

A Review on Executive Functions and Memory Processes Associated with Feeding and Eating Disorders

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ABSTRACT

From the beginning of humankind, feeding has become one of the most important requirements of social adaptation and survival. Since the 20th century, research on feeding and eating disorders has tried to give some explanations of various eating behaviors, such as starving because of thoughts about being overweight or non-stop binge eating by the individual, relational, or social factors. However, they are inadequate to fully explain the psychopathological and cognitive factors underlying feeding and eating disorders. The complex behavioral pattern behind eating disorders can lead to impairments in people's attention, memory, and metacognitive processes. Certain higher-order cognitive mechanisms such as problem solving, reasoning, and decision making are impaired in individuals suffering from eating disorders, especially anorexia nervosa, bulimia nervosa, and binge eating disorder, compared to healthy individuals. Several researches aimed to find out evidence that may recover these impairments or that may lead to preventive measures for the risk of developing eating disorders. The aim of the current study is to examine the researches on the effects of eating disorders on individuals' executive functions and memory processes and to explore the links between eating disorders, executive functions, and memory.

Keywords: Eating disorders, memory, executive functions, cognitive processes

ÖZ

Beslenme ve Yeme Bozuklukları ile İlişkili Yürütücü İşlevler ve Bellek Süreçleri Üzerine Bir Gözden Geçirme Çalışması

İnsanlığın var oluşundan bu yana beslenme, sosyal adaptasyonun ve hayatta kalmanın en önemli gerekliliklerinden biri olmuştur. 20. yüzyıldan itibaren beslenme ve yeme bozuklukları üzerine yapılan araştırmalar, insanların aşırı kilolu oldukları düşüncesi ile kendilerini aç bırakmaları ya da durmaksızın yemek yemeleri gibi çeşitli yeme davranışlarına bireysel, ilişkisel ya da toplumsal faktörler ile birtakım açıklamalar getirmeye çalışmış; ancak beslenme ve yeme bozukluklarının altında yatan psikopatolojik ve bilişsel faktörleri açıklamada yetersiz kalmıştır. Yeme bozukluklarının altındaki karmaşık davranış örüntüsü, kişilerin dikkat, bellek ve üstbilişsel süreçlerinde bozulmaların ortaya çıkmasına yol açabilmektedir. Özellikle anoreksiya nervoza, bulimiya nervoza ve tıknırcasına yeme bozukluğu gibi yeme bozukluklarından muzdarip bireylerin problem çözme, muhakeme ve karar verme gibi belirli üst düzey bilişsel mekanizmalarında sağlıklı bireylere kıyasla bozulmalara rastlanmaktadır. Bu bozulmalar ile ilgili çeşitli araştırmalar mevcuttur ve bu araştırmalar genellikle bu bozulmalarda iyileştirme sağlayabilecek ya da yeme bozukluğu geliştirme riski için koruyucu önlemler alınmasına yol açabilecek bulgular elde etmeyi amaçlamaktadır. Bu çalışmanın amacı, yeme bozukluklarının bireylerin yürütücü işlevleri ve bellek süreçlerine olan etkilerine yönelik araştırmaları incelemek ve bu etkiler arasındaki bağlantıları keşfetmektir.

Anahtar Sözcükler: Yeme bozuklukları, bellek, yürütücü işlevler, bilişsel süreçler

INTRODUCTION

National Institute of Mental Health's definition indicates that eating disorders are medical diseases that are determined by critical disturbances related to individuals' eating behaviors and thoughts about them.¹ In the societies that have been developed since the early ages, gaining some eating habits and determining eating preferences has been one of the most important aspects of social adaptation for all the humanity.² Studies indicate that eating disorders are generally seen in the younger female populations in Western societies, but in non-Western societies eating disorders are generally seen in the elderly female populations.³ Various prevalence studies about the eating disorders indicate that anorexia nervosa disorder's lifetime prevalence through women can be 4%, and bulimia nervosa disorder's lifetime prevalence through women can be 2%. Moreover, binge eating disorder's lifetime prevalence could be 2%, but the information about the outcome and course of this disorder's in society is limited. The mortality rate of bulimia nervosa and anorexia nervosa is also very high.⁴ Non-symptomatic behaviors such as regular binge eating, misuse of laxatives, fasting for weight loss are common in men as well as women. Although the rate of anorexia nervosa seen in men is around 25% and their risks of mortality are very high, it is too late to diagnose them. It may be because of the prejudice that males do not suffer from eating disorders.⁵ Due to various individual (e.g., genetic or biological factors, personality characteristics, etc.), familial or relational (some family therapy concepts such as triangulation, enmeshment or conflict-avoidance systems) and social factors (e.g., cultural expectations or gender roles) throughout the history,⁶ people sometimes get sick because of whetting their appetite for attractive foods; sometimes they cannot stop their eating in environments that are plenty of food available, or they sometimes starve because of thoughts about being overweight. Considering that every factor can be a possible reason for the presence of eating disorders, they were inadequate to fully explain the feeding and eating disorders because eating behaviors may also occur as a psychopathological disorder.

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition's (DSM-5) feeding and eating disorder category include pica, rumination disorder, avoidant/restrictive food intake disorder, anorexia nervosa, bulimia nervosa, and binge eating disorder. On the other hand, this category also includes two umbrella diagnoses; those are other specified feeding or eating disorder and unspecified feeding or eating disorder.⁷ According to DSM-5, pica is defined as eating substances with or without nutritional value such as soil. Rumination disorder is generally defined as the regurgitation of food. Regurgitated food may be either re-chewed, re-swallowed, or spits out. Avoidant/restrictive food intake disorder is defined as not showing a clear interest in food, avoiding the sensual properties of food, and/or worrying about eating. Individuals suffering from anorexia nervosa or bulimia nervosa have maladaptive eating behaviors to establish dominance on their body weight and extraordinary thoughts or perceptions about their body weight and/or shape. The difference between bulimia nervosa and anorexia nervosa is that people who suffer from bulimia nervosa have some compensatory behaviors such as using weight-loss pills, misusing laxatives or purgatives, or self-induced vomiting. Binge eating disorder is defined by consuming food in large portions during a divided time period, for example, a 2-hour period. People could lose their control during this eating period. Night eating syndrome is included in other specified feeding or eating disorder, and it is characterized by excessive eating, loss of appetite in the mornings, skipping breakfast, difficulty falling asleep, or maintaining sleep. People with any type of eating disorder may be underweight, normal weight range, or overweight.⁷

Obesity is not in the DSM-5 classification, but it should be accepted

that it is a significant health problem in the community. The prevalence of obesity in the world has almost tripled since 1975.⁸ Obesity is an abnormal or excessive fat accumulation that may impair health. A person with a body mass index (BMI) of 30 or more is generally classified as obese.⁸ There are no definite psychological and behavioral obesity-related features, but in a subgroup of obese cases, emotional binge eating may be seen. These people are consumed extremely large amounts of food, and they have serious distortions related to their body images (they may find themselves abjectly funny), their self-esteem is low, and their self-perceptions are negative.^{9,10}

Feeding is one of the most important aspects of social adaptation and survival, but it is a highly complex behavior that is influenced by many factors. Due to its complexity, information processing processes may deteriorate such as cognitive biases and distortions, attention processes (e.g., divided and sustained attention), memory processes (e.g., executive functions and working memory, explicit and implicit memory, and autobiographical memory) and metacognitive processes.¹¹ Certain memory impairments have been found in people suffering from eating disorders compared to healthy individuals. There is a lot of research on these memory impairments, and researchers aim to find ways to treat these impairments. Memory impairments are mostly seen in marker disorders such as anorexia nervosa, bulimia nervosa, and binge eating disorder. The current study aims to review executive functions and memory processes associated with feeding and eating disorders in the following sections. In the first part of the review, executive functions are reviewed in detail and the links between eating disorders and a set of cognitive processes are mentioned. In the second, the third and the fourth part of the review, the relation between eating disorders and "implicit and explicit memory", "short-term memory and long-term memory" and "autobiographical memory" is presented, respectively.

Executive Functions

Executive functions are a set of neuropsychological processes that are responsible for higher-order cognitive mechanisms such as working memory, problem solving, reasoning, decision making, inhibitory control, self-regulation, and goal-directed behaviors and activities. There have been several studies on executive functions in individuals suffering from eating disorders¹² and there is some evidence that executive functions such as decision making, set shifting, and problem solving are impaired in eating disorders.¹³⁻¹⁵ According to meta-analysis studies on executive functions in eating disorders, set shifting, central coherence, decision making, and intellectual functioning problems were observed in individuals suffering from anorexia nervosa, whereas attention, impulsivity, inhibitory control, and cognitive flexibility problems were observed in people suffering from bulimia nervosa.^{12,15-18} Although there are few studies on binge eating behaviors,¹² poor decision making, and cognitive flexibility performance were observed.¹⁹

Attentional Bias

Attentional bias refers to how an individual's perception is influenced by certain variables in their attention. It is mostly measured by a modified Stroop color task^{20,21} and a modified dot-probe task²¹⁻²³ in eating disorders. Several studies conducted with the Stroop color task found that people with eating disorders and restrained eaters show greater attentional bias to food-related words.^{21,24} When the findings of attentional bias were examined according to the types of eating disorders, it was seen that the studies were mostly conducted on people with anorexia nervosa and bulimia nervosa. Recent studies have indicated an attentional bias towards food stimuli in individuals with anorexia and bulimia nervosa compared to the healthy control group in the modified Stroop color task.^{16,21,24}

Individuals suffering from eating disorders may also exhibit

attentional biases in eating disorder-related traits such as food, body shape, and weight especially in a modified visual dot-probe task.^{22,23} For instance, in a recent study²³ where the attentional biases of body shape in women with eating disorders such as anorexia or bulimia nervosa were investigated with a visual dot-probe task, the participants were shown thin, normal and obese body pictures in pairs. Both eating disorders and healthy control groups showed an attentional bias towards the fatter one than the two other body shape pictures. On the other hand, when the pairs included two extreme body shapes (e.g., thin vs. obese), a significant decrease in reaction time was observed compared to the pairs including a normal body shape picture for the eating disorder group. These results have indicated that attentional resources were automatically shifted to the location of the disorder-related stimulus in women with eating disorders.

Set Shifting

One of the impairments of individuals suffering from eating disorders in executive functions is set shifting difficulties. According to the definition of Miyake et al.,²⁵ set shifting is the executive function about “the ability to shift back and forth between multiple tasks, operations or mental sets”. Individuals diagnosed with eating disorders and obesity had significantly lower scores than healthy controls on cognitive tasks, such as Tower of London,^{26,27} the Trail Making Test^{19,28}, Wisconsin Card Sorting Test^{14,29}, and the Brixton Spatial Anticipation Task.^{14,30} People with anorexia nervosa and bulimia nervosa were observed to have deterioration in their set shifting performance compared with the healthy control groups.^{14,30,31} Even in some studies, it was suggested that set shifting ability could be the key determinant for anorexia nervosa disorder.^{30,32} However, in a recent study, researchers measured the cognitive functioning of people with binge eating disorder, and no impairment was observed in their set shifting performances assessed by Intra-dimensional/Extra-dimensional Set-Shift Task, that is the computerized version of the Wisconsin Card Sorting Task.³³ Besides, in some researches that examined the differences in the set shifting performance in adolescents between anorexia nervosa and healthy control group, no significant difference was found.^{34,35} In fact, some researchers have suggested that cognitive dysfunctions in adults may be the result of chronic disorders due to the similar set shifting performance level in adolescents with and without anorexia nervosa. Although adolescents at the onset of anorexia nervosa do not differ from their healthy peers, their set shifting performance may change as the disease progresses.³⁴ When people with bulimia nervosa are compared with other healthy groups, no set shifting performance differences were observed between these two groups;³⁶ however, difficulties in adopting new strategies, namely, cognitive flexibility,³⁷ and problems with decision making were found.²⁸ A recent study by Mang et al.³⁸ concluded that cognitive flexibility is measured with set shifting performance and is impaired in individuals suffering from eating disorders with bulimic features such as binge eating. According to another research, when individuals suffering from binge eating disorder were compared to anorexia nervosa groups and healthy controls in terms of neuropsychological tasks, such as the Trail Making Test Part A and B, and the Wisconsin Card Sorting Test, the performance of the individuals suffering from binge eating disorder were worse than the healthy controls.¹⁹ Overall, an inadequate set shifting ability is common in eating disorder types and obesity. However, there is no clear implication about the people suffering from binge eating disorder because there are very few studies that examined binge eating in eating disorder types.

Working Memory

The inadequacy of set shifting performance is a characteristic feature in eating disorders, and this situation indicates significant im-

pairments in working memory performance of individuals, specifically with bulimia nervosa and anorexia nervosa.^{12,15-17} As a memory model developed by Baddeley and Hitch,³⁹ working memory has limited storage and processing features, and it includes dynamic components that affect the information kept in the memory for a short time. In a study with teenagers diagnosed with anorexia nervosa, their brain activation was observed with functional magnetic resonance imaging technique during working memory tasks; as a result, hyperactivation was observed in their parietal and temporal lobes, especially in superior temporal gyrus, when they were dealing with the tasks.⁴⁰ On the other hand, in a number of studies, no significant performance differences between individuals diagnosed with certain eating disorders and healthy control groups were found in working memory measures, especially in the Iowa Gambling Task.^{16,41} Although the meta-analysis and review studies mention the existence of contradictory findings on this issue, there are some impairments in working memory and executive functions in general, and these impairments are associated with prefrontal brain circuit functions as a biological base.¹⁶ In particular, there are different serious causes about the severity of working memory impairment, measurement scales, and stimuli, and the number of studies examining the potential impact of other relevant factors such as duration of the disease, severity of symptoms, or comorbidity are very few.⁴²

Central Coherence

Another executive dysfunction of individuals suffering from eating disorders is central coherence, which can be defined as the difficulty of combining singular pieces into a meaningful whole and focusing too much on small details. The weakness of central coherence is a factor that contributes to eating disorders.⁴³ To measure the central coherence ability, neuropsychological tasks such as the Rey-Osterrieth Complex Figure Test,⁴⁴ the Group Embedded Figures Test,⁴⁵ the Object Assembly⁴⁶ and the Overlapping Figures Test⁴⁷ are commonly used. People with anorexia nervosa are known to exhibit the ability of central coherence based on the details and strong cognitive rigidity.^{12,16,19} In addition, in the meta-analysis study of Lang et al.,⁴³ they examined the weak central coherence effect in people diagnosed with eating disorders, and they found superior local processing but inefficient global processing in people suffering from eating disorder. Central coherence's weakness may be the evidence that people with a diagnosis of an eating disorder often show attentional bias (e.g., focusing more on details), especially for body image, weight, and eating.¹¹ Besides, it can be difficult to generalize the results to all eating disorders because there are a very few central coherence studies in binge eating disorder.⁴²

Problem Solving and Decision Making

Problem solving and decision making are other impaired executive functions in people suffering from certain eating disorders. The decision making process is an important issue to be investigated within the scope of eating disorder psychopathology due to the inconsistencies in the goals and actions of people with eating disorders (e.g., bingeing despite the desire to lose weight) or the ongoing actions despite their needs for change (e.g., they are stubbornly restricted eating although they are underweight).⁴² The most commonly used decision making tasks are the Iowa Gambling Task, the Columbia Card Task, the Game of Dice Task, and the Balloon Analogue Risk Task.⁴⁸ The Iowa Gambling Task is often used for the determination of deterioration in eating disorders.¹⁸ Nevertheless, contradictory results were found in studies about decision making impairments in eating disorders. For instance, in some studies, it has been stated that people suffering from bulimia nervosa and/or anorexia nervosa have worse decision making performance than healthy controls,^{12,18,19,28} which is either a consequence of weak set shifting ability⁴⁹ or low impulsivity.⁵⁰ Another study examining the differences in people

suffering from anorexia nervosa and binge eating disorder in terms of decision making, set shifting and central coherence functions, both individuals suffering from anorexia nervosa and binge eating disorder have poorer decision making and difficulties for adapting new changes compared to healthy controls, even as impulsivity increases, their performance is weakened.¹⁹ To measure the problem solving performance, neuropsychological tasks such as the Tower of Hanoi, the Tower of London, and matrix reasoning are used, and it has been found that individuals suffering from anorexia nervosa disorder have less problem solving ability than healthy controls.¹⁸

Implicit and Explicit Memory

Explicit memory is measured by remembering past events or experiences consciously through recall, recognition, or recency judgment; whereas implicit memory stores the information that cannot be recalled consciously, but only measured by observable performance. Both explicit and implicit memory studies were conducted in people with having eating disorders. It has been observed that people with eating disorders (especially anorexia nervosa and bulimia nervosa) show explicit memory bias by representing an elaboration process for words related to body weight or shape and eating.⁵¹⁻⁵³ Moreover, memory bias about food or body-related words was found to be related to hunger levels of people with bulimia nervosa. It was not only specific to people having bulimia nervosa or anorexia nervosa but also observed in people suffering from depression.⁵² However, it is not exactly clear which situations are related to these memory biases. In recall tests, individuals with anorexia nervosa have memorized the words related to the recently mentioned themes better than neutral words, but these biases are not correlated with the anxiety levels and symptoms of them.⁵⁴

On the other hand, explicit memory bias is observed in people with eating disorders. They are more likely to recall the food, body shape, and weight-related words than the neutral-valenced words.^{41,51} This effect was not only observed in recall tests⁴¹ but also in recognition tests.⁵⁵ In Tekcan et al.⁵⁵'s study of 46 women, of whom 23 diagnosed with anorexia nervosa and 23 healthy controls, the experimenters tested people with anorexia nervosa with free recall and yes/no recognition tests to investigate the directed forgetting effect. In a directed forgetting task, participants are first told to memorize as many items as possible from a list of 54 experimental items and four buffer items. For half of these experimental items, participants are given instructions to remember them, and for the other half, participants are given instructions to forget them. However, for buffer words, participants are given instructions to always remember them. After this session, experimenters continued with the test session. At the beginning of the test session, the participants have performed a free recall task followed by a recognition test, including 18 distractor words for each category (positive, negative, and neutral). For each word, participants are asked to express whether or not they studied them. A directed forgetting effect manifests itself on people suffering from anorexia nervosa with a higher rate of recollection of words that to be forgotten, and this effect made a more significant difference for disorder-related words compared to neutral ones. Therefore, in consequence of overvaluation of weight and shape, an extreme focus on the information and deep processing about them, which is commonly observed in people with eating disorders, especially in anorexia nervosa, binge eating disorder, and bulimia nervosa, it is possible to explain the higher rate of recalling of people with an eating disorder by cognitive bias, even attentional bias.^{20,22,51,53,55-58}

While research on explicit memory in eating disorders indicates the presence of cognitive bias, it is not possible to get the same deductions for implicit memory because studies on implicit memory are limited.¹¹ In a study by Hermans et al.,⁵¹ they used the word stem completion task

to measure implicit memory performance, and they found no evidence for a similar bias like explicit memory. In contrast, another study⁵⁹ used the Jacoby's White Noise Judgment Task, an implicit memory test, in which participants were required to repeat certain sentences aloud after listening. Then, the participants listened to these old sentences together with new sentences that they had not listened before with a white noise changing intensity in the background. The participants were expected to assess how high the intensity of white noise in the background. After all, they perceived the intensity of white noise in familiar sentences as less and softer than the new ones and there was some partial evidence for implicit memory bias in people with anorexia and bulimia nervosa for emotional sentences as against neutral sentences; however, there was no supportive evidence about explicit memory bias.⁵⁹ Therefore, the research findings of both explicit and implicit memory bias studies in eating disorders are controversial, and further studies are needed on people with eating disorders to obtain clear information.

Short-Term Memory and Long-Term Memory

Individuals diagnosed with certain eating disorders selectively process food-, weight, body shape-, or disorder-related information.⁶⁰ As a result, these disorder-related stimuli can lead to improved memory performance in "incidental, explicit or self-referential encoding tasks".^{51,61} Studies on eating disorders also include two types of memory, which are short-term memory and long-term memory. Short-term memory is evaluated by the immediate recall tasks, while long-term memory is evaluated by using delayed recall and recognition tests. Depending on the retention interval given between the study and test sessions, recall and recognition performance can be measured either immediately or delayed. Recall refers to the cognitive process of retrieving the information which is stored in the past, while the recognition test measures a person's ability to distinguish previously presented information from new information. Long-term memory, which is described as learning performance, reflects the capability of an individual to hold information in mind as a function of the number of acquisition trials.⁶²

Both short-term and long-term memory studies conducted on eating disorders were mostly performed on individuals with anorexia nervosa; research findings show conflicting results, though. The performance levels did not differ in verbal short-term memory (immediate recall or learning) and long-term memory (delayed recall or recognition) of people suffering from anorexia nervosa.^{63,64} In addition, Lauer et al.⁶⁴ and Jones, Duncan, Brouwers, and Mirsky⁶⁵ examined people having anorexia nervosa and bulimia nervosa in terms of short-term and long-term memory performances, and they did not observe any significant difference compared to healthy controls. Besides, there are also studies showing that people with anorexia nervosa short-term and long-term memory performances are weaker in comparison with the healthy controls.^{35,66-68} The limited number of verbal short-term and long-term memory studies in eating disorders hinders consensus in the literature.³⁵ For example, in a total of 11 studies examining the memory performances on adolescents and adults suffering from anorexia nervosa, only one study⁶⁹ found that people with anorexia nervosa had better verbal short-term memory performance compared to the healthy control group. In the other seven studies, no significant difference was found between individuals with anorexia nervosa and healthy control group in terms of their verbal short-term memory performances. In contrast, in three studies, it was found that people suffering from anorexia nervosa performed worse than healthy controls.⁷⁰ Although similar cognitive tasks such as verbal recall or digit span, were applied in the test batteries in these studies, one study showed that the immediate recall (short-term memory) performance of anorexics was poor,⁶⁷ while another study found that these people had poor delayed recognition performance

(long-term memory), but they had superior working memory performance.⁶⁹

In Terhoeven et al.⁶²'s study, which is one of the most recent studies on short-term and long-term memory in eating disorders, the Verbal Learning and Memory Test (VLMT), a German version of the Rey Auditory Verbal Learning Test,⁷¹ was applied to the anorexia nervosa group and healthy controls. VLMT measures short-term memory that is based on immediate recall, and long-term memory that is based on verbal recognition and delayed recall. Recall, recognition, and learning performances were measured with two separate lists; one of them included fifteen semantically relevant words based on categories (e.g., for sports category: Eishockeystar – Ice Hockey Star) and the other list included fifteen semantically irrelevant words (e.g., Festmonat – Holiday Season). For the recall performance assessment, the words from the semantically related or unrelated list were read to the participants five times in total. After each repetition, the participants were tested for immediate recall performances. Learning performance was measured by subtracting the total number of words recalled in the first recall trial from the sum of the words recalled in a total of five recall trials. After these five immediate recall trials, two different lists of fifteen semantically relevant (e.g., for musical instrument category: Bassgitarre – Bass Guitar) or irrelevant (e.g., Klatsch – Gossip) distractor words for proactive interference, and immediate recall trials were made again for these distractor lists. After an interval of 30 minutes, the participants tried to remember as many words as they could from the first two lists (delayed recall) by free recall. Then, a recognition test was applied. The participants distinguished the words from a total of 50 words that are previously seen, including all words that previously recalled immediately, and 20 new words they had never seen before. According to the results, regardless of whether the words were semantically related or not, the participants' short-term memory performance was significantly poorer in anorexia nervosa group than the healthy group, but there was no significant difference between these two groups in terms of long-term memory performance.⁶²

Therefore, short-term and long-term memory dysfunctions related to impaired working memory in anorexia nervosa should be discussed and more comprehensive studies should be carried out, including different eating disorder types and sub-types other than anorexia nervosa.

Autobiographical Memory

Autobiographical memory refers to the whole recall of self and personal experiences and includes both fact and event information. The remember-know distinction emphasized by Mandler⁷² and Tulving⁷³ is crucial in the experimental studies on the episodic memory retrieval. Knowing refers to the familiarity to an event or experience, while remembering refers to a full recollective experience of an event. Therefore, the specificity of autobiographical memory has been the subject of much research in different populations.⁷⁴ The studies conducted on this fact are generally examined with the Autobiographical Memory Test developed by Williams and Broadbent.⁷⁵ Considering the fact that the occurrence of the effect of the autobiographical memory specificity effect, many studies predict the severity of psychopathology and treatment success in eating disorders. Autobiographical memory has been examined in feeding and eating disorders in recent studies.⁷⁶⁻⁷⁸ Ball et al.⁷⁶ analyzed the relationship between restrained eating and memory specificity among female university students. In the experiment, participants were shown the body image and food-related words and unbiased words. Their autobiographical memories about these words were then asked. The Restraint Scale was applied to measure the restriction level of participants in food. Those who took higher scores on the Restraint Scale had fewer autobiographical moments, and their memories were more general. In other words, dieters avoided telling their personal

memories more than non-dieters when they saw food and diet-related words such as chocolate, mirror, or bikini. This phenomenon is called overgeneral autobiographical memory. Overgeneral autobiographical memory is seen not only in restrained eaters but also in people suffering from bulimia nervosa and anorexia nervosa.^{78,79}

Many affective disorders may suffer from difficulties in retrieving the specificity of autobiographical memory (e.g., overgenerality of memory is a common feature in people with major depressive disorder or traumatized individuals). There is a similar pattern in individuals suffering from eating disorders.^{76,79,80} Two models try to clarify reduced autobiographical memory specificity, in other words, overgenerality of memory within psychopathology. The first model is the Functional Avoidance Model by Conway and Pleydell-Pearce⁸¹, the second model is the CaR-FA-X Model by Williams et al.⁸²

According to the Functional Avoidance Model, people avoid remembering memories that create negative affectivity.⁸¹ Raes et al.⁸³ stated that this coping strategy is a functional and habitual response pattern to move away from anxiety-laden memories because it is flexible and helpful. This functional situation makes autobiographical memory specificity even more difficult.⁸¹ Hence, functional avoidance is stated as a reason, as well as reduced executive functioning, for overgeneral autobiographical memory associated with eating disorder psychopathology. Specific negative memories are known to activate coping mechanisms related to eating behaviors. Researchers have shown that people suffering from eating disorders with bulimic features have reduced autobiographical memory flexibility. As a reason for this, people use binge eating, which is one of the symptoms of bulimia nervosa as a coping strategy.³⁸

The CaR-FA-X Model is a more elaborated version of the Functional Avoidance Model. It mentions three mechanisms: CaR (capture and rumination), FA (functional avoidance) and, X (impaired executive control). Capture and rumination occur as a result of the capture of self-related information when a cue is presented that will intensively activate the individual's self-schemas, which states to a person's beliefs and opinions about themselves (e.g., weight: I can never lose weight). This captured self-related information disrupts the memory hierarchy and ruminates on restoring information in memory at a more general level.⁸² Functional avoidance refers to keep away from remembering painful experiences and feelings about the situation (e.g., for eating disorders, it is about body image and weight loss), and impaired executive control which reflects the deficits in updating and maintaining the information, in turn, causes decreased autobiographical memory specificity.⁷⁶

Overgenerality of memory also affects people's skills, such as problem solving or imagination of future events.⁸² Moreover, it is known that emotion regulation of people with eating disorders is disrupted, and they display maladaptive behaviors such as binge eating because they try to get away from negative feelings.⁸⁴ This situation negatively affects the autobiographical memories of individuals suffering from eating disorders, and it can be said that they have emotion regulation dysfunctions. For example, in the study of Huber et al.,⁸⁵ they found that people with anorexia nervosa have fewer and more general memories in recalling specific autobiographical events in response to food and body-related cues, and the specific memories they retrieved were negative especially for body-related cues.

Regarding this issue, the Fading Affect Bias (FAB), which refers to the propensity for the affect caused by thinking of positive past events to disappear more slowly than the affect caused by thinking of negative past events, is significantly reduced in individuals who show signs of disordered eating in the context of autobiographical memory and emotion regulation relationship. Eating, shape, and weight concerns about eating

disorder signs each have their effect on this bias.⁸⁴

Findings of overgenerality of autobiographical memory or reduced autobiographical memory specificity effect in eating disorders are contradictory. Some studies support the Functional Avoidance Model,^{80,86} while some studies support the CaR-FA-X Model.^{76,83} Although the supported models are different, the overall conclusion of the studies is that overgeneralization in autobiographical memory reveals reduced autobiographical memory specificity effect due to functional avoidance. In future studies, it is essential to take into account the capacity of autobiographical and working memory, including neural circuits, when processing body-related content⁸⁷ and, specific autobiographical memory processes that lead to both FAB and its disruption.⁸⁴

CONCLUSION

Research findings on memory processes and executive functions in eating disorders indicate that there are significant deteriorations in individuals suffering from various eating disorders, especially in anorexia nervosa disorder. Otherwise, a few studies are focusing on the neuropsychological evaluation of executive functions in people suffering from eating disorders. Given the lack of comprehensive investigations of executive function impairments, especially in binge eating disorder and various subtypes of eating disorders (e.g., bingeing/purging subtype of anorexia nervosa), it prevents the generalizability of the research findings.¹² At the same time, people's BMI's remarkable contribution to their specific executive function skills can be examined in more detail based on some common aspects of extreme weight conditions such as anorexia nervosa or obesity; thus the generalizability of working memory and executive functions findings can be improved.^{12,16}

Despite the existence of cognitive bias in explicit memory bias on eating disorders, implicit memory studies' findings are limited. The results of short-term and long-term memory impairments in anorexia nervosa are also insufficient, and more extensive research is required, including other eating disorder types. Autobiographical memory, which is another type of memory with limited findings, has recently started to be examined on people having eating disorders. Reduced autobiographical memory specificity effect has been observed in people with eating disorders in addition to many affective disorders. In other words, overgeneral autobiographical memory is a functional avoidance behavior compared to the two most known models: Functional Avoidance Model and CaR-FA-X Model. Conway and Pleydell-Pearce proposed a method called a truncated search for this behavior. According to this method, a truncated search is a passive avoidance reaction. Perceptual-sensual fragments emerge related to the representation of past traumas and psychological problems that have been encoded in the person's episodic memory and lead to catastrophic distress in one's mood.⁸¹ Negative affect observed with the emergence of these fragments leads to a passive avoidance reaction. This situation, which can also be called cognitive avoidance, is seen as a developing but functional coping strategy over time.⁸²

All of the findings on executive functions and memory processes in eating disorders pave the way for early diagnosis and treatment methods for these disorders. Considering the importance of cognitive impairments, genetic and twin studies can also be included in the research process to evaluate the heritability of eating disorders, and new psychotherapeutic intervention techniques can be determined, and preventive measures can be taken in people at risk of developing eating disorders to prevent or reduce the occurrence of cognitive impairments. Likewise, some studies reported that 33% of the male athletes and 62% of the female athletes who started to do weight classed, such as kickboxing or aesthetic sports for body image such as bodybuilding, were predisposed to eating disorders.⁸⁸ It is also known that eating disorders are frequently

seen in the age of 18 and over, under the age of 60.⁸⁹ Consequently, it is assessed that studies about cognitive impairments observed in memory processes and executive functions have potential to contribute greatly to psychotherapeutic methods such as dialectical behavior therapy that has a great effect on eating disorders (e.g., bulimia nervosa or binge eating disorder) and cognitive behavioral therapy.⁹⁰

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