Proceedings of the International Conference on Global Politics and Socio-Humanities
DOI: 10.54254/2753-7048/26/20230805

The Correlation Between Anorexia Nervosa and Depression, Anxiety, and Memory

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Abstract: Neuropsychological functioning became an area of interest, researchers tended to gain more understanding and therapy options in anorexia nervosa (AN) based on the results of neuropsychology of anorexia nervosa. The study investigated the neuropsychological deficits in individuals with anorexia nervosa in comparison to healthy individuals. The main direction is to explore the effects of AN on the symptoms of depression, anxiety and memory performance in AN patient. Existing evidence on depression, anxiety and memory symptoms for outcomes related to AN was reviewed. The findings from current studies identify extensive evidence for the correlation between anorexia nervosa and depressive, anxious and memory symptoms. Anxiety and short-term memory demonstrated close relationships with AN. Most of the research found there was a positive correlation between the symptoms of depression and AN. The experiments about the recovery of memory in AN patient after treatment drew different conclusions. Some present controversies and areas in future studies are determined.

Keywords: anorexia nervosa, depression, anxiety, immediate memory, neuropsychology

1. Introduction

Anorexia nervosa (AN) is a severe mental illness associated with severely low body weight (body mass index [BMI] < 17.5 kg/m2) caused by restrictive eating [1,2]. In previous studies, researchers focused on the behaviors and cognitions in the diagnosis and therapy of patients with anorexia nervosa [1]. The inferior treatment outcomes stimulated researchers to seek a new direction to conduct their investigations. Neuropsychological functioning became an area of interest to emphasize in the research, because it was possible to provide a better understanding of patients' behaviors and cognitions of the illness for researchers and doctors [1]. According to this, a large number of research revolved around neuropsychological impairments, especially some typical symptoms like depression and anxiety in AN patients. These outcomes can provide more information about the direction of difference between AN participants and the control group. In addition, some studies stated that AN affected the cognitive area in patients' brains. However, many of these results were based on studies of visual-spatial abilities and executive functions [3]. Several current reviews were searched to find more memory performance between AN patients and healthy controls.

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2. Definition

2.1. Definition of Anorexia Nervosa (AN)

In the first edition of the Diagnostic and Statistical Manual of Mental Disorders, anorexia nervosa (AN) was classified under a category of psychophysiological autonomic and visceral disorders in the 1950s [4]. For ease of understanding, abbreviation of AN is preferred to use in the following text. As the development of psychology, AN refers as a category of feeding and eating disorders in DSM-5 now. Meanwhile, three fundamental symptoms and criterion of AN are mentioned in DSM-5 involving limitation in persistent energy intake, intensive fear, and anxiety of gaining weight or be outweighed even in low level of weight, and the obstacle in perception of weight or shape. Some associated features involving both depressive signs and symptoms in patients underweight too much are found in DSM-5 [5].

2.2. Definition of Depression

According to the DSM-5, depression is a depressive illness involving major depressive disorder, disruptive mood dysregulation disorder, and a few other types of depression. The additional symptom of AN that mentioned in DSM-5 is the major depressive disorder. Furthermore, the criterion of major depressive disorder includes having depressed mood every day, reducing interests or pleasures and attention or concentration, working up or reducing an appetite, feeling fatigue and guilt or invaluable, insomnia, psychomotor agitation, or retardation. These symptoms could have negative influence on patients' daily, working, and social life [5]. The depressive symptoms is more understandable and will be used below.

2.3. Definition of Anxiety

Anxiety refers to anxiety disorder that have features with excessive fear or anxiety and some associated disturbances. In DSM-5, the development of anxiety disorders could lead to the high risk in AN is also be mentioned. A social anxiety disorder—social phobia is a typical example that AN patients could feel anxious and embarrassed when they found some other people are seeing them [5].

3. Literature Review

3.1. The Correlation Between AN and Depressive Symptoms

Nowadays, some studies about eating disorders pay more attention on the correlation between AN and depression. In Pleple et al.'s study, 222 AN patients participated the experiment that investigated the correlation between AN and depressive symptoms. To avoid some confounding variables, patients who had some potentially confound disorders including some metabolic diseases could be excluded. The time intervals of the experiment were before patients went to the hospital and after they left there. By using some scales like Beck Depression Inventory (BDI), some indictors diagnosed the level of AN like Body Mass Index (BMI). Meanwhile, it has been found a positive association between AN symptoms and depressed symptoms in cross-sectional research, based on analysis in statistical aspect like multiple linear regression. There is also a negative correlation between AN change and the change in depressive symptoms in the longitudinal study [6]. 70 female patients that meet a DSM-4 criterion were included by some other researchers to look into this correlation. For assessing the severity of depression symptoms, some scientific scales, including the BDI and Hamilton Rating Scale for Depression (HRSD), as well as a statistical analysis—the BMDP Statistical Software package—were used. Eventually, the researchers found that underweight AN patient always had higher scores in depressive symptoms' scales. This proved that AN patients got lower level of depressive symptoms

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when they gained weight. However, the depressive symptoms could not eliminate over time [7]. Meanwhile, a study also found that emotional dysfunction was an important feature in AN because AN patients had higher levels of co-morbid psychopathological conditions. Therefore, emotional dysfunction could be a mediator between AN and depressive symptoms [8]. Overall, most of researchers found the positive correlation between AN and depressive symptoms.

Whereas some researchers found different results above. An example is Kawai et al.'s study. 24 women patients that accord with AN criterion in DSM-4 participates the experiment by using some scales involving Eating Disorder Inventory (EDI) to evaluate the level of AN and the Zung Self-Rating Depression Scales (SDS) to evaluate the level of depressive symptoms. Meanwhile, the researchers also used some statistical analysis involving multiple linear regression and forced removal method to find the correlation between AN and depressive symptoms. Finally, they found a different result that there was no correlation between AN and subjective symptoms including depressive symptoms [9]. The reasons why the result was reached may be some limitations in this study. The limitations will be discussed in the next part.

3.2. The Correlation Between AN and Anxiety

Anxiety usually comes from the great mental stress, worried or fears. These could come from the environment, society, or the people around. There are also some physical symptoms appear together with the anxiety. So, the relationship between AN and anxiety might be reciprocal, the anxiety could cause the AN. Also, the AN can leads to the anxiety feeling. The most common symptoms of AN is underweight, so most research investigate about the relationship between the underweight of AN and the level of anxiety. Previous research has shown that people with anorexia experience different depression and anxiety level at different stages of the disorder, patients also will have different physical symptoms. To the patients who have AN have some difference on emotions with healthy people. Studies have shown that people with anorexia experience increased anxiety when they are underweight. As the weight comes back on, the symptoms of anxiety improved. Even though the anorexic patients had regained their weight, they still had higher symptoms of anxiety than the healthy people.

In the Hildebrandt et al.'s study, they investigate about the anxiety in Anorexia Nervosa. The passage talked about the triggers of the anxiety in AN. Eating, food, social comment, shape, and weight, interoceptive cues, all of these could be the cause of the anxiety, so anxiety is a central mental feature of AN. Individuals usually very pay attention to the social comment to themselves, so this leads the social evaluation becomes a trigger of anxiety and cause of AN. The concomitant physical symptoms could be some stomach diseases. The passage also talked about the correlation between fear and AN, worry and AN. The article notes that AN overlaps with anxiety disorders, and that people with anorexia face unique triggers that trigger feelings of anxiety. Anxiety, worry, and related avoidance behaviors are at the core of AN. Exposure therapy is one of the most effective interventions for treating anxiety and avoidance behavior. Family-based treatment approaches have much in common with exposure therapy in the management of anxiety problems in anorexia. The home-based treatment approach enables a comprehensive exposure therapy through dietary/eating exposure in the patient's home environment. This lateral proof that there is a high correlation between anxiety and AN. The limitation of this research is that it mainly concentrated on teenagers, and there might be some mental harm to those teenager participants who experienced exposure therapy [10].

The depression, anxiety and obsessionality are the common emotion present in underweight patients who with AN. The research compares the emotion level of healthy women and the women with AN. In Pollice et al.'s study, they used standardized trained rather instruments to rate depression, anxiety, obsession, and compulsion. They use Hamilton Anxiety Rating Scale to rate the level of anxiety during the research. It mainly concentrated on self-report The depression and obsessionality

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are also studied in the research. They studied three groups of women with AN. The participants' anxiety level have been measured at the beginning of the research, then after a series of treatment (weight control) their anxiety level have been measured again. The result has shown that the score for depression, anxiety and obsessionalty were most increased in underweight state. Which means anxiety present in AN patient. As the weight increased, these scored has reduced. Which means these negative emotions could improve by the control of the weight. So, the correlation between the AN and anxiety is obvious. The limitation of the research is that it only focusses on the female with AN. There might be differences of different genders with AN. So, the results can't represent the whole population of AN. It can only show the situation of female with AN [7].

There also some view said that the anxiety in AN might influence the nerves system function. But there is research shows that the anxiety during the AN do not affect the neuropsychological function. In the research it shows the relationship between the BMI (body mass index) and anxiety of AN [11].

To conclude, there is actual correlation between AN and anxiety. Anxiety is the mainly feature of the AN, also anxiety could be the trigger of the AN. The anxiety disorders also have many similarities to the AN. There is a close relationship between AN and anxiety.

3.3. The Correlation Between AN and Memory

Many studies explored the association between anorexia nervosa and cognitive obstacles. Memory performance was a necessity to be tested. Memory performance includes short-term memory (immediate recall and learning) and long-term memory (delayed recall and recognition). According to the research from Terhoeven et al., 27 females with acute AN were in the patients' group which was compared to the control group with 30 female participants. The assessment includes the Rey Auditory Verbal Learning Test and the Wechsler Memory Scale (WMS-R). AN patients performed normal word recognition but experienced difficulties with recalling and learning them. Meanwhile, their performance in long-term memory was like healthy control participants [2]. Similarly, in the study of Sherman et al., RCFT measures of strategic planning and immediate nonverbal memory demonstrated that impaired organization in the RCFT led to decreased encoding and retrieval of information from memory, so copy and recall conditions were impaired [12]. Agreed with the previous research, Lozano-Serra et al. illustrated that the control group had better scores in all situations, so the AN group and the control group differed in immediate recall, time to copy, and organization of RCFT. [3].

Patients with Anorexia nervosa usually need a period for therapy and recovery, contributing to several follow-up studies. Investigators constantly tracked the situations and changes and updated their statistics to check the memory differences between the time before therapy and the period after recovery in the same AN group. The main finding from Lozano-Serra et al. is that although there was an apparent different score between the underweight AN group and the normal control group, patients with AN improved significantly after recovery [3]. However, Bosanac et al. acknowledged that the AN group had significant impairment in CDR immediate word recall, but these researchers drew a different conclusion in the follow-up studies. They found that weight recovered AN participants had consistent negative results with underweight AN patient [13]. Therefore, it is determined that patients with AN significantly impaired immediate memory, but investigators did not reach a consensus on whether their difficulties in memory could recover after treatment.

4. Discussion and Suggestion

4.1. The Correlation Between AN and Depressive Symptoms

In conclusion, the result in the most of research is that there is a positive correlation between AN and depressive symptoms. When patients AN symptom gradually alleviated, their level of depressive

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symptoms would also be relieved but could not be eliminated [6,7]. Furthermore, some researchers also found indirect but more clear relationship between them. For example, Rai et al. found that the emotional dysfunction has indirect correlation between them, because it works as a mediator to impact both AN and depressive symptoms [8]. Therefore, when doctors treat some AN patient, they could not only concentrate on their BMI to monitor the level of weight, but also pay more attention on their mental conditions like depressive symptoms. These may help doctors treat these patients more comprehensive and ensure patients' both physical and mental health. In the future, the researchers can investigate more mediators to find the real correlation throughout the mechanisms between AN and depressive symptoms.

By contrast, a different result was found in Kawai et al.'s study. They found that there is no correlation between AN and depressive symptoms [9]. However, this in appropriate result may be because some limitations in this study. Firstly, a general limitation is the small sample size that only 24 participants and same gender and culture that were all in Japan, it could lead to the lack in generalizability and eventually may make study invalid to get an inaccurate result. Moreover, some inappropriate statistical analysis could also lead to the larger p-values ($p>0.05$). Therefore, these p-values may provide some inaccurate and even wrong result. Next, three of the participants used some anti-depressed drugs in the process of this experiment. Medicine may be also a factor that had an influence on the results in SDS and eventually lead to inaccurate results. Finally, the researchers used cognitive behavior therapy (CBT) to help patients reduce the AN symptom through their experiment. However, the function of CBT is not only reducing AN symptom but also alleviating some other symptoms like depressive symptoms. Hence, the results of this study may be lack of validity. In summary, this study may not very accurate and valid to prove the correlation between AN and depressive symptoms.

4.2. The Correlation Between AN and Memory

In general, there is a positive correlation between anorexia nervosa and memory. Patients with AN generally impaired immediate memory and had normal performance in delayed memory. Although the score of delayed recall in AN group was less than the score gained by controls, participants with AN could fully remember the materials after a 30-min delay. This further suggested that AN would not decrease patients' ability to store information. Lower scores of delayed recalls in AN group might be caused by the low gaining of information in initial encoding which also contributed to immediate memory difficulty, but the total amount of information patients learned was similar to it learned by controls [14].

Several factors may cause further limitations of the research. Despite statistical control, participants with different education levels may affect the result of the investigation. Different educational background was more likely to influence the speed of understanding and memorizing the information in the test. Although investigators strictly control the gender and age of participants in their experiments to make sure that the results could be more accurate, these outcomes could only describe the situations of female adolescents but could not be appropriate to males and other age groups like adults and elderly people. Meanwhile, those experiments involved a small number of participants, so the samples were not enough to be supported as evidence. More importantly, obsessed with the symptoms of neuropsychological impairments, some patients were taking related medicine. The functions of medication might play a role in affecting the investigation results.

Whether the immediate memory impairment could be recovered or improved after treatment, researchers have not yet reached a definitive conclusion, so more relative follow-up studies are needed. Therefore, our future study will focus on evaluating the effectiveness of cognitive rehabilitation used in patients. With these results of exploration, researchers will be more likely to adjust and improve the methods of therapy.

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5. Conclusion

The correlations between AN and two psychological symptoms—depressive symptoms and anxiety and memory are mentioned in the dissertation. According to previous studies, the correlations are all found. In the aspect of depressive symptoms, the positive correlation between AN and this symptom is found. Therefore, the depressive symptoms will reduce when AN reduces. In anxiety aspect, AN and anxiety interact with each other. Anxiety could be a feature in AN, meanwhile, AN could also lead to anxiety. AN could lead to the impairment in the memory. During the study in our dissertation, some other controversy is also found. Therefore, the limitations in some experiments that gave different results are demonstrated in the discussion part and the results are ignored in general conclusion. We supposed that there were the clear correlations between AN and depression, anxiety, and memory, but more specific feature like mediators will also be found in the future by some more elaborate research. Meanwhile, when patients have AN symptoms, doctors could pay more attention to not only their physical functions involving weight, but also their psychological situations like psychological disorders and functions of memory. Some associated treatments including exposure therapy could also be used to alleviate AN symptoms.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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