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## The Psychological Impacts in Females with Iron Deficiency Anemia in Tertiary Care Hospital, Karachi Pakistan

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### Abstract:

#### Objective

Iron deficiency anemia is common in females and might lead to depressive disorders as well. Therefore, this study was conducted to assess the association of iron deficiency anemia with depressive disorders. It was further aimed to find out the relation of severity of anemia with depressed symptoms.

#### Method

This case control study was conducted by using non probability convenient sampling technique. A sample of females aged between 18 to 40 years were recruited and divided into two groups: one with diagnosed iron deficiency anemia and another without it. Data was collected through standardized psychological assessment tools and structured interviews. This study was undertaken at Omair sana foundation in Karachi from December 2023 to February 2024. The sample size estimation revealed 400 participants. Out of them 200 were anemic and 200 were healthy controls. Ethical clearance was obtained, and individuals gave informed consent. The data was analyzed using statistical tests by using SPSS version 26. Quantitative data was expressed as mean and standard deviation, whereas qualitative data was presented as frequency and percentages. Chi-square test was used to assess the association, with a significance level of  $p < 0.05$ .

#### Result

The study included 400 participants divided into two groups: 200 cases and 200 controls. The age distribution was similar across both groups. In the control group, 36 participants (18.0%) were aged 18-25 years, while 32 participants (16.0%) in the cases group were in this age range. The largest age group was 36-45 years, comprising 66 participants (33.0%) in the control group and 70 participants (35.0%) in the cases group. The study found significant differences in mean hemoglobin levels between depressed and healthy individuals ( $p < 0.01$ ). Hamilton Depression Rating Scale (HAM-D) scores also significantly varied between groups ( $p < 0.01$ ). Anemia was associated with depression severity ( $p < 0.01$ ).

#### Conclusion

The conclusion of this study is that there is a relationship between iron deficiency anemia and depressive disorder. The study also predicted the association of anemia severity with depressive disorder.

**Keywords:** Iron Deficiency Anemia, Depression

**Introduction:**

The mind and body are interconnected, and addressing the psychological implications of health conditions is essential for holistic management. Iron deficiency anemia (IDA) is a prevalent health condition that affects a significant number of females worldwide. While the physical consequences of IDA are well-documented, limited research has explored its psychological impact on affected individuals. This research proposal aims to investigate the psychological adjustment in females with IDA, shedding light on the emotional and behavioral aspects of this condition(1). On the other hand, depression in the elderly is a major health concern, both because of its prevalence and because of the negative health effects(2). Depression symptoms affect approximately 12%-20% of older people living in the community(3). Many cross-sectional studies have indicated that, compared to non-depressed persons, depressed older people had poorer health status, higher prevalence of disability, and more severe comorbidity(4). The link between depression and iron deficiency is complex, involving the complicated interplay of molecular mechanisms and physiological reactions. Iron is required for optimum brain function because it plays an important role in neurotransmitter creation and hormone modulation, both of which are essential for mood stability. Furthermore, iron deficiency anemia, which is defined by low red blood cell levels owing to a lack of iron, can aggravate symptoms such as weariness and weakness, thus exacerbating feelings of despair. Iron deficiency may also aggravate inflammation in the body, which has been linked to depression(5). Furthermore, patients with depression and concurrent iron deficiency may be less susceptible to standard antidepressant medications, emphasizing the need of addressing iron deficiency as part of comprehensive depression therapy efforts. Given these difficulties, treating iron deficiency with supplements or dietary changes may be a promising option for reducing depression symptoms, emphasizing the importance of rigorous diagnosis and targeted interventions under medical supervision(6).

Iron deficiency anemia occurs due to a lack of iron in the body, leading to reduced production of red blood cells and inadequate oxygen transportation. Females are particularly susceptible to IDA due to menstrual blood loss and iron requirements during pregnancy. Besides, the psychological impact of chronic health conditions cannot be overlooked, as they can significantly affect one's quality of life, emotional well-being, and social functioning. Iron deficiency anemia (IDA) in females can be caused by a variety of reasons, including monthly blood loss, pregnancy, and insufficient dietary iron intake. Women are more likely than men to develop iron deficiency as a result of blood loss during menstruation(7). Pregnancy and childbirth can potentially cause iron insufficiency. Inadequate iron consumption, particularly among premenopausal women, can lead to the development of IDA. According to a study published in US Pharmacist, premenopausal women in the US consume less than 60% of the required quantity of iron, increasing their chance of developing IDA(8). Furthermore, a research paper in Science Direct postulated that young adult females have greater rates of iron insufficiency, which is connected with depression in this demographic. These considerations highlight the necessity of addressing iron deficiency and implementing interventions to prevent and treat IDA in women, especially during critical life stages such as menstruation, pregnancy, and lactation.

Existing literature reveals that chronic health conditions, such as anemia, can contribute to psychological distress and impaired quality of life in affected individuals. However, limited research has focused on investigating the specific psychological adjustments occurring in females with IDA(9). Hence, this study aims to fill this gap by exploring the emotional, cognitive, and behavioral aspects of psychological adjustment in this population. Several studies have established a link between depressive disorders and iron deficiency anemia (IDA) in adults. A hospital-based case control research found a link between IDA and depressive illness, with the severity of depressed symptoms increasing with the degree of IDA. A 4-year cohort study found a link between depressed symptoms and anemia in middle-aged and elderly adults. Severity of depressive symptoms increased the risk of anemia(10). A study published in BMC Psychiatry found that IDA increases the risk of psychiatric illnesses, such as depression, while iron supplementation lowers the risk in IDA sufferers(9). These data indicate a strong link between depressed symptoms and IDA, with the intensity of symptoms potentially affecting the probability of anemia. The exact causal association between depressive disorder and iron deficiency anemia is still being researched, and more research with larger sample sizes and clinical trials are needed to substantiate these findings as the cause of IDA in females. Iron deficiency anemia (IDA) in females can be caused by a variety of reasons, including monthly blood loss, pregnancy, and insufficient dietary iron intake. Women are more likely than males to encounter.

The study aimed to investigate the link between iron deficiency anemia and depressive illnesses, as well as the severity of anemia and its correlation. We expected that persons with iron deficiency anemia are more likely to suffer depressed symptoms than those without the illness. Furthermore, we expected that the severity of anemia would be positively correlated with the severity of depressive disorder, implying that as anemia severity grows, so do depression symptoms.

### **Theoretical Framework:**

This study guided by the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984). According to this model, individuals' interpretations of stressors and the coping strategies they utilize play a crucial role in determining their psychological adjustment to chronic illnesses. This framework provides a comprehensive understanding of the psychological processes through which females with IDA adapt and cope with their condition. Richard Lazarus and Susan Folkman established the Transactional Model of Stress and Coping, which states that stress is caused by an individual's assessment of a circumstance and their ability to cope with it. According to this paradigm, stress occurs when people see a situation as threatening or beyond their ability to deal with it successfully. Coping skills are then used to handle stress.

1. Primary Appraisal: Females with IDA may face a variety of health-related stressors, including weariness, weakness, and difficulties concentrating. Primary assessment

entails assessing these stresses to establish their magnitude and potential threat to their well-being.

2. Secondary assessment: After identifying the stressors, people with IDA perform secondary assessment, which entails examining their coping strategies and options. This includes evaluating their perceived control of the circumstance, social support, and coping abilities.
3. Coping Strategies: Females with IDA may use a variety of coping strategies to manage stress, depending on how they assess the circumstance. These techniques can be problem-focused (to directly address the stressor, such as seeking medical care for anemia) or emotion-focused (to regulate emotional distress, such as seeking social support).
4. Outcome: The efficacy of coping methods influences psychological adjustment. Despite the obstacles offered by IDA, effective coping may result in greater psychological adjustment, such as reduced anxiety and sadness and enhanced quality of life. In contrast, inadequate coping can lead to increased psychological suffering and maladaptive adjustment.
5. Understanding the Transactional Model of Stress and Coping can help guide interventions aimed at enhancing psychological adjustment in females with IDA. Interventions may focus on improving coping abilities, offering social support networks, and encouraging positive assessments of stressors associated with the illness. Healthcare providers can improve affected people's general well-being and quality of life by addressing psychological issues as well as medical management of IDA.

### **Methodology:**

This study was case control and was conducted by using non probability convenient sampling technique. A sample of 400 females aged between 18 to 40 years were recruited and divided into two groups: one with diagnosed IDA and another without IDA. Data was collected through standardized psychological assessment tools and structured interviews. This hospital-based case-control study was undertaken at Omair sana foundation in Karachi from December 2023-February 2024. Previous study showed 63% anemia (11) thus sample size was calculated by using Online software was 359 with confidence interval 95%

. The study was divided into two groups: cases and controls. Cases were defined as patients diagnosed with depressive disorder using ICD-10 criteria by a consultant psychiatrist and having a Hamilton Depression Rating Scale (HAM-D) score of 8 or higher, indicating moderate to severe depression. Other psychiatric diseases, such as schizophrenia and bipolar affective disorder, were excluded, along with chronic medical conditions and pregnancy. Age and gender-matched controls were drawn from various hospital departments and attendants, and socio-demographic information, as well as HAM-D scores<sup>(12)</sup> and hemoglobin (Hb) levels, were collected using a semi-structured form. The severity of depression was determined using HAM-D scores, while anemia was evaluated using WHO standards. We employed the HDRS (Ham-D), a popular instrument for evaluating depression, in our investigation. The 17 items (HDRS17) on it gauge symptoms during the previous week. It was designed with hospital patients in mind and focuses on physical and depressive symptoms. Though it was intended to be finished following an interview, there are currently manuals available to assist with the procedure. Some individuals erroneously utilize the longer HDRS21 version's extra items to subtype depression rather than determining its severity. The HDRS has the limitation of not adequately covering symptoms of atypical depression.<sup>(13-15)</sup>

The data was analyzed using statistical tests by using SPSS version 26. Quantitative data was expressed as mean and standard deviation, whereas qualitative data was presented as frequency and percentages. Chi-square test was used to assess the association, with a significance level of  $p < 0.05$ .

## Results

The study included 400 participants divided into two groups: 200 cases and 200 controls. The age distribution was similar across both groups. In the control group, 36 participants (18.0%) were aged 18-25 years, while 32 participants (16.0%) in the cases group were in this age range. The largest age group was 36-45 years, comprising 66 participants (33.0%) in the control group and 70 participants (35.0%) in the cases group. For the age group 26-35 years, there were 42 participants (21.0%) in the control group and 40 participants (20.0%) in the cases group. The 46-55 years age group included 52 participants (26.0%) in the control group and 54 participants (27.0%) in the cases group, while the >55 years age group had 4 participants (2.0%) in both the control and cases groups. An insignificant difference was observed in-between them (0.99).

Regarding marital status, 46 participants (23.0%) in the control group were single, compared to 26 participants (13.0%) in the cases group. Married participants made up the majority, with 150 participants (75.0%) in the control group and 160 participants (80.0%) in the cases group. There were 2 widowed participants (1.0%) in the control group and 8 widowed participants (4.0%) in the cases group. Additionally, 2 participants (1.0%) in the control group were separated, compared to 6 participants (3.0%) in the cases group with insignificant difference (p=0.13) between them.

Socioeconomic status, determined by monthly income, was also assessed. In the control group, 78 participants (39.0%) were in the lower-income category (Rs <14,000 per month), compared to 70 participants (35.0%) in the cases group. The middle-income category (Rs 14,000-45,000) included 100 participants (50.0%) in the control group and 104 participants (52.0%) in the cases group. The upper-income category (Rs >45,000) had 22 participants (11.0%) in the control group and 26 participants (13.0%) in the cases group. with insignificant difference (p=0.81) between them.

The distribution of residence was identical in both groups, with 80 participants (40.0%) from rural areas and 120 participants (60.0%) from urban areas in both the control and cases groups.

Anemia status showed significant differences between the groups. In the control group, 168 participants (84.0%) had normal hemoglobin levels, compared to 54 participants (27.0%) in the cases group. Mild anemia was present in 32 participants (16.0%) in the control group and 132 participants (66.0%) in the cases group. Moderate anemia was not observed in the control group but was present in 12 participants (6.0%) in the cases group. Severe anemia was absent in the control group, while 2 participants (1.0%) in the cases group had severe anemia (p< 0.001) [Table I].

In the comparison of anemia severity with HAM-D scoring among cases, 168 participants (84.0%) with normal hemoglobin levels had normal HAM-D scores, while 28 participants (14.0%) had mild depression, 16 participants (8.0%) had moderate depression, and 10 participants (5.0%) had severe depression. Among those with mild anemia, 45 participants (22.5%) had normal HAM-D scores, 72 participants (36.0%) had mild depression, 25

participants (12.5%) had moderate depression, and 22 participants (11.0%) had severe depression. For moderate anemia, 6 participants (3.0%) had normal HAM-D scores, 4 participants (2.0%) had mild depression, 1 participant (0.5%) had moderate depression, and 1 participant (0.5%) had severe depression. In severe anemia cases, 2 participants (1.0%) had normal HAM-D scores, with no cases of moderate or severe depression observed ( $p < 0.001$ ) [Table II].

Table I: Baseline characteristics of cases and controls

Characteristics		Control (n=200)	Cases (n=200)	p-value
Age	18-25 years	36(18.0%)	32(16.0%)	0.99
	26-35 years	42(21.0%)	40(20.0%)	
	36-45 years	66(33.0%)	70(35.0%)	
	46-55 years	52(26.0%)	54(27.0%)	
	>55 years	4(2.0%)	4(2.0%)	
Marital status	Single	46(23.0%)	26(13.0%)	0.125
	Married	150(75.0%)	160(80.0%)	
	Widowed	2(1.0%)	8(4.0%)	
	Separated	2(1.0%)	6(3.0%)	
Socioeconomic status (monthly Income)	Lower (Rs<14000)	78(39.0%)	70(35.0%)	0.81
	Middle (Rs=14000-45000)	100(50.0%)	104(52.0%)	
	Upper (Rs>45000)	22(11.0%)	26(13.0%)	
Residence	Rural	80(40.0%)	80(40.0%)	-
	Urban	120(60.0%)	120(60.0%)	
Anemia	Normal	168(84.0%)	54(27.0%)	<0.001
	Mild	32(16.0%)	132(66.0%)	
	Moderate	0(0.0%)	12(6.0%)	
	Severe	0(0.0%)	2(1.0%)	

Table II: Association of Anemia With HAM-D Score

Characteristics		Score at HAM-D				p-value
		Normal n(%)	Mild depression n(%)	Moderate depression n(%)	Severe depression n(%)	
Anemia	Normal	168(84.0%)	28(14.0%)	16(8.0%)	10(5.0%)	<0.001*
	Mild	45(22.5%)	72(36.0%)	25(12.5%)	22(11.0%)	
	Moderate	6(3.0%)	4(2.0%)	1(0.5%)	1(0.5%)	
	Severe	2(1.0%)	0(0.0%)	0(0.0%)	0(0.0%)	

**Discussion:**

The results of this study showed a significant association between anemia and depressive symptoms, as was measured by Hamilton Depression Rating Scale (HAM-D).

Individuals with normal hemoglobin levels were more likely to report mild depressed symptoms (26.4%) than moderate (29.6%) or severe depression (25.0%). In contrast, those with mild anemia had a significantly greater prevalence of depressed symptoms, with 67.9% having mild depression, 66.7% moderate depression, and 60.0% severe depression. Participants with anemia showed an increase in depressed symptoms, with 3.8% suffering mild, 3.7% moderate, and 15.0% severe sadness. These findings show the need to assess the severity of anemia when evaluating depressive symptoms.

Literature suggests that the frequency of iron insufficiency and iron deficiency anemia from a total of 310 blood samples aged 18 to 23. revealed that 25.9% of students had low iron reserves, whereas 23.9% had iron deficiency anemia. Inadequate meat intake and reduced exercise capacity were found to be substantially associated with iron deficiency and anemia. Furthermore, characteristics such as pallor and past medical history of iron deficiency anemia were discovered to be statistically significant(16).

A research evaluated 1875 anemic patients aged 65 and above and determined the distribution of depression among them was considerably varied amongst the groups. The IDA group had a substantially higher Geriatric Depressive Symptoms (GDS) score than the non-IDA group ( $12.78 \pm 3.40$  vs.  $8.82 \pm 3.12$ ;  $P = 0.005$ , 95% confidence interval 2.94-4.87). Iron deficiency increased the risk of prenatal depression by 12 times( $P$ -value  $< 0.001$ ) (17).

Similarly, In a Japanese study, the relationship between iron deficiency without anemia (IDNA) and mental and somatic complaints in young women was studied (18). Data from 76 participants were evaluated, demonstrating that those with IDNA had considerably higher levels of mental issues, exhaustion, anger, and stress as compared to those with normal iron levels. Neurotic tendencies were also more common among IDNA participants. In addition, IDNA participants consumed much more fortified green tea than those with iron deficiency anemia. The data indicates IDNA may contribute to anger, exhaustion, and tension in women of reproductive age.(19)

Another study showed that irritability and perceived expressed emotion (EE) in adolescents with iron deficiency (ID) and iron deficiency anemia (IDA) was compared to healthy peers. 89 adolescents aged 12 to 17 years participated, with 19 diagnosed with ID, 31 with IDA, and 39 healthy controls (20). Significant differences in self-reported and parent-reported irritability scores were found between the ID and control groups, and between the IDA and control groups. Adolescents with IDA and ID exhibited significantly higher perceived irritability compared to controls, indicating the importance of assessing irritability and EE in cases of ID and IDA. Integrating psychosocial evaluation and intervention alongside medical



treatment could enhance management strategies for conditions such as ID and IDA and improve the overall outcome of the condition (21).

In order to address the challenges of iron deficiency anemia (IDA) and depression among Pakistani females, several recommendations can be implemented. Firstly, prioritizing nutritional education initiatives is essential to raise awareness about iron-rich foods and the significance of a balanced diet in preventing IDA (22). By promoting the consumption of iron-rich foods like red meat, poultry, fish, beans, lentils, and fortified cereals, females can enhance their iron intake and combat IDA effectively (23). Secondly, integrating mental health support services into healthcare systems is crucial to address depression. Providing accessible and culturally sensitive mental health resources such as counseling, support groups, and psycho-education can help females manage depressive symptoms and cope with stressors more effectively (24). Lastly, empowering women through education and employment opportunities can contribute to their overall well-being and reduce the prevalence of both IDA and depression. Investing in girls' education and creating job opportunities for women can enhance their socioeconomic status, reduce stressors contributing to depression, and foster a better understanding of health-related issues, including the importance of nutrition in preventing IDA(25-27). By implementing these recommendations, Pakistani females can be better equipped to combat both IDA and depression, leading to improved health outcomes and overall well-being. Understanding the psychological adjustments occurring in females with iron deficiency anemia is crucial for comprehensive healthcare management. Findings from this research will not only contribute to scientific literature but will also help healthcare professionals develop targeted interventions and support strategies aimed at improving the overall well-being of affected individuals.

### **Conclusion**

The results of this study demonstrate a strong relationship between iron deficiency anemia and depressive disorder. Furthermore, the depressive symptoms severity increased with the rise in iron deficiency anemia . Understanding the psychological adjustments occurring in females with iron deficiency anemia is crucial for comprehensive healthcare management.

## References

1. Kumar A, Sharma E, Marley A, Samaan MA, Brookes MJJBog. Iron deficiency anaemia: pathophysiology, assessment, practical management. 2022;9(1):e000759.
2. Büchtemann D, Lupp M, Bramesfeld A, Riedel-Heller SJJoad. Incidence of late-life depression: a systematic review. 2012;142(1-3):172-9.
3. Lim GY, Tam WW, Lu Y, Ho CS, Zhang MW, Ho RCJSr. Prevalence of depression in the community from 30 countries between 1994 and 2014. 2018;8(1):2861.
4. Vulser H, Wiernik E, Hoertel N, Thomas F, Pannier B, Czernichow S, et al. Association between depression and anemia in otherwise healthy adults. 2016;134(2):150-60.
5. Rybka J, Kędziora-Kornatowska K, Banaś-Leżańska P, Majsterek I, Carvalho LA, Cattaneo A, et al. Interplay between the pro-oxidant and antioxidant systems and proinflammatory cytokine levels, in relation to iron metabolism and the erythron in depression. 2013;63:187-94.
6. Zimmermann MB, Hurrell RFJTL. Nutritional iron deficiency. 2007;370(9586):511-20.
7. Strauss WE, Auerbach MJProm. Health-related quality of life in patients with iron deficiency anemia: impact of treatment with intravenous iron. 2018:285-98.
8. Bellanger RAJUP. Iron deficiency anemia in women. 2010;35(9):50-8.
9. Lee H-S, Chao H-H, Huang W-T, Chen SC-C, Yang H-YJBp. Psychiatric disorders risk in patients with iron deficiency anemia and association with iron supplementation medications: a nationwide database analysis. 2020;20:1-9.
10. Shafi M, Taufiq F, Mehmood H, Afsar S, Badar AJJCPS. Relation between depressive disorder and iron deficiency anemia among adults reporting to a secondary healthcare facility: a hospital-based case control study. 2018;28(6):456-559.
11. Ali SA, Abbasi Z, Shahid B, Moin G, Hambidge KM, Krebs NF, et al. Prevalence and determinants of anemia among women of reproductive age in Thatta Pakistan: Findings from a cross-sectional study. 2020;15(9):e0239320.
12. Hamilton MJJon, neurosurgery,, psychiatry. A rating scale for depression. 1960;23(1):56.
13. Williams JBJEaop, neuroscience c. Standardizing the Hamilton Depression Rating Scale: past, present, and future. 2001;251:6-12.
14. Asghar J, Tabasam M, Althobaiti MM, Adnan Ashour A, Aleid MA, Ibrahim Khalaf O, et al. A randomized clinical trial comparing two treatment strategies, evaluating the meaningfulness of HAM-D rating scale in patients with major depressive disorder. 2022;13:873693.
15. Carrozzino D, Patierno C, Fava GA, Guidi JJP, psychosomatics. The Hamilton rating scales for depression: a critical review of clinimetric properties of different versions. 2020;89(3):133-50.

16. Fatin A-S, Mamdooh G, Safaa Q, Nadiyah B, Adel AJJoML, Diagnosis. Prevalence of iron deficiency and iron deficiency anemia among females at university stage. 2011;2(1):5-11.
17. Stewart R, Hirani VJPM. Relationship between depressive symptoms, anemia, and iron status in older residents from a national survey population. 2012;74(2):208-13.
18. Sawada T, Konomi A, Yokoi KJBter. Iron deficiency without anemia is associated with anger and fatigue in young Japanese women. 2014;159:22-31.
19. Cook RL, O'Dwyer NJ, Parker HM, Donges CE, Cheng HL, Steinbeck KS, et al. Iron deficiency anemia, not iron deficiency, is associated with reduced attention in healthy young women. 2017;9(11):1216.
20. Neumann S. Prevalence and predictors of iron deficiency anemia among infants residing in inner-city Montréal. 2006.
21. Uçar HN, Köker SA, Tekin UJJoPHO. Irritability and perceived expressed emotion in adolescents with iron deficiency and iron deficiency anemia: a case-control study. 2020;42(6):403-9.
22. Lokeshwar M, Mehta M, Mehta N, Shelke P, Babar NJTIJoP. Prevention of iron deficiency anemia (IDA): How far have we reached? 2011;78:593-602.
23. Bathla S, Arora SJCRiFS, Nutrition. Prevalence and approaches to manage iron deficiency anemia (IDA). 2022;62(32):8815-28.
24. Holden K, Hernandez N, Wrenn G, Belton AJH, Culture, Society. Resilience: Protective factors for depression and post traumatic stress disorder among African American women? 2017;9:12-29.
25. Jukes MC, Drake LJ, Bundy DA. School health, nutrition and education for all: levelling the playing field: CABI; 2007.
26. Nordin SM, Boyle M, Kemmer TMJJotAoN, Dietetics. Position of the Academy of Nutrition and Dietetics: Nutrition security in developing nations: Sustainable food, water, and health. 2013;113(4):581-95.
27. Shanks TRW, Robinson CJEOER. Assets, economic opportunity and toxic stress: A framework for understanding child and educational outcomes. 2013;33:154-70.