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The Effectiveness of Alpha-Asymmetry Neurofeedback on Depression and Rumination in Women with Sexual Dysfunction

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Quantitative Study

Abstract

Background: The purpose of the current study was to correct frontal alpha asymmetry (FAA) in order to reduce depression and rumination in women with sexual dysfunction using neurofeedback intervention and comparing its effectiveness with a control group.

Methods: The research method was a quasi-experimental design with a pretest-posttest and control group. The target population included all women with sexual dysfunction in the northern part of Tehran city, Iran, in the year 2021. Initially, a sexual dysfunction questionnaire was distributed among 100 women with sexual dysfunction visiting psychological clinics in the northern part of Tehran, and from among those who scored high on the sexual dysfunction questionnaire, 20 individuals were conveniently selected and divided into two groups of 10 (experimental and control). At this stage, depression and rumination questionnaires were administered as a pretest to the subjects. Subsequently, the experimental group received the intervention of FAA correction in 15 sessions of 45 minutes each, and then, the aforementioned tests were administered again as a posttest. Data were analyzed using analysis of covariance (ANCOVA) in SPSS software.

Results: The results of this study emphasize the effectiveness of alpha asymmetry neurofeedback in reducing symptoms of rumination following neurofeedback training, which is significant due to the important role of these two variables in the continuation of depression.

Conclusion: The findings of the current study suggest that neurofeedback training can be used as a beneficial intervention to reduce symptoms of depression and rumination in women with sexual dysfunction.

Keywords: Alpha asymmetry; Neurofeedback; Depression; Rumination; Sexual dysfunction

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Introduction

Marriage and cohabitation always start with a beautiful outlook for couples, but after a while, due to differences between men and women that stem from growing up in two different environments (Ruhlmann, Gallus, & Durtschi, 2018), as well as a lack of sufficient understanding of each other's psychological characteristics and personality, problems arise, creating an unpleasant image of marriage (Ebrahimi, 2020). Moreover, marital relationships are sometimes accompanied by problems and dissatisfaction that lead to conflict in couples. After marriage, changes occur in the lifestyle, social relationships, and interpersonal relationships of both parties, all of which require the couple's ability to adapt (Siegel, Dekel, & Svetlitzky, 2021), as each individual has been nurtured in a unique developmental context and possesses a lifestyle that includes personal and social values and beliefs, which are, in fact, different from those of their spouse. Thus, they must adapt to these conditions, sharing life with another person who has different beliefs, values, and culture (Jomenia, Nazari, & Soliemanian, 2021).

One of the issues that cause conflict and its continuation in couples is their sexual dysfunction. Although the exact prevalence of women's sexual disorders is difficult to determine, existing statistics indicate that about 19% to 45% of women suffer from at least one sexual problem. A good sexual relationship can lead to pleasure, satisfaction, and emotional closeness in couples, while sexual dysfunction can cause severe individual dissatisfaction and negatively affect quality of life (QOL) and interpersonal relationships (Mosadegh, Darbani, & Parsakia, 2023; Shadanloo, Yousefi, Parsakia, Hejazi, & Dolatabadi, 2023). Even in the short term, this disorder can lead to the emergence of dissatisfaction, grief, and sorrow, and if it becomes chronic, it can lead to disturbance, depression, damage to interpersonal relationships, increased conflict, and problems in other aspects of individual life (Hamzehgardeshi, Sabetghadam, Pourasghar, Khani, Moosazadeh, & Malary, 2023). According to the American Psychiatric Association (APA), female sexual dysfunction is divided into 4 categories: disorders of sexual desire, arousal, orgasm, and pain, where sexual desire disorder means that despite being physically healthy, the individual has no desire for sexual participation and behavior, and arousal disorder appears as a decrease in vaginal lubrication or painful intercourse, in some of these women, vascular congestion in response to erotic stimuli significantly decreases. Physiologically, orgasm means reaching the peak of sexual pleasure. Before reaching this stage, the arousal phase must be completed. The fundamental problem in most patients is that they remain in the arousal phase and cannot move to the next stage, gradually losing their sexual desire (Hasanzadeh Mofrad, Karami Dehkordi, Mozaffar Tizabi, & Amirian, 2015).

Women's sexual dysfunction is a multidimensional and multifactorial problem linked to biological, psychological, social, and cultural factors, affecting overall well-being and QOL (Ghassami, Shairi, Asghari Moghadam, & Rahmati, 2014). One of the characteristics in women with sexual dysfunction is depression. Despite numerous researches on improving diagnostic and prognostic methods, the prevalence of depression remains high (Patten, Williams, Lavorato, Bulloch, Wiens, & Wang, 2016).

According to the World Health Organization (WHO), by 2020, depression will be the second leading cause of disability (Reddy, 2010). In this context, rumination can be considered an underlying factor for the failure of psychotherapeutic and pharmacological methods, and consequently, as an explanation for cognitive deficits

in depressed individuals (Askari Masuleh & Taheri, 2023; Watkins, 2018). The cognitive resource theory suggests that negative thoughts of depression and rumination consume the cognitive abilities that should be involved in task-related processes (Gotlib & Joormann, 2010; Levens, Muhtadie, & Gotlib, 2009; Watkins & Moulds, 2005).

Based on this theory, valuable cognitive resources are diverted towards irrelevant depressive and ruminative thought processes. Some researchers believe that rumination in depression stems from a defect in executive functions in cognitive control functions, such as inhibition (De Lissnyder, Ernst, Derakshan, & De, 2010; Owens, Koster, & Derakshan, 2013), ultimately leading to excessive processing and preoccupation with negative emotions (Gotlib & Joormann, 2010; Owens et al., 2013).

Overall, findings from various studies indicate that there is a relationship between depression, rumination, and cognitive impairment, especially damages related to attention, inhibition, and working memory processes (Connolly, Wagner, Shapero, Pendergast, Abramson, & Alloy, 2014; Gotlib & Joormann, 2010; Hertel, 1998; Levens et al., 2009; Watkins & Moulds, 2005).

Furthermore, frontal left asymmetry (FLA) is a common finding in brainwave measurements of individuals with depression and rumination (Blackhart, Minnix, & Kline, 2006; Feng et al., 2012; Mathersul, Williams, Hopkinson, & Kemp, 2008). FLA is defined as the relative difference between the levels of electrical activity in the left and right frontal hemispheres during EEG measurement in a resting state (Davidson, 1998; Henriques & Davidson, 1990). Research regarding the hyperactivity of the right hemisphere and relatively low activity of the left hemisphere - disorder associated with a lack of coordination in intrahemispheric brain activity - emphasizes the connection of depression with high activity of the right hemisphere (Allen, Urry, Hitt, & Coan, 2004; Baehr, Rosenfeld, Baehr, & Earnest, 1998; Baehr, Rosenfeld, Baehr, & Earnest, 1999; Carvalho et al., 2011; Gold, Fachner, & Erkkila, 2013; Gotlib, 1998; Gotlib & Joormann, 2010; Vuga, Fox, Cohn, George, Levenstein, & Kovacs, 2006). Thus, frontal alpha asymmetry (FAA) reflects the balance between the activity of the right and left frontal hemispheres (Allen et al., 2004). Evidence suggests that the right hemisphere primarily encompasses the processing of negative emotions, pessimistic thoughts, and maladaptive thinking styles, all of which play a role in the cognitive phenomenology of depression, and subsequently, in the increase in anxiety, stress, and pain associated with illness (Spielberg et al., 2012).

One of the therapeutic methods used to correct alpha asymmetry in order to reduce depression and rumination is neurofeedback intervention. Electroencephalography (EEG) biofeedback, or neurofeedback, is presented as a tool for adjusting hemispheric asymmetry in frontal activity with the aim of regulating affect (Brambilla, Pirovano, Mira, Rizzo, Scano, & Mastropietro, 2021). Typically, biofeedback is a biobehavioral technique aimed at changing physiological activity and, in turn, improving health or performance. According to biofeedback principles, neurofeedback also relies on the premise that providing individuals with information about brain activity can expand their conscious control and help them learn how to regulate their brain activity (Aghaziarati, Fard, Rahimi, & Parsakia, 2023). Repeating neurofeedback sessions strengthens and creates new brain connections and pathways in the mechanism of neural reconstruction, leading to positive changes in emotions. One of the most common neurofeedback protocols for treating affective disorders is the alpha asymmetry protocol (ALAY), which has been used in various studies and yielded different findings (Allen et al., 2004; Choi, Chi, Chung, Kim, Ahn, & Kim,

2011; Quaedflieg, Smulders, Meyer, Peeters, Merckelbach, & Smeets, 2016). The results of these studies have shown therapeutic effectiveness for individuals with depression or anxiety, but the criticisms that can be made of each are the small number of intervention sessions and the selection of individuals with depression solely based on the presence of symptoms, regardless of the initiating factor of the disorder. Therefore, on the one hand, designing a clinical trial that, in addition to diagnosing and treating depression symptoms, examines the initiating factor of depression symptoms, and on the other hand, examining the effect of neurofeedback intervention on improving rumination scores and executive functions in individuals with depression and comparing the results with a placebo group will demonstrate the importance of such a research. From a clinical perspective, similar patterns of FAA have been observed in different conditions characterized by emotional dysregulation, such as anxiety and depression (Mennella, Messerotti, Buodo, & Palomba, 2015; Moscovitch, Santesso, Miskovic, McCabe, Antony, & Schmidt, 2011; Stewart, Coan, Towers, & Allen, 2011).

Thus, in the present study, an attempt was made to control the anxiety variable of the participants and to adjust the therapeutic protocol with the goal of reducing alpha power on the left hemisphere to correct FAA. In this study, in addition to frontal alpha power, frontal beta power was measured as an indicator of frontal activity. Ultimately, the current research was conducted with the aim of assessing the effectiveness of alpha asymmetry neurofeedback on depression and rumination in women with sexual dysfunction conflicts.

Methods

This quasi-experimental study was conducted with a matched two-group, pretest-posttest design, consisting of an experimental group and a control group. The target population included all women with sexual dysfunction in the northern part of Tehran city, Iran, in the year 2021. Initially, a sexual dysfunction questionnaire was distributed among 100 women with sexual dysfunction visiting psychological clinics in the northern part of Tehran. From among those who scored high on the sexual dysfunction questionnaire, 20 individuals were conveniently selected and divided into two groups of 10, experimental and control.

Research Tools

1. Female Sexual Function Index: The Female Sexual Function Index (FSFI(is referred to as the gold standard for assessing women's sexual function, and has been translated and validated in more than 30 different countries (Ghassami et al., 2014). It consists of 19 questions, measuring 6 dimensions of sexual function (sexual desire, orgasm, arousal, sexual pain, lubrication, and sexual satisfaction) over the past 4 weeks. The score range for the sexual desire dimension is 1.6-2 points, and for the other dimensions 0-6. The minimum score for the sexual desire dimension is 1.2, for sexual arousal, lubrication, orgasm, and pain is 0, and for sexual satisfaction is 0.8 or 0, with a minimum total scale score of 2. The maximum score for each section is 6, and for the total scale, it is 36. Obviously, the total score is obtained from the sum of the scores of the 6 sections. A score of 0 indicates that the individual has had no sexual activity in the past month. The reliability of this tool in previous studies has been estimated at 0.87, and the cut-off point for the total scale to diagnose sexual dysfunction has been determined to be 28 or less (Shayan, Masoumi, Yazdi-Ravandi, & Zarenezhad, 2015).

2. Beck Depression Inventory-II: The Beck Depression Inventory (BDI) is a widely used self-report tool for measuring depression-related cognitions. The revised version (BDI-II) is more aligned with the DSM-IV criteria and covers all elements of depression based on cognitive theory (Steer, Clark, Beck, & Ranieri, 1999). Stefan-Dabson, Mohammadkhani, and Massah-Choulabi (2007) reported a one-week test-retest reliability coefficient of 0.93 for this questionnaire in a sample of 354 individuals.

3. Ruminative Responses Scale: Nolen-Hoeksema and Morrow (1991) developed the Ruminative Response Scale (RRS) as a self-assessment questionnaire. In Iran, Bagherinezhad, Salehi Fadardi, and Tabatabayi (2010) reported the correlation of this scale with the BDI at 0.79 and with the Beck Anxiety Inventory (BAI) at 0.56.

4. Two-Channel EEG Diagnostic System; Clinical Q: This diagnostic system is a two-channel EEG recording conducted using the ProComp2 Infiniti device in this study.

This system has a clinical database of 1508 clinical references and is based on the notion that a client reporting a specific mental state (e.g., anxiety) also presents a neurophysiological representation of that state. According to the diathesis-stress model, the condition reported by the client is related to the neurological background that appears. Thus, a normative database would consider the client normal (or symptom-free) and consistent with normative databases as long as the client only has the neurological background. To evaluate in Clinical Q, points Cz, O1, F3, and Fz (the international 10-20 system for EEG recording sites) are recorded under specific conditions (eyes closed or open) for a specific duration (320 seconds). Finally, the recorded measurements are presented in Excel output tables. According to the Clinical Q database, if the alpha range (8-12 Hz) on the left is more than 15% different from the right (less activity in the left hemisphere) and if the beta range (12-18 Hz) on the right is more than 15% different from the left (more activity in the right hemisphere), depression symptoms should be examined. Considering the clinical characteristics of our sample and the hypotheses of our research (depression resulting from marital conflicts and cognitive impairments in depression), several other indices in Clinical Q are significant; one is the change in alpha amplitude over Cz in the eyes open condition compared to eyes closed less than 30%, which encourages clinicians to explore problems in short-term memory and information retention. Another is the difference of less than 50% in alpha amplitude over O1 from eyes open to eyes closed, which, directs the specialist towards examining symptoms of post-traumatic stress; therefore, here the difference in alpha and beta amplitudes over F3-F4 as a characteristic of reactive depression disorder and its severity before and after the intervention and pseudo-intervention are evaluated. The difference in alpha amplitude in eyes open compared to eyes closed in Cz, O1 is also measured as an indicator of the effectiveness or ineffectiveness of the intervention or pseudo-intervention of neurofeedback in both groups (Swingle, 2015).

Procedure: After the pretest phase and random assignment of participants to two groups, the intervention program was implemented. According to the intervention plan, each group received 15 sessions of 45 minutes 3 times a week for the experimental intervention and sham intervention. At the end of the experimental and sham intervention sessions, all measurements from the pretest phase were repeated as a posttest. It is worth mentioning that in the current study, since the therapist had to implement the treatment protocol purposefully, the double-blind method was not feasible. To eliminate the effect of suggestion or being in the intervention situation on the research results, a sham neurofeedback intervention was used. This group received a treatment program completely identical to the intervention group,

including 15 regular 45-minute sessions and baseline assessment at the beginning of each session, with the difference that instead of receiving neurofeedback training, they only observed a recorded program without being able to change it. In informing applicants of the research, it was stated that they would participate in therapeutic sessions for depression symptoms and that several different therapeutic methods would be used in this research plan, with individuals being randomly selected for each method; therefore, participants of the sham neurofeedback group participated in sessions without knowing about the fictitious nature of their training program. It is notable that in adherence to ethical and professional principles, after the end of the therapeutic program and conducting the posttest, the participants of this group were informed about the fictitious nature of their therapeutic program and were offered 15 sessions of actual neurofeedback training free of charge.

Analysis: Data were analyzed using analysis of covariance (ANCOVA) in SPSS software (version 22; IBM Corp., Armonk, NY, USA).

Results

Mean and standard deviation of the measured variables in the pretest and posttest are presented in table 1.

Based on Clinical Q assessment, the beta asymmetry on F3-F4 also emphasizes the examination of depression symptoms; this study analyzed the difference of more than 15% in beta range on F4 compared to F3 to assess the effectiveness of neurofeedback intervention.

Therefore, the hypothesis comparing the effectiveness of neurofeedback intervention between the two groups on frontal beta asymmetry scores was tested using the ANCOVA statistical method, with groups as the independent variable, beta asymmetry scores in the pretest as the covariate, and beta asymmetry scores in the posttest as the dependent variable. The results showed a significant difference between the two groups [$F(1,26) = 73.083$; $P < 0.001$; Partial $\eta^2 = 0.73$; $d = 3.28$].

Additionally, to test whether the neurofeedback intervention in the experimental group could effectively impact rumination scores, depression, and alpha range on Cz compared to the control group, the multivariate analysis of covariance (MANCOVA) model was used.

Table 1. Mean and standard deviation of measured variables in the pretest and posttest

Variables	Steps	Intervention Group (n = 15) (Mean ± SD)	Control Group (n = 15) (Mean ± SD)
Depression	Pretest	25.06 ± 3.41	24.73 ± 3.91
	Posttest	16.53 ± 3.66	24.80 ± 4.67
Rumination	Pretest	61.20 ± 6.53	66.06 ± 6.07
	Posttest	42.86 ± 5.96	64.06 ± 6.69
Alpha Asymmetry	Pretest	47.26 ± 11.57	46.49 ± 15.45
	Posttest	26.78 ± 12.11	46.06 ± 14.64
Beta Asymmetry	Pretest	28.54 ± 9.23	32.67 ± 10.09
	Posttest	21.87 ± 8.54	38.81 ± 10.97
Alpha Range Difference on O1	Pretest	28.46 ± 8.30	29.43 ± 7.60
	Posttest	37.12 ± 8.12	30.53 ± 8.97
Alpha Range Difference on Cz	Pretest	21.06 ± 5.10	21.84 ± 4.71
	Posttest	29.94 ± 7.04	22.44 ± 6.27

SD: Standard deviation

Table 2. Effect size between subjects

Variables	df			F	P-value	Cohen's d*
	Group	Error	Sum			
Rumination	1	17	20	79.902	0.0005	3.65
Depression	1	17	20	33.639	0.0005	2.39
Alpha Difference on Cz	1	17	20	20.658	0.0005	1.88

* To understand the effect size, Eta^2 was converted to Cohen's d.

In this model, group as the independent variable, rumination scores, depression, and the difference in alpha range on Cz in the posttest as the dependent variables, and scores of these variables in the pretest as the covariate were entered into the analysis. The results of Box's M test indicated that the assumption of homogeneity of covariance matrices between the two groups was met (P = 0.422; F = 1.028). The analysis results [F(5,23) = 28.811; P > 0.001; Wilks' Lambda = 0.117; Partial η^2 = 0.88) showed that control variables had no significant effect on the model. In contrast, a significant difference was observed between the two groups in the dependent variables.

The test results for between-subject effects in MANCOVA are summarized in table 2. As observed, the effect size of rumination, executive functions, and the difference in alpha range significantly indicates the impact of the experimental variable (intervention) on them. Among the measured variables, rumination showed the highest, whereas sustained attention showed the lowest susceptibility to the experimental variable.

Lastly, to address the final research question of whether employing neurofeedback intervention could lead to a significant reduction in depression scores and improve the neurocognitive index (difference in alpha range between open and closed eyes on O1) compared to the control group, the MANCOVA model was used. In this model, group as the independent variable, depression scores and the difference in alpha range on O1 in the pretest as the covariate, and scores of these two in the posttest as the dependent variable were entered into the analysis. The analysis results showed a significant difference between the two groups in terms of the impact of neurofeedback intervention on love trauma scores and the difference in alpha on O1.

Discussion

The present study distinguishes itself from other similar studies in several aspects.

First, in addition to assessing and correcting FAA in depressed individuals, assessing and correcting frontal beta asymmetry was also examined as an indicator of frontal activity in participants with sexual dysfunction disorders. Second, the initiating event or factor for depression symptoms in participants with sexual dysfunction was considered a criterion for entry into the research, and the impact of alpha symmetry neurofeedback on it was neurologically measured.

Finally, cognitive deficits were evaluated not only through the participants' performance on standardized computer tasks, but also through neurocognitive assessment. Moreover, the effectiveness of neurofeedback training on them and their relationship with rumination was measured.

The current findings support the initial hypothesis that correcting FAA can lead to a reduction in depression symptoms, which is in line with the results of several

previous studies (Allen et al., 2004; Harmon-Jones, Gable, & Peterson, 2010; Mennella et al., 2015; Peeters, Ronner, Bodar, van Os, & Lousberg, 2014; Quaedflieg et al., 2016; Young et al., 2018). However, there are still discrepancies in the findings of different studies, challenging the certainty of this relationship. For instance, the findings of Mennella et al. (2015) indicated a reduction in rumination scores in participants after neurofeedback training.

Certainly, research methodologies vary across studies, including differences in measurement tools and scalp points considered representative of the frontal area. Only studies that followed the 10-20 system were reviewed here, encompassing the number and duration of neurofeedback sessions, the treatment protocol, and participants' clinical histories. Therefore, methodological differences lead to varied findings across studies, some of which are contradicted in other studies. This issue can be considered a limitation of the research due to the vast scope of the study area and the development of neuroscientific methods in clinical psychology. Thus, in the current study, researchers also examined the neurocognitive index of frontal beta asymmetry in relation to depression symptoms. The findings are consistent with that of Peeters et al. (2014), who stated that training to increase frontal alpha also increases beta at that point, while such changes do not occur in theta or delta ranges, showing the correction of alpha and beta in the frontal lobe only in the experimental group, not the sham intervention group (Peeters et al., 2014). Therefore, the findings of this study can be more confidently relied upon and generalized to similar groups, as not only were clinical trial methodologies adhered to, but neurocognitive indicators related to depression symptoms were also considered and examined.

Another distinctive feature of this research is that it tried to use brain activity training (neurofeedback) instead of the usual psychological methods for reducing rumination, improving cognitive components involved in rumination (working memory, cognitive inhibition, and sustained attention), and achieving a reduction in rumination responses. Therefore, the first research question in this study sought to measure the effectiveness of neurofeedback intervention on reducing rumination responses, and improving working memory, cognitive inhibition, sustained attention, and the neurocognitive index of executive functions. Statistical findings indicated that implementing the neurofeedback protocol was effective in improving these components, whereas such an effect was not observed in the sham intervention group.

Thus, the findings of the present study, emphasizing the theoretical assumptions of the resource allocation theory and related research (Connolly et al., 2014; Gotlib & Joormann, 2010; Hertel, 1998; Levens et al., 2009; Watkins & Moulds, 2005), indicate the effectiveness of correcting alpha asymmetry in reducing cognitive impairments of depression and rumination. Hence, these results suggest that neurofeedback training for FAA, in addition to reducing depressive mood symptoms, can effectively improve executive functions and rumination. Considering that rumination is a significant factor in the recurrence and persistence of depressive disorder, the importance and application of this finding become clear. In other words, the current research findings assert that effective methods for reducing rumination can be utilized to decrease and prevent the recurrence of depressive symptoms. Although as a clinical trial, this finding needs repetition of results in similar studies to determine its reliability, the clinical significance and application of the results cannot be overlooked.

The third characteristic of this study is the examination of the initiating factor for

depression symptoms. In most similar studies, being depressed and diagnosed with a depressive disorder according to the DSM was considered a condition for research entry, without considering factors such as the initiating event or duration of depressive disorder. Here, conflict in marital life was considered as the stressor initiating depression symptoms. This study, using brain training as one of the relatively new methods in psychological rehabilitation, with neurofeedback being one of the most established, was able to correct alpha and beta asymmetry in the frontal lobes of women with sexual dysfunction disorders, improve rumination, and improve the effects left from various marital conflicts.

Conclusion

The results of this study are significant due to the vital role of depression and rumination in the continuation of depression. The findings of this study can be used as a valuable intervention to reduce symptoms of depression and rumination in women with sexual dysfunction.

Conflict of Interests

Authors have no conflict of interests.

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References

Aghaziarati, A., Fard, F., Rahimi, H., & Parsakia, K. (2023). Investigating the Effect of Electrical Stimulation (tDCS) of the Prefrontal Cortex of the Brain on the Improvement of Behavioral and Neurological Symptoms of Children with Specific Learning Disabilities. *Health Nexus, 1* (2), 44-50. doi:10.61838/kman.hn.1.2.6 [doi].

Allen, J. J., Urry, H. L., Hitt, S. K., & Coan, J. A. (2004). The stability of resting frontal electroencephalographic asymmetry in depression. *Psychophysiology., 41*(2), 269-280. doi:PSYP149 [pii];10.1111/j.1469-8986.2003.00149.x [doi]. Retrieved from PM:15032992

Askari Masuleh, S., & Taheri, F. (2023). Predicting Organizational Commitment by Rumination. *KMAN Couns. Psychol. Nexus, 1*(2), 157-163.

Baehr, E., Rosenfeld, J. P., Baehr, R., & Earnest, C. (1998). Comparison of two EEG asymmetry indices in depressed patients vs. normal controls. *Int.J Psychophysiol., 31*(1), 89-92. doi:S0167876098000415 [pii];10.1016/s0167-8760(98)00041-5 [doi]. Retrieved from PM:9934624

Baehr, E., Rosenfeld, J. P., Baehr, R., & Earnest, C. (1999). 8 - Clinical Use of an Alpha Asymmetry Neurofeedback Protocol in the Treatment of Mood Disorders. In J.R. Evans & A. Abarbanel (Eds.), *Introduction to Quantitative EEG and Neurofeedback* (pp. 181-201. doi:10.1016/B978-012243790-8/50009-2 [doi]). San Diego: Academic Press.

Bagherinezhad, M., Salehi Fadardi, J., & Tabatabayi, S. M. (2010). The relationship between rumination and depression in a sample of Iranian student. *Research in Clinical Psychology and Counseling, 11*(1), 21. doi:10.22067/IJAP.V11I1.6910 [doi].

Blackhart, G. C., Minnix, J. A., & Kline, J. P. (2006). Can EEG asymmetry patterns predict future development of anxiety and depression? A preliminary study. *Biol.Psychol, 72*(1), 46-50. doi:S0301-0511(05)00131-6 [pii];10.1016/j.biopsycho.2005.06.010 [doi]. Retrieved from PM:16223557

Brambilla, C., Pirovano, I., Mira, R. M., Rizzo, G., Scano, A., & Mastropietro, A. (2021). Combined Use of EMG and EEG Techniques for Neuromotor Assessment in Rehabilitative

Applications: A Systematic Review. *Sensors.(Basel.), 21*(21). doi:s21217014 [pii];sensors-21-07014 [pii];10.3390/s21217014 [doi]. Retrieved from PM:34770320

Carvalho, A., Moraes, H., Silveira, H., Ribeiro, P., Piedade, R. A., Deslandes, A. C. et al. (2011). EEG frontal asymmetry in the depressed and remitted elderly: Is it related to the trait or to the state of depression? *J Affect.Disord., 129*(1-3), 143-148. doi:S0165-0327(10)00559-8 [pii];10.1016/j.jad.2010.08.023 [doi]. Retrieved from PM:20870292

Choi, S. W., Chi, S. E., Chung, S. Y., Kim, J. W., Ahn, C. Y., & Kim, H. T. (2011). Is alpha wave neurofeedback effective with randomized clinical trials in depression? A pilot study. *Neuropsychobiology, 63*(1), 43-51. doi:000322290 [pii];10.1159/000322290 [doi]. Retrieved from PM:21063132

Connolly, S. L., Wagner, C. A., Shapero, B. G., Pendergast, L. L., Abramson, L. Y., & Alloy, L. B. (2014). Rumination prospectively predicts executive functioning impairments in adolescents. J Behav Ther Exp.Psychiatry, 45(1), 46-56. doi:S0005-7916(13)00059-1 [pii];10.1016/j.jbtep.2013.07.009 [doi]. Retrieved from PM:23978629

Davidson, R. J. (1998). Anterior electrophysiological asymmetries, emotion, and depression: conceptual and methodological conundrums. *Psychophysiology., 35*(5), 607-614. doi:10.1017/s0048577298000134 [doi]. Retrieved from PM:9715104

De Lissnyder, E., Ernst, H. W., Derakshan, N., & De, R. (2010). The association between depressive symptoms and executive control impairments in response to emotional and non-emotional information. *Cognition and Emotion, 24*(2), 264-280. doi: 10.1080/02699930903378354 [doi].

Ebrahimi, L. (2020). Prediction of the tendency toward emotional divorce based on personality traits, metacognitive beliefs and emotional maturity of couples. *Journal of Counseling Research, 19*(74), 36-61. doi: 10.29252/jcr.19.74.36 [doi].

Feng, X., Forbes, E. E., Kovacs, M., George, C. J., Lopez-Duran, N. L., Fox, N. A. et al. (2012). Children's depressive symptoms in relation to EEG frontal asymmetry and maternal depression. *J Abnorm.Child.Psychol, 40*(2), 265-276. doi:10.1007/s10802-011-9564-9 [doi]. Retrieved from PM:21894523

Ghassami, m., Shairi, M. R., Asghari Moghadam, M. A., & Rahmati, N. (2014). The study of the psychometric properties of the 6-item version of the female sexual function index (fsfi-6) amongest iranian women. *J Urmia Nurs Midwifery Fac, 12*(7), 532-543.

Gold, C., Fachner, J., & Erkkila, J. (2013). Validity and reliability of electroencephalographic frontal alpha asymmetry and frontal midline theta as biomarkers for depression. *Scand.J Psychol, 54*(2), 118-126. doi:10.1111/sjop.12022 [doi]. Retrieved from PM:23278257

Gotlib, I. H. (1998). EEG Alpha Asymmetry, Depression, and Cognitive Functioning. *Cognition and Emotion, 12*(3), 449-478. doi:10.1080/026999398379673 [doi].

Gotlib, I. H., & Joormann, J. (2010). Cognition and depression: Current status and future directions. *Annu.Rev Clin Psychol, 6*, 285-312. doi:10.1146/annurev.clinpsy.121208.131305 [doi]. Retrieved from PM:20192795

Hamzehgardeshi, Z., Sabetghadam, S., Pourasghar, M., Khani, S., Moosazadeh, M., & Malary, M. (2023). Prevalence and predictors of sexual distress in married reproductive-age women: A cross-sectional study from Iran. *Health Sci Rep., 6*(9), e1513. doi:HSR21513 [pii];10.1002/hsr2.1513 [doi]. Retrieved from PM:37655267

Harmon-Jones, E., Gable, P. A., & Peterson, C. K. (2010). The role of asymmetric frontal cortical activity in emotion-related phenomena: a review and update. *Biol.Psychol, 84*(3), 451-462. doi:S0301-0511(09)00182-3 [pii];10.1016/j.biopsycho.2009.08.010 [doi]. Retrieved from PM:19733618

Hasanzadeh Mofrad, M., Karami Dehkordi, A., Mozaffar Tizabi, N., & Amirian, M. (2015). Survey of sexual dysfunction in women with cervical cancer and a history of pelvic radiation therapy in 2009 to 2013 in Ghaem and Omid hospitals, Mashhad. *Iran J Obstet Gynecol Infertil, 18*(144), 9-18.

Henriques, J. B., & Davidson, R. J. (1990). Regional brain electrical asymmetries discriminate between previously depressed and healthy control subjects. *J Abnorm.Psychol, 99*(1), 22-31. doi:10.1037//0021-843x.99.1.22 [doi]. Retrieved from PM:2307762

Hertel, P. T. (1998). Relation between rumination and impaired memory in dysphoric moods. *J Abnorm.Psychol, 107*(1), 166-172. doi:10.1037//0021-843x.107.1.166 [doi]. Retrieved from PM:9505050

Jomenia, S., Nazari, A. M., & Soliemanian, A. A. (2021). Identifying the indicators of the problems of couples seeking a divorce in Torkaman city. *Applied Family Therapy Journal, 2*(3), 170-195.

Levens, S. M., Muhtadie, L., & Gotlib, I. H. (2009). Rumination and impaired resource allocation in depression. *J Abnorm.Psychol, 118*(4), 757-766. doi:2009-20626-007 [pii];10.1037/a0017206 [doi]. Retrieved from PM:19899845

Mathersul, D., Williams, L. M., Hopkinson, P. J., & Kemp, A. H. (2008). Investigating models of affect: relationships among EEG alpha asymmetry, depression, and anxiety. *Emotion, 8*(4), 560-572. doi:2008-09984-012 [pii];10.1037/a0012811 [doi]. Retrieved from PM:18729586

Mennella, R., Messerotti, B. S., Buodo, G., & Palomba, D. (2015). Emotional modulation of alpha asymmetry in dysphoria: results from an emotional imagery task. *Int.J Psychophysiol., 97*(2), 113-119. doi:S0167-8760(15)00207-X [pii];10.1016/j.ijpsycho.2015.05.013 [doi]. Retrieved from PM:26027782

Mosadegh, H., Darbani, S. A., & Parsakia, K. (2023). The mediating role of sexual satisfaction in the relationship between personality traits and emotional divorce in men. *Journal of Applied Family Therapy, 4*(4), 191-202. doi: 10.22034/AFTJ.2023.425358.2227 [doi].

Moscovitch, D. A., Santesso, D. L., Miskovic, V., McCabe, R. E., Antony, M. M., & Schmidt, L. A. (2011). Frontal EEG asymmetry and symptom response to cognitive behavioral therapy in patients with social anxiety disorder. *Biol.Psychol, 87*(3), 379-385. doi:S0301-0511(11)00113-X [pii];10.1016/j.biopsycho.2011.04.009 [doi]. Retrieved from PM:21571033

Nolen-Hoeksema, S., & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: the 1989 Loma Prieta Earthquake. *J Pers.Soc.Psychol, 61*(1), 115-121. doi:10.1037//0022-3514.61.1.115 [doi]. Retrieved from PM:1890582

Owens, M., Koster, E. H., & Derakshan, N. (2013). Improving attention control in dysphoria through cognitive training: transfer effects on working memory capacity and filtering efficiency. *Psychophysiology., 50*(3), 297-307. doi:10.1111/psyp.12010 [doi]. Retrieved from PM:23350956

Patten, S. B., Williams, J. V. A., Lavorato, D. H., Bulloch, A. G. M., Wiens, K., & Wang, J. (2016). Why is major depression prevalence not changing? *J Affect.Disord., 190*, 93-97. doi:S0165-0327(15)30474-2 [pii];10.1016/j.jad.2015.09.002 [doi]. Retrieved from PM:26485311

Peeters, F., Ronner, J., Bodar, L., van Os, J., & Lousberg, R. (2014). Validation of a neurofeedback paradigm: manipulating frontal EEG alpha-activity and its impact on mood. *Int.J Psychophysiol., 93*(1), 116-120. doi:S0167-8760(13)00181-5 [pii];10.1016/j.ijpsycho.2013.06.010 [doi]. Retrieved from PM:23773999

Quaedflieg, C. W., Smulders, F. T., Meyer, T., Peeters, F., Merckelbach, H., & Smeets, T. (2016). The validity of individual frontal alpha asymmetry EEG neurofeedback. *Soc.Cogn Affect.Neurosci, 11*(1), 33-43. doi:nsv090 [pii];10.1093/scan/nsv090 [doi]. Retrieved from PM:26163671

Reddy, M. S. (2010). Depression: the disorder and the burden. *Indian.J Psychol Med, 32*(1), 1-2. doi:IJPsyM-32-1 [pii];10.4103/0253-7176.70510 [doi]. Retrieved from PM:21799550

Richard, J. (1998). Affective Style and Affective Disorders: Perspectives from Affective Neuroscience. Cognition and Emotion, 12(3), 307-330. doi:10.1080/026999398379628 [doi].

Ruhlmann, L. M., Gallus, K. L., & Durtschi, J. A. (2018). Exploring relationship satisfaction and attachment behaviors in single- and dual-trauma couples: A pilot study. *Traumatology, 24*(1), 27-35. doi:10.1037/trm0000129 [doi].

Shadanloo, B., Yousefi, Z., Parsakia, K., Hejazi, S., & Dolatabadi, M. (2023). The role of whey supplementation on sensation seeking, parent-child relationship, family communication, anger and sex desire among athletes, athletes using whey and normal population. *Health Nexus, 1*(1), 40-47. doi:10.61838/hn.1.1.7 [doi].

Shayan, A., Masoumi, S. Z., Yazdi-Ravandi, S., & Zarenezhad, M. (2015). Factors affecting spouse abuse in women referred to the Shiraz legal medicine center in 2013. *Pajouhan Sci J, 14*(1), 39-48.

Siegel, A., Dekel, R., & Svetlitzky, V. (2021). The contribution of empathy to the adjustment of military veterans and their female partners. *Family Relations: An Interdisciplinary Journal of Applied Family Studies, 70*(2), 437-451. doi:10.1111/fare.12523 [doi].

Spielberg, J. M., Miller, G. A., Warren, S. L., Engels, A. S., Crocker, L. D., Banich, M. T. et al. (2012). A brain network instantiating approach and avoidance motivation. *Psychophysiology., 49*(9), 1200-1214. doi:10.1111/j.1469-8986.2012.01443.x [doi]. Retrieved from PM:22845892

Steer, R. A., Clark, D. A., Beck, A. T., & Ranieri, W. F. (1999). Common and specific dimensions of self-reported anxiety and depression: the BDI-II versus the BDI-IA. *Behav Res Ther, 37*(2), 183-190. doi:S0005796798000874 [pii];10.1016/s0005-7967(98)00087-4 [doi]. Retrieved from PM:9990749

Stefan-Dabson, K., Mohammadkhani, P., & Massah-Choulabi, O. (2007). Psychometrics Characteristic of Beck Depression Inventory-II in Patients with Magor Depressive Disorder. *J Rehab, 8*(Spec), 80-86.

Stewart, J. L., Coan, J. A., Towers, D. N., & Allen, J. J. (2011). Frontal EEG asymmetry during emotional challenge differentiates individuals with and without lifetime major depressive disorder. *J Affect.Disord., 129*(1-3), 167-174. doi:S0165-0327(10)00565-3 [pii];10.1016/j.jad.2010.08.029 [doi]. Retrieved from PM:20870293

Swingle, P. G. (2015). *Adding Neurotherapy to Your Practice: Clinician's Guide to the ClinicalQ, Neurofeedback, and Braindriving*. Cham: Springer International Publishing.

Thibault, R. T., Lifshitz, M., & Raz, A. (2016). The self-regulating brain and neurofeedback: Experimental science and clinical promise. *Cortex., 74*, 247-261. doi:S0010-9452(15)00376-7 [pii];10.1016/j.cortex.2015.10.024 [doi]. Retrieved from PM:26706052

Vuga, M., Fox, N. A., Cohn, J. F., George, C. J., Levenstein, R. M., & Kovacs, M. (2006). Long-term stability of frontal electroencephalographic asymmetry in adults with a history of depression and controls. *Int.J Psychophysiol., 59*(2), 107-115. doi:S0167-8760(05)00126-1 [pii];10.1016/j.ijpsycho.2005.02.008 [doi]. Retrieved from PM:16002168

Watkins, E., & Moulds, M. (2005). Distinct modes of ruminative self-focus: impact of abstract versus concrete rumination on problem solving in depression. *Emotion, 5*(3), 319-328. doi:2005-11380-007 [pii];10.1037/1528-3542.5.3.319 [doi]. Retrieved from PM:16187867

Watkins, E. R. (2018). *Rumination-Focused Cognitive-Behavioral Therapy for Depression*. New York, NY: Guilford Publications.

Young, K. D., Siegle, G. J., Misaki, M., Zotev, V., Phillips, R., Drevets, W. C. et al. (2018). Altered task-based and resting-state amygdala functional connectivity following real-time fMRI amygdala neurofeedback training in major depressive disorder. *Neuroimage.Clin, 17*, 691-703. doi:S2213-1582(17)30309-1 [pii];10.1016/j.nicl.2017.12.004 [doi]. Retrieved from PM:29270356