improve the therapeutic effects. However, as explained above, the mental imagery technique did not produce better results than the verbal technique.

The authors (McEvoy et al., 2020) therefore explain that these results indicate that the tools common to the two different approaches (exposure technique, cognitive restructuring, etc.) have the greatest impact on anxiety symptomatology. In fact, if the addition of mental imagery does not make a significant difference, this means that it has significantly less influence than the techniques common to both approaches.

McEvoy et al. (2020), will compare group CBT based on mental imagery with traditional CBT based on verbal techniques. McEvoy et al. (2022), decided to observe two indicators in this study: heart rate variability (HRV) and skin conductance, as these are two important factors in emotional regulation and physiological arousal. These factors were taken into account because the authors explain that, for a person with social anxiety disorder, exposure to problematic social environments causes specific reactions. It is these reactions that emotional regulation and physiological arousal are designed to assess. McEvoy et al. (2022) involved 107 participants diagnosed with social anxiety disorder. Each participant attended 12 sessions per week, each lasting two hours. HRV and cutaneous conductance were measured before and after treatment and also one and six months after treatment. The results obtained showed that the mental imagery approach resulted in a decrease in HRV after treatment, while the verbal approach group obtained a greater increase in HRV. In terms of cutaneous conductance, no significant difference was observed between the two groups. These results may have several meanings: firstly, they show a difference between the two therapies in terms of the psychological impact on patients. Secondly, the group that received the mental imagery approach regulated their stress management better than the groups that received the verbal approach. However, the researchers explain that the increase in HRV in the verbal group could mean that this group activated its parasympathetic system more to compensate for greater sympathetic activation. In other words, this means that this group would make more effort to manage greater stress than the mental imagery group, a finding that may be paradoxical given that high heart rate variability (HRV) can also mean better management of perceived stress. Furthermore, the lack of difference in skin conductance measurement suggests that both CBT approaches may be effective in reducing the general level of physiological arousal. In terms of methodological limitations, the authors explain that the addition of a control group could allow better analysis of the results by excluding contextual effects unrelated to the therapy. In conclusion, group CBT based on mental imagery offers better results than group CBT based on verbal communication, in terms of the ability to deal effectively with stressful situations. The authors also consider that the results

of their study demonstrate the importance of measuring biological indicators in research evaluating the effect of an intervention. They also support the need for further research into the effectiveness of CBT based on mental imagery, as this approach could offer advantages over conventional CBT.

Finally, the study by Kyron et al. (2023) and McEvoy et al. (2022; 2023), measured certain cognitive biases in order to assess their link with social anxiety disorders. Kyron et al. (2023) carried out a randomized study comparing verbal CBT to CBT based on mental imagery with 105 participants with social anxiety disorder. Each participant received twelve sessions per week and a follow-up session one month after the end of treatment. The researchers assessed five indicators using several scales: symptoms of social anxiety, safety behaviors (or avoidance behaviors), the probability and perceived cost of social failure, fear of negative evaluation, preoccupation with negative self-representation and negative beliefs about oneself. The results indicate that the groups receiving verbal CBT and CBT with mental imagery showed significant improvements on all indicators after dispensing with the total intervention. Kyron et al. (2023) noted no significant differences between the two forms of CBT. However, they observed that evaluative social beliefs (fear of negative evaluation, estimation of the probability of social failure and preoccupation with negative self-representation) were positively correlated with symptom severity one month after the end of treatment. The authors explain that the results confirm cognitive models (presented previously), which explain that fear of negative evaluation and negative beliefs about oneself are important factors in the stability of social anxiety. These cognitive biases lead to safety and avoidance behaviors, which isolate and comfort the person in these fears. The researchers observed that a reduction in the fear of negative evaluation and preoccupation with self-representation is associated with a reduction in the symptoms of social anxiety disorder and safety behaviors. This suggests that these two cognitive biases may be important factors in the maintenance of SAD and therefore an important target for treatment. On the other hand, estimates of the probability and cost of social failure did not show a strong relationship with SAD symptoms. This may suggest that these cognitive biases are less fundamental in the maintenance of SAD. Safety behaviors are also considered to be an important factor in the maintenance of SAD symptoms. In fact, the maintenance of safety and avoidance behaviors after treatment was a good indicator of the maintenance or return of symptoms. Indeed, this indicator is important to evaluate in the prevention of relapses. In conclusion, this study supports the idea that social beliefs and safety behaviours play an important role both during

and after the treatment of social anxiety disorder. More specifically, the reduction of negative self-beliefs and the reduction of safety behaviors appear to be fundamental factors in the maintenance or otherwise of a social anxiety disorder.

These studies of McEvoy et al. (2020), McEvoy et al. (2022) and Kyron et al. (2023) brought together all the existing studies on this new form of CBT based on mental imagery from 2020. These studies therefore provide a comprehensive overview of what is known and what is lacking about this new therapy. In conclusion, these studies provide solid evidence that verbal and mental imagery group CBT is an effective treatment for reducing symptoms specific to social anxiety disorder. However, the imagery-based form does not provide any significant benefit compared with the more traditional verbal approach. McEvoy et al. (2020), McEvoy et al. (2022) and Kyron et al. (2023) highlight several important points: firstly, negative beliefs must remain important targets in psychotherapy, because of their major influence on target symptoms both during and after treatment. Secondly, for McEvoy et al. (2022) CBT using mental imagery has a positive impact on the physiological regulation of emotions. Overall, it is important to continue research into the precise functioning of cognitive and physiological mechanisms in order to better adapt therapies and therefore improve treatments for people with social anxiety disorders. The fourth part does not deal with a new form of CBT but with the interaction of another therapy with CBT. The aim is to evaluate the effectiveness of therapeutic yoga as a complement to CBT.

O'Shea et al. (2022) evaluated the effectiveness of using therapeutic yoga as a complement to CBT to treat anxiety and depressive disorders. The authors believe that by adding a physical component (yoga) to a psychological component (CBT), the effects could be interesting. This study was carried out on 59 adult participants diagnosed with depressive or anxiety disorders, divided into 2 groups. The first group received simple CBT and the second group received CBT and yoga. Symptoms were assessed before and after the intervention, as well as 3 months after the treatment was withdrawn. O'Shea et al. (2022), show that both groups showed a significant improvement in anxiety or depressive symptoms. In addition, the CBT and yoga group showed greater improvement in depressive symptoms than the CBT alone group. The results were similar for anxiety symptoms, but with a smaller effect. In addition, the effects are more persistent in the CBT and yoga group than in the CBT alone group. O'Shea et al. (2022) suggests that the addition of therapeutic yoga, as a complement to CBT, has a positive impact on the management of anxiety and depressive symptoms. In fact, the authors explain that yoga can improve the mindfulness tool by adding

a bodily valence, and therefore an additional tool for working on meta-cognition; identifying and analyzing maladaptive thoughts. On the other hand, the small sample size is a shortcoming of this study, and more studies of this type are needed.

O'Shea et al. (2022) will follow his own advice and carry out a study on this topic in 2023. O'Shea et al. (2023) will also focus on therapeutic yoga as a complement to CBT for people with anxiety or depressive disorders, with the emphasis on the long-term effects (from 12 months) of this intervention. There is little reliable data on this aspect of therapy. 59 participants were split into two groups for this study, the first with CBT alone and the second with CBT and yoga for a period of 12 months. Measurements were taken at the end of the intervention and again at 3 and 12 months post-intervention. This study used data from a rating scale (DASS-21) and also feedback from participants on which tools they preferred. The results showed that the group receiving CBT and yoga maintained greater improvements over time after 12 months than the CBT group alone. In terms of feedback from participants, those in the CBT and yoga group explained that yoga had provided them with more tools that they could incorporate into their daily lives afterwards (such as breathing and mindfulness techniques). The authors explain that these tools, linked to CBT, could help participants to stick more easily to CBT concepts in the long term (after the intervention). Conversely, participants in the CBT-only group explained that they found it more difficult to maintain the benefits of CBT on their own.

To sum up these studies of O'Shea et al. (2022) and O'Shea et al. (2023), therapeutic yoga reinforces the immediate and long-term benefits of CBT. In conclusion, these two studies presented above demonstrate that therapeutic yoga as a complement to CBT is effective. This combined intervention brings about a better reduction in anxiety and depressive symptoms in the short and long term, and also enables the therapeutic tools of CBT to be better remembered. The authors cite breathing techniques and mindfulness as yoga tools that significantly improve symptoms. Given these findings, it would be worthwhile incorporating therapeutic yoga sessions more regularly into CBT-based psychotherapies, in order to reap the benefits just mentioned. The researchers also indicated the need for more RCTs to validate these conclusions, which are based on just two studies with a small sample size. The study by O'Shea et al. (2023) is the only one to take into account subjective indicators of the participants in this part. The following study aims to take into account and measure these subjective indicators, which they will call the participants' experiential experience.

Yarwood et al. (2023) explains in its preamble that there are essentially quantitative studies aimed at measuring the effectiveness of CBT. They therefore chose to carry out a qualitative study on the users of this therapy. They are going to evaluate the experiential experience of participants who have undergone CBT for anxiety and depressive symptoms. This study is therefore a systematic review bringing together other qualitative studies in which one of the measures takes into account the experiential experience of participants who have received CBT to improve anxiety and depressive symptoms. Yarwood et al. (2023) selected included only adult participants. In the end, fourteen studies were selected for this systematic review. The results indicate that four key points stand out: the demands of CBT, the lack of duration or depth, the therapeutic alliance and the improvement in mood. On the first point, the participants reported the demands of CBT as being too much work, whether it be the tasks to be carried out between sessions or even the work or cognitive exercises during the sessions. Yarwood et al. (2023) link this high demand for commitment to depressive disorders, since the lack of motivation and energy induced by these disorders, combined with the high demands of CBT, do not help to include as many people as possible in this therapy. In the second point, participants mentioned the lack of depth and insufficient length of the sessions. The two elements are linked, as participants explained that the sessions were too short to address their problems in depth. They also said that the intervention sometimes focused too much on the symptoms at hand, neglecting the malaise and the indirect causes of the participants' problems. The fixed number of sessions was seen as a hindrance to deeper reflection, and they would have liked a longer therapy. In the third point, the participants mentioned the therapeutic alliance. The therapist-patient relationship is essential to the success of a therapy such as CBT. The participants felt that a non-judgemental, caring and empathetic therapist greatly facilitated the smooth running of the therapy. This good relationship puts the patient at ease, but also makes it easier to motivate the patient to carry out tasks that are sometimes more uncomfortable. Finally, the fourth point is that the majority of participants reported that they had observed improvements in themselves and better management of their mood after undergoing CBT. They also explained that they had a better understanding of how their thoughts work, identifying and sometimes modifying them.

Following this observation, Yarwood et al. (2023) spoke of the importance of making CBT more flexible and individualized to suit more patients, and thus of providing a therapy that is even more relevant to each person. This will have the effect of maintaining the effects of the therapy for longer and also of working on deeper anxieties. In conclusion, the authors

note that although CBT has strong scientific and clinical value, there is still a shortfall in terms of improving the effectiveness and accessibility of this therapy; better personalization and a strong therapeutic relationship are the two areas that need to be promoted in order to achieve even greater results.

First of all, the major point to highlight is that CBT is indeed widely effective in treating anxiety and depressive symptoms, with numerous empirical proofs (Yarwood et al., 2024; O'Shea et al., 2022; Mahardika et al., 2020), the identification and modification of erroneous thoughts leads to a significant improvement in disorders. Today, CBT is very versatile, with different forms of this therapy giving conclusive results (O'Shea et al., 2022; O'Shea et al., 2023; Biagianti et al., 2023; McEvoy et al., 2020; McEvoy et al., 2022). Several different forms of the same therapy provide a wider choice to best support patients. For example, there is group CBT based on mental imagery or verbal therapy (McEvoy et al., 2020; McEvoy et al., 2022), combined forms of CBT with therapeutic yoga (O'Shea et al., 2022; O'Shea et al., 2023) and even online forms (Biagianti et al., 2023; Prasad et al., 2023). Moreover, these forms of online CBT make it possible to offer access to care that would not previously have been possible, for example for people with social anxiety disorders, access to a physical practice can be difficult, so establishing a climate of trust upstream with online therapy is a good alternative (Biagianti et al., 2023; Prasad et al., 2023). The final benefit is that some forms of CBT, such as CBT combined with therapeutic yoga, can improve long-term effects for up to 12 months after intervention (O'Shea et al., 2023). Secondly, as regards the disadvantages of CBT, patient commitment is a limitation which has been highlighted in these studies. For online CBT, when a patient was not in regular contact with a therapist, the drop-out rate increased (Biagianti et al., 2023). As far as the overall operation of CBT is concerned, the fact that sessions are sometimes too short, the demands of the therapy during and between sessions and the fact that it is sometimes too concrete are factors which can reduce patient commitment (Yarwood et al., 2023), this type of limitation is not expressed by other researchers like Mahardika et al. (2020), McEvoy et al. (2020), McEvoy et al. (2022), O'Shea et al. (2022) and O'Shea et al. (2023). The final limitation would therefore be the absence of physiological indicators in traditional CBT, whereas observed previously, these indicators are sometimes essential for improving the effects of therapy (McEvoy et al., 2022). In addition, there are still areas of research that need to be explored in order to gain a better understanding of how CBT works. Indeed, although cognitive biases and mechanisms are involved in CBT, their precise role and implication are currently poorly understood

(Kyron et al., 2023). Some studies show that integrating a practice with CBT is effective, but there is still a lack of standardized and rigorous studies to confirm these conclusions (O'Shea et al., 2023).

Finally, the future of CBT is upon us. Whether through the creation and evaluation of new forms of CBT, the introduction of mixed interventions, new data such as lived experience or the use of deep learning, research is abundant, diverse and of high quality. This gives grounds for optimism about the future of this therapy. Especially as the researchers themselves have noted the shortcomings of this therapy, whether in terms of individualization, flexibility, or knowledge of the precise functioning of cognitive mechanisms. From the point of view of research, CBT is evolving into an increasingly effective, accessible, and individualized therapy.

The Cognitive Bias Modification

Chen et al. (2020) focusses solely on the benefits of the CBM-I intervention for depression. They studied the impact of interpretation bias on depression with the CBM-I intervention in 40 Chinese undergraduate students with depressive symptoms and recurrent negative interpretations. The students received two weeks of CBM-I training. A positive correlation was found between changes in depressive symptoms and changes in interpretation bias. There would be fewer depressive symptoms and more positive interpretation for the CBM-I group compared to the control group. On the other hand, the results showed that the CBM-I intervention did not work on major depression. This study highlights the potential of the CBM-I intervention as a brief and simple delivery approach. The researchers suggest that a CBM-I approach with few sessions, for a population of Chinese students with mild to moderate depressive symptoms, may be useful. In particular, to prevent a worsening of the depressive disorder.

Chen et al. (2020) presented three limitations. The first is that the sample size was quite small, making the results less reliable. The second is that the effects of the intervention were only measured for two weeks after the intervention, which cannot express the effectiveness of CBM-I over the long term. It would therefore be interesting to test this intervention over a longer period in order to assess its long-term effects. Thirdly, the results obtained were compared to a waiting-list control group and not to another therapy with good scientific validity, such as CBT, for example.

Wooldridge et al. (2021) studied the impact of attentional biases on depression with the CBM-A intervention, using a novel eye-tracking approach. They observed that, after the intervention, participants in the active group spent less time looking at sad faces than at happy ones, compared with the control group. Furthermore, in the emotional memory test, the control group showed a significantly greater tendency to remember negative words than positive ones. This result is typical of depressed populations, who will have stronger attentional biases towards items with negative valence. The CBM-A intervention group, on the other hand, remembered negative words only slightly better than positive words. Wooldridge et al. (2021) support the idea that CBM-A works well in depressive symptomatology. They also suggest that people with stronger rumination biases may benefit more from CBM-A treatments. Overall, however, this randomized trial showed mixed results in terms of participants' capacity for attentional disengagement. Nor did they observe any significant changes in participants' mood, nor was there any significant change in depressive symptoms. The authors put forward a hypothesis to explain their results: after cognitive biases have been modified, there would need to be a time lag for the modified cognitive biases to have an impact on mood, whereas in this study, mood was measured rapidly after the CBM-A was administered. It would therefore also have been interesting to observe participants' moods for a longer period of time. Two methodological limitations may explain these results. The sample size was small and therefore less reliable and the lack of consistency in terms of administration and methodology, due to the rather complex eye-tracking tools used. It is therefore important to repeat studies of this type with a larger sample and a more robust methodology.

At the same time as Wooldridge et al. (2021) and Xia et al. (2023) carried out a systematic review and meta-analysis of the effectiveness of attentional bias modification (CBM-A) in treating depression, secondary research assessed the impact of CBM-A on rumination and attentional control. This meta-analysis included 20 randomized studies. The results did not support the claim that CBM-A intervention could be effective in reducing depression-related attentional biases, and hence depressive symptomatology. However, in the secondary results, a significant reduction in rumination was noted in this study after the CBM-A intervention. Baeyens et al. (2016) means that ruminations are a process involved in the development and maintenance of depression.

These results suggest that CBM-A may have promoted a (non-significant) reduction in depressive symptoms by reducing rumination. Still in the secondary results, the data

indicated that CBM-A was not effective in improving attentional control. However, attentional control seems to have an impact on depressive symptoms, particularly through rumination, so better performance in attentional control should lead to a reduction in depressive symptoms. The authors therefore explain the need for further research into the effect of CBM-A on attentional control. In particular on the variable of exposure time to the material, since a longer exposure time to CBM-A would allow better attentional avoidance of negative stimuli. Regarding the ideal CBM-A protocol for reducing depressive symptoms, the authors highlight several points: laboratory interventions obtain better results than home interventions. The version of CBM-A with attentional probes was the most effective, while those with spatial cueing, visual search or the free visualization task had no effect. With regard to the different types of stimuli, face stimuli had a significantly better effect than word stimuli. Finally, about the different stimulus orientations, the left-to-right arrangement obtained better results than the top-to-bottom arrangement.

Xia et al. (2023) explain that the limitations of this study are the excessive heterogeneity of the sample and the limited number of studies involved. These limitations make it impossible to draw conclusions from this meta-analysis but reinforce the need to conduct other RCTs exploring the efficacy of CBM-A in reducing depressive symptomatology, in order to eventually benefit from a more interesting number of studies to conduct a meta-analysis. This limitation also applies to the effect of CBM-A on rumination and attentional control, and to defining the ideal CBM-A protocol for reducing depression.

Li et al. (2023) evaluates both CBM-I and CBM-A in a depressive population. This is one of the only recent studies to evaluate both simultaneously in this population. Li et al. (2023) study was to investigate the effect of modifying cognitive biases on depression using the CBM intervention. Based on 10 randomized studies, they found that both forms of CBM (CBM-I and CBM-A) significantly reduced depression symptom scores. Moreover, CBM-I had a relatively better score. On the other hand, the CBM intervention had a positive result for patients with severe to moderate depressive symptoms. The population with mild symptoms did not score well. This may be explained by the fact that the smaller the bias (as in the case of subjects with mild symptoms), the smaller the impact of the intervention. Another explanation is that subjects with severe and moderate depression may have a greater margin of symptom improvement than subjects with mild depression, and therefore potentially a greater difference in symptoms after the intervention than those with less severe

symptoms. The main limitation of this meta-analysis is the relatively small sample size (467 participants), which makes the results of this study less reliable.

Fodor et al. (2020) was one of the few to evaluate the effect of CBM intervention on a depressive and anxious population in the CBM-A and CBM-I modalities. The authors carried out a meta-analysis to assess the effectiveness of CBM interventions (CBM-I and CBM-A) on anxiety and depressive symptoms. This meta-analysis included 85 randomized studies. The results indicate that the CBM interventions showed modest to small benefits compared with the control groups for anxiety and depressive symptomatology. Overall, for anxious participants, the CBM-I intervention performed better than the waiting list. For depressive participants, only the CBM-I intervention outperformed the waiting list. Moreover, the results between the types of CBM intervention were similar overall, with the exception of comorbid depression, where CBM-I obtained significantly better results than CBM-A. The only significant results obtained with CBM-A were small effects. The effectiveness of the combined treatment of CBM-I and CBM-A cannot be established, as all the evidence in favor of combined treatment was indirect, and direct comparisons would be necessary to avoid too much interference. In view of the results obtained, the researchers are in favor of continuing research into the CBM-I intervention using a robust methodology and establishing whether the intervention should be implemented independently or in combination with another. For the CBM-A intervention, the researchers take a different view in view of the small effects observed in most of the studies, and they doubt that further investment in research is relevant and justified. Except for studies testing an alternative form of CBM-A, which could potentially yield more interesting results. As a limit, the researchers emphasize the heterogeneity of the results. They question the direct impact of CBM on cognitive biases and put forward the possibility that CBM interventions encourage participants to resort to cognitive restructuring instead.

Ji et al. (2021) studied the effectiveness of CBM-I on anxiety over several sessions in a community sample who reported moderate to severe anxiety symptoms. Participation in this study was open to the public and therefore to people from all over the world. The study was conducted via the internet, not in a laboratory, but in real-life conditions. Participants who had received CBM-I training showed a greater reduction in negative interpretation bias and a greater increase in positive interpretation bias than the control group. The CBM-I intervention induced greater engagement with interpretation bias than participants who did not receive the intervention. According to the researchers, this study provides preliminary

evidence on the feasibility and effectiveness of a free Internet-based cognitive intervention for anxiety symptoms, as they consider that the CBM-I intervention has the potential to reduce these symptoms.

Ji et al. (2021) emphasize the need to study more precisely the optimal number of sessions required to achieve a significant change in anxiety symptoms. In addition, they see the advantage of increasing the number of studies on interventions carried out on the Internet with a free population, as few studies of this type exist and the clinical benefit of this type of intervention is therefore still unknown. Another important fact is that the drop-out rate for participants in online interventions (outside the laboratory) is always high, and this aspect may raise questions about the real effectiveness of this type of intervention. The researchers also point out that the advantage of Internet-based interventions is that they can reach many people with mental disorders who are not receiving care.

Martinelli et al. (2022) discusses the effectiveness of CBM (CBM-I and CBM-A) through the reduction of targeted biases, and not through the reduction of symptoms. This meta-analysis is based on 161 samples and represents one of the largest studies on the modification of cognitive biases, with 10716 participants. The secondary objective of this study is to observe which methods are the most effective in modifying target biases. This meta-analysis only includes RCTs assessing cognitive biases before and after administration, in addition to comparison with the control group. The results showed that CBM-I and CBM-A had medium to large effect sizes for modifying cognitive biases. The study found no significant difference in effect size between the CBM-I and CBM-A approaches. CBM-I achieved significant results in increasing positive interpretations of ambiguous stimuli, decreasing negative interpretations and modifying overall biases in the desired direction.

For the secondary objective, Martinelli et al. (2022) observed that for the two CBM conditions, the large number of students participating in the studies may lead to an overestimation of the size of the effect on the general population. This would be due to the large proportion of students in these studies (around half of the studies are essentially made up of students), technological familiarity and familiarity with evaluative pedagogical contexts, all of which would make students more sensitive to CBM than the rest of the population.

Martinelli et al. (2022) also looked at the difference in the effect of CBM depending on whether the target population was clinical (with a diagnosis) or non-clinical (without a

diagnosis). The results indicate greater reductions in interpretation bias (CBM-I) for non-clinical populations than for clinical populations. Another part of the research looked at the specific types of symptoms on which CBM acts. For CBM-A, they observed a significant reduction in attention bias for non-specific anxiety, specific phobias and depressive symptoms, but no significant effect on social anxiety.

For CBM-I, they observed significantly positive effect sizes in the reduction of interpretation bias for all types of symptoms, including non-specific anxiety, depression, rumination, OCD or social anxiety. Social anxiety, which showed no reduction with CBM-A, had the strongest effect with CBM-I. Thus, for anxiety symptoms CBM-I seems to perform better than CBM-A, while for depressive symptoms it is CBM-A that obtains the best results compared with CBM-I. In addition, the CBM-I and CBM-A approaches appear to be ten times more effective in the laboratory than in a natural environment, particularly for CBM-A with attentional probes. For example, CBM-A with in-line attentional probes (in a natural environment) did not show significant results in terms of bias reduction.

For Martinelli et al. (2022) the main limitation of their meta-analysis is the considerable heterogeneity of the results, which may call into question the reliability of the results obtained. In addition, the fact that sub-groups were set up for each symptom, in order to evaluate each symptom, had the effect of greatly reducing the sample size of each sub-group. They point out that with the exception of two sub-groups, all the others were calculated using less than 10 studies, which may be insufficient. For them, this simply reflects the importance of continuing research through specific studies of precise symptoms.

CBM is an intervention that is the subject of research on themes other than depressive and anxiety disorders. Some research addresses topics such as emotion regulation, aggressive behavior or the problem of attrition specific to the conditions in which the CBM intervention is carried out. Below are studies dealing with subjects related to the initial topic, which will help to broaden knowledge of the CBM intervention.

Ghosh et al. (2023) raised the idea that CBT-based internet therapies, such as CBM, have a high drop-out rate, due to a repetitive and boring intervention. The aim of their research was therefore to create a game with a gameplay with the same therapeutic effectiveness but with a higher rate of engagement. They assessed the effectiveness of their games on three evaluation criteria in the form of feedback from participants: clarity of instructions, enjoyment of the game and clarity of the aim of the game. Overall, the feedback

from the participants was positive. Ghosh et al. (2023) specify that they found the results interesting, but that they only involved 15 participants, and that it would be interesting to continue the research with larger samples. They also state that testing these games outside the laboratory would also be interesting.

Dietel et al. (2024) conducted a randomized controlled trial to evaluate the effects of CBM-ART on emotion regulation. CBM-ART is a version of CBM adapted to emotion regulation by integrating Affect Regulation Training (ART) with CBM. Participants received a one-week active intervention. The results indicate that the intervention reduced negative interpretation bias and increased positive interpretation bias.

Van Dijk et al. (2024) conducted research on two meta-analyses addressing the value of CBM intervention on aggressive behavior. Overall, a slight effect of CBM-I on aggressive behavior was detected. The researchers therefore explain that this result suggests that the CBM-I intervention could be of interest in the search for the interpretation biases that exist in aggression.

Concerning the effectiveness of the CBM intervention. Overall, the CBM intervention produces positive results on anxiety and depressive states, as well as on clinical and non-clinical states (Martinelli et al., 2022), although results differ from study to study or modality to modality (CBM-I or CBM-A). Some studies found no significant difference between CBM-A and CBM-I (Martinelli et al., 2022), while others found a significant difference (Fodor et al., 2020).

Let's start with the CBM-I modality, for anxiety disorders the recent scientific literature indicates that this intervention obtains either good (Ji et al., 2021; Martinelli et al., 2022) or moderate (Fodor et al., 2020; Martinelli et al., 2022) results. On the one hand, CBM-I obtained significantly better results than the waiting list for reducing anxiety symptoms (Fodor et al., 2020), while on the other hand the researchers obtained a significant reduction in negative interpretation bias and a significant increase in positive interpretation bias (Ji et al., 2021). For depressive disorders, the results are also positive (Chen et al., 2020; Li et al., 2023), indicating a significant reduction in depressive symptoms and negative interpretation bias. However, some contradictory differences remain: Chen et al. (2020) explain that the effects of the intervention did not work for participants with major depressive disorders, whereas Li et al. (2023) explain that they obtained good results for severe and moderate symptoms but not for mild symptoms. According to current studies, the CBM-I

intervention has sufficient preliminary evidence to be considered effective in treating anxiety and depressive disorders.

Continuing with the CBM-A intervention, Fodor et al. (2020) and Martinelli et al. (2022) indicate that for anxiety populations, the results obtained are either non-significant or with small effect sizes. For the depressive population, as for the CBM-I intervention, CBM-A obtained good results (Martinelli et al., 2022), particularly for severe and moderate symptoms (Li et al., 2023). Moreover, CBM-I appears to be more effective than CBM-A. Wooldridge et al. (2021) did not show any significant changes in depressive symptoms, although there was a moderate improvement in emotional memory, which is an element that can help treat depressive disorders. Finally, the last study indicates that it is not possible to state that this intervention is effective in reducing depressive symptoms (Xia et al., 2023).

The CBM-A intervention does not obtain sufficiently good results to reduce anxiety (Fodor et al., 2020) and depressive symptoms (Wooldridge et al., 2021; Xia et al., 2023), the only studies that obtain interesting results mean that the CBM-I intervention is significantly more interesting (Li et al., 2023). Only Martinelli et al. (2022) indicate that the CBM intervention is interesting overall, but they also specify that the CBM-A intervention with attentional probes outside the laboratory (i.e. on-line) does not obtain significant results. However, as described above, the attentional probe modality is the one most frequently used, but it does not seem suitable for use in a natural environment, so research should perhaps look into this aspect. Indeed, an intervention that is only effective in the laboratory does not seem to be a relevant intervention, especially as the CBM intervention has the advantage, initially, of being adaptable and usable in patients' homes.

However, it is difficult to agree with the conclusions of Fodor et al. (2020), given the results obtained for the CBM-A intervention with anxious and depressed populations, further research does not seem relevant or justified, as the intervention is not sufficiently effective overall. Nevertheless, the results obtained for CBM-A are perhaps more indicative of an ineffective protocol than of the absence of a link between attentional biases and anxiety and depressive symptoms. Based on the study by Xia et al. (2023), certain test conditions may be preferable for future research. The modality with attentional probe, face stimulus and left-to-right stimulus orientation gives the best results. In addition, Martinelli et al. (2022) put forward the idea that further research should be carried out, in particular on the transferability

of this intervention from the laboratory to the natural environment, where the aim of an intervention is to be effective.

It is important to note that positive results of CBM have been observed and can be extended to other domains (Dietel et al., 2024; Van Dijk et al., 2024). The fact that CBM has interesting effects on cognitive biases for other disorders demonstrates that the intervention does indeed modify what it is supposed to modify: cognitive biases. This finding means that the validity of the CBM method is good. If the efficacy and validity of the CBM intervention are confirmed, the fact that it is brief, inexpensive to set up and very accessible to the general public can also be added, making this psychotherapy almost unavoidable in the support of people with depressive and/or anxiety symptoms. Secondly, it is interesting to consider the form in which the CBM intervention should be administered. Indeed, in general, researchers approach this intervention as being autonomous and sufficient, whereas other opinions indicate that this intervention should be complementary to another intervention, such as CBT, in order to obtain optimal results. Finally, the last opinion concerns the use of CBM as a preventive intervention.

The CBM intervention, because it can be used at home and independently, seems ideal for use as a complement to another intervention. On the other hand, some researchers (Fodor et al., 2020) have questioned the direct impact of CBM on cognitive biases, arguing that CBM induces participants to use cognitive remediation. If this finding is true, it raises several questions: CBT is a preferred intervention for treating depressive and anxiety disorders, in the field of cognitive psychology, so it's possible to assume that combining CBM and CBT would give the most relevant results, yet both interventions use (more or less directly) cognitive remediation. The question is therefore whether these two interventions will not have counterproductive effects. It would therefore be interesting to conduct research on CBT and CBM combined.

The preventive aspect of CBM is very intuitive and encouraged by some researchers (Chen et al., 2020; Martinelli et al., 2022), as this intervention is very accessible because it can be used directly at home on the Internet, especially as the effects of CBM-I are greater for non-clinical than clinical populations (Martinelli et al., 2022). However, there is a limit to this: the poor results of CBM on mild symptoms (Li et al., 2023) are problematic because it is the mild symptoms that preventive action will target.

The third point deals with the methods of delivery and the protocol of the CBM intervention, which will be relevant to evaluate in order to improve and remedy the shortcomings of this intervention. A majority of the studies presented report a low or even problematic attrition rate (Ghosh et al., 2023). The very high attrition rate of participants in these studies is a factor limiting the reliability of the results obtained. If an intervention is effective, but the majority of participants drop out before the end, is the intervention still really effective? Since dropouts are not included in the significant results, it is possible to assume that this is a significant bias. Furthermore, a population with depressive symptoms may have a marked reduction in interest or pleasure in activities (American Psychiatric Association, 2013), so the difficulty of completing the therapy, however short and accessible it may be, is a real factor limiting the effectiveness of the intervention, which needs to be taken into account. The study by Ghosh et al. (2023) examines the problem of retaining participants for the CBM intervention, so they have proposed new aspects to limit this aspect. Is an aspect of the research that should not be underestimated.

The other main point concerning the CBM is the timing of the follow-up: how many sessions are needed to obtain optimum results? For how long? How often? For example, Vives et al. (2019) obtain good results with an intervention of 5 sessions in 5 days, but there aren't many recent studies evaluating the differences in results according to the duration or frequency of the intervention. This is an important area of research to explore.

The fourth and final point deals with the methodology of CBM studies. CBM is a very recent intervention, so there are many research biases and grey areas about how this therapy works and how effective it is. The fourth and final point concerns the methodology of CBM studies. As CBM is a very recent intervention, there are many research biases and grey areas concerning the functioning and efficacy of this therapy. Four sections below deal with methodological aspects. All the studies presented have either a small sample size or a small number of studies (in the case of meta-analyses). This aspect, which is not negligible, may call into question the representativeness of the results and the potential reproducibility of the intervention. Secondly, most of the studies presented did not take into account the long-term results of this intervention, a point that remains to be explored in greater depth, to observe whether the impact of this intervention is significant over a longer period. Thirdly, the question of the control group is addressed. In general, the effects of the CBM intervention are compared with a waiting-list control group. Achieving significantly better results than a waiting list is positive, but not sufficient. It is by comparing the CBM intervention with other

interventions of high scientific validity that it is possible to characterize its true effectiveness. On the other hand, if the CBM intervention is considered a complementary intervention to conventional therapy (face-to-face), it is enough to compare the CBM intervention with a "passive" control group. It's also important to notify that there are no studies evaluating the effectiveness of the CBM intervention as a complement to another intervention. Fourthly, Wooldridge et al. (2021) stressed the importance of adding to the studies a second measurement of symptoms later after having benefited from CBM, there would be a first measurement rapidly after the end of the intervention and then a second in the medium term. They explain this by arguing that after modifying cognitive biases, the impact on depressive or anxiety symptoms is neither direct or immediate, and that by assessing symptoms only shortly after the intervention, researchers would miss the real effect of CBM.

Optimistically, given the empirical value of CBM, it seems that some scientific attention is focusing on this intervention. In the short term, it would be good to obtain enough quality studies to clarify the current grey areas. In conclusion, although the CBM intervention has research gaps, it nevertheless has potential to be exploited.

The Cognitive remediation

Therond et al. (2021) carried out a systematic review and meta-analysis of the effectiveness of cognitive remediation (CR) for people suffering from major depressive disorder. The results of this study support the value of using cognitive remediation to improve global cognition in adults with major depressive disorder with a moderate effect size. The effect size varied according to the cognitive domain. CR having a significant effect and a high effect size on verbal memory. It had a significant effect and a moderate effect size on processing speed, attention, working memory and executive functioning. However, there was no significant effect on visuo-spatial memory or verbal fluency. It was observed that CR had an interesting effect on most of the cognitive domains evaluated. However, this conclusion is limited by the small number of studies and therefore by a sample too small to be representative of the population evaluated. The researchers also state that they did not find any significant difference depending on whether CR was carried out in a group or individually, nor was there any significant difference depending on the duration of CR.

In the same theme, Mokhtari et al. (2023) also carried out a systematic review and meta-analysis about cognitive remediation and its value for patients with major depressive disorder. The results of this study indicate that cognitive remediation is an intervention with

significantly positive effects on executive functions, verbal learning and working memory for patients suffering from major depressive disorder. The researchers indicate that further research in this area is warranted. Despite a very good sample size, certain limitations of this study should be noted: only three studies evaluated a follow-up measure. These data are important for assessing the persistence of cognitive remediation over time. The second limitation of this study concerns the population selected: there was no differentiation between each patient in terms of the severity and duration of the disorder, or even whether or not they had received pharmaceutical treatment. These data could be important factors, since the effect of the intervention could differ according to these criteria.

The results of Mokhtari et al. (2023) were more conclusive than those of the study by Thérond et al. (2021), thanks to the larger sample size. The studies by Thérond et al. (2021) and Mokhtari et al. (2023) agree that cognitive remediation is beneficial for patients with major depressive disorder, and they also find similar results for the cognitive domains positively impacted, namely verbal memory, working memory and executive functions. On the other hand, Thérond et al. (2021) emphasize that some cognitive domains are more sensitive to CR than others, an aspect not explored by Mokhtari et al. (2023). This difference suggests that CR requires complementary approaches to achieve complete improvement in cognitive domains in major depressive disorder. This confirms the interest and relevance of integrating CR into psychotherapies based on cognitive theory.

Conclusion

The literature consulted indicates the need for further research on the role of cognitive biases in depressive and anxiety symptoms, and into the effectiveness of existing psychotherapies. Cognitive psychology is widely used in Europe and throughout the world, with conclusive clinical and laboratory results. Cognitive biases are linked to mental disorders, but it is not yet possible to know what the precise links between biases are, which ones predominate, and which ones have no effect; how to observe them accurately; how to create a less costly and more individualized therapy; what exact biases cognitive psychotherapies influence, and to what extent; and many questions remain unanswered.

Furthermore, there is a consensus that CBT is a functional therapy for treating anxiety and depressive disorders (Mahardika & Hidayat, 2020), and that combining CBT with other methods gives interesting results, these results indicate that people who received CBT and

yoga had a better immediate and long-term reduction in anxiety and depressive symptoms than those who received CBT alone (O'Shea et al., 2022; O'Shea et al., 2023). Therefore the research could focus more on therapies combining CBT and CBM, taking into account the potential interest of CBM as a complementary or preventive therapy (Chen et al., 2020; Martinelli et al., 2022), as well as the positive and intrinsic effect of CBM on anxiety and depressive symptoms (Chen et al., 2020; Li et al., 2023; Ji et al., 2021; Martinelli et al., 2022).

The most frequently cited limitations of the studies are that the sample size is too small, the number of studies too small and the lack of medium- and long-term data. These three limitations come up against the obvious reality of research funding in the social sciences and humanities. These three limitations mentioned would require more time and therefore more funding to be overcome. The total absence of recent longitudinal studies on these topics, despite the need expressed by scientists, is largely explained by a purely non-scientific aspect, either time or funding. The review begins by explaining that the management of depressive and anxiety disorders, given their importance and impact on health, is a major global health issue.

This literature review enhances many scientific studies dealing with cognitive bias and mental disorders and one observation stands out: the high level of methodological rigor. Indeed, the desire to propose relevant research must be at the heart of the concerns of researchers in this field. Having said that, yes, the treatment of mental disorders remains a major challenge, but from the point of view of research it is moving in the right direction. The advances in psychotherapy research using cognitive psychology over the last four years, highlighted in this literature review, bear testimony to this. In conclusion, research is moving forward, adapting to external conditions and, above all, being aware of what it doesn't know.

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