Print ISSN : 3080-3551 | Online ISSN : 3080-356X
Pakistan Journal of Mental Health

Original Article

SEASONALITY AND SEASONAL PSYCHIATRIC DISORDERS IN ADULTS

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KEYWORDS
Seasonal Attitude, Seasonal Affective Disorder, Depression, Winter Depression

CITE THIS ARTICLE:
Riaz, H. (2024). Seasonality and seasonal psychiatric disorders in adults. Pakistan Journal of Mental Health, 1(1), 25-33.

ARTICLE DETAILS:
Received on 25 Sep, 2024
Accepted on 15 Nov, 2024
Published on 25 Dec, 2024

ABSTRACT

Seasonal changes can profoundly influence human mood and behavior, leading to a range of psychiatric disorders. This study explores the complex relationship between seasonality and mental health, focusing on adult populations. We delve into the prevalence and characteristics of seasonal affective disorder (SAD), a recurrent depressive disorder closely linked to seasonal fluctuations. Additionally, we examine the potential impact of seasonality on psychiatric conditions across months. The sample was 300 adults. Measures of the study include the Seasonal Attitudes Scale (Sigmon et al., 2007), the Personal Inventory for Depression and SAD (Terman et al., 1993), and the depression subscale of the Depression Anxiety Stress Scale (Lovibond & Levibond, 1995). Results revealed that seasonal attitude significantly positively predicted seasonal affective disorder, depression, and winter depression among adults. Gender differences revealed that women significantly scored higher on seasonal affective disorder, depression, and winter depression among adults. Findings also revealed that seasonal worst conditions were found in January, June, and December. By understanding the intricate interplay between seasonality and mental health, we can develop effective interventions to mitigate the negative effects of these conditions and improve the quality of life for individuals affected.

I. INTRODUCTION

The affective disorders are characterized by seasonality, mostly as winter depression, commonly referred to as winter-type seasonal affective disorder (SAD). Patients with seasonal Affective Disorder (SAD) of the winter type fit the criteria of recurrent major depressive disorder or bipolar disorder, with manifested seasonal changes in the onset, the severity, and the remission of symptoms, particularly apparent during the winter period (American Psychiatric Association (APA), 2013). There is already a large amount of evidence that a similar seasonal effect exists on depressive symptoms, which is not limited to Seasonal Affective Disorder (SAD). Studies have shown that seasonal issues in influencing depression symptoms prevalence and the severity of the symptoms are not limited to the parameters of the Seasonal Affective Disorder (Morken et al., 2002). The studies show that depressive symptoms in people with known depressive disorders (Fellinger et al., 2022) and even in the non-clinical population (Kasper et al., 1989) have a seasonal influence on the severity of depressive symptoms. The differences in the emotional state, behavioural pattern, and physiological reactions over the seasons are the problems that have captivated human attention since ancient times. Over the past 20 years, the understanding of seasonal affective disorder (SAD), the presence of which is characterized by the development of a mild affective episode every year during a specific season, has been given more attention regarding the fluctuations in psychiatric disorders on an annual basis in both academic psychiatry and the general population (Rasmussen, 2020). Research conducted on changes in emotional well-being and behaviour on an annual basis in the field of psychiatry has been

done on the higher prevalence of suicide, hospitalization due to mood disorders, and the occurrence of episodes of mood disorders during spring and autumn months (Angst et al., 2005). The definition of Seasonal Affective Disorder (SAD) mainly accentuates the differences in mood and behavior observed during the summer and the winter seasons.

The study has analyzed the seasonal differences in mental symptoms and disorders in patients and behavioural and mood fluctuations in the general population (Basnet et al., 2016). Many studies investigating seasonal changes in the larger population have majorly focused on the variations in mood, sleep duration, weight, and various other aspects in comparing summer to that of winter. It appears that the depressive mood of the general population increases during the winter months. During the winter season, it is noted that people tend to have a longer period of sleep as compared to the time of the summer season. Moreover, the body weight, blood pressure, or cholesterol levels of adults increase significantly in the period (Woodhouse et al., 1993). Birth rates, a measure of sexual activity behavior, are highest in spring in the whole of northern Europe, which suggests a seasonal pattern, which could reflect more sexual activity in summer (Pagon et al., 2013). The authors confirm that winter sadness of Seasonal Affective Disorder (SAD) appears to be a deep-seated result of a bigger yearly variation which affects a significant proportion of the populace (Mersch, 1999). Studies show seasonal variation on the changes in the suicide rates, onset of affective episodes, initiation of depression management consultation with healthcare providers, initiation of antidepressant prescriptions, and affective disorders hospitalization. Numerous studies have indicated increased activity during the spring with a smaller peak observed during late fall (Tucker and Gilliland, 2007). Epidemiological research, and clinical observations have found two remarkable patterns of seasonal variation in mental symptoms a difference in mood between summer and winter and an increased activity in spring and autumn. The main focus of the research into the possible causes of these seasonal changes has been on the changes in the length of daylight (Rasmussen et al., 2020).

The symptoms of depression are widely present within the population of old people; however, they are frequently ignored and under-treated (Mojtabai, 2014). The moods of elderly citizens can be more susceptible to different external factors, predetermined by the practical factors of reduced physical activity in the winter months (Gatti, 2019), as well as the changes in neurophysiology associated with the process of ageing, including changes in circadian rhythms (Partridge et al., 2018). Much of the available literature on seasonality in epidemiology has been unable to consider older age groups (or has been based on specific age extremes) (Grassly & Fraser, 2006). Moreover, the studies examining the effectiveness of the bright light therapy in older adults have been done mainly in institutional or specialized care settings, and thus the findings cannot be generalized to the general elderly population (Sumaya et al., 2001). Climate change is a significant societal health issue in the contemporary community in collaboration with the ageing population (Smith & Woodward, 2014). However, little attention has been given to the effect that the long-term climate, which can be described as a consistent pattern of weather over a period of three decades, has on the mood. The previous studies tended to depend on self-reported mood seasonality or seasonal data, without incorporating the objective weather variables (McConville et al., 2002). Another recent survey conducted in Spain, using local objective climate data, has shown that residents in regions characterized by hot climate, low precipitation, and length of sunshine had a higher tendency towards the development of depression (Henriquez Sanchez et al., 2014). A potential study, however, revealed that there was a minor correlation between objective weather conditions and mood (Jones & Kerr, 2013).

Seasonal affective disorder is a specific clinical subtype of mood disorder, which is characterized by the regularity of significant episodes of depression and their dependence on the seasonal fluctuations (Rosenthal et al., 1984). The most recognized form of seasonal affective disorder is winter depression, which is characterized by the clinical symptoms of depression that occur throughout the winter and autumn seasons, and eventually result in a complete recovery of mood during the spring and summer periods. The symptoms of seasonal affective disorder can include a melancholic mood, strong weakness, a preference to sleep excessively, a greater appetite, and a specific tendency to consumption of carbohydrates, and the resultant weight gain (Lee et al., 2011). People with a seasonal affective disorder (SAD) are also very prone to fluctuation in their moods over the course of the year, with depression experienced over the fall and winter months, followed by mood stabilisation over the spring and summer seasons (Rosenthal et al., 1984). Many people who are diagnosed with Seasonal Affective Disorder (SAD) present with so-called atypical symptoms of depression, which are high sleep levels, excessive fatigue, a marked

increase in appetite, and a peculiar tendency towards consuming foods rich in carbohydrates (Sher, 2004). Seasonal Affective Disorder (SAD) seems to be associated with a lack of light in the winter season (Bunney & Bunney, 2000), and light therapy is recognized as the most effective intervention for SAD, which is supported by numerous studies that highlight the effectiveness of this treatment technique (Golden et al., 2005). It has been reported that when light therapy is administered in the morning, it is highly effective rather than when it is done in the evening (Terman & Terman, 2010). Even though it has not been possible to reach a unified conception of the underlying pathophysiological processes of Seasonal Affective Disorder (SAD), several theories and lines of thought have been brought up, including circadian phase shift and retinal insensitivity to light (Rohan et al., 2009).

Isaac et al. (2003) state that seasonal affective disorder (SAD) has different symptoms in both men and women. Research has shown that females with Seasonal Affective Disorder (SAD) experience more pronounced shifts in appetite, weight gain as well and the length of sleep than males do. Kasper et al. (1989) observed that persistently, women with Seasonal Affective Disorder (SAD) experience elevated betterments in blood glucose levels and augmented insulin resistance during the winter season. The same phenomenon is consistent with established gender differences in weight gain and food habits, and the disparity in the responses of the individuals affected by SAD to the glucose tolerance tests. Hung et al. (2007) noted that changes in blood glucose level and insulin resistance among female patients of SAD as opposed to their control group are more pronounced during the winter period, which is consistent with the significant changes in carbohydrate craving and the gain of body mass. Objectives of the study are given below:

1. To investigate the effect of seasonality on depression and winter depression.
2. To investigate the link between seasonal and non-seasonal depression.
3. To identify the gender differences in all study variables.
4. To compare the intensity of depression in different months.

II. METHOD

Participants

This investigation employed a cross-sectional survey methodology. The sample for the current study included a total of 300 adults. The study comprised 150 male and 150 female participants, all aged between 20 and 35 years. Information was collected from multiple educational institutions in Haripur. Data were collected from the participants using purposive sampling strategies. Documentation of all participants occurred during their standard work hours.

Measures

The subsequent measures were employed for the collection of data. The Seasonal Attitudes Scale, developed by Sigmon et al. (2007), comprises 25 items. Responses are assessed using a scale ranging from 1 (not at all reflective of my identity) to 7 (highly reflective of my identity). Scores can range from 25 to 175. Scores among the general population range from 25 to 100, while individuals with SAD typically score between 130 and 175. This measure demonstrates sufficient psychometric properties. 2 The Personal Inventory for Depression and Seasonal Affective Disorder, developed by Terman et al. in 1993, comprises 30 items. Scales employ dichotomous formats, a five-point Likert-type framework, and a 13-option response scale. The response classifications included 0 for No, 1 for Yes, 0 for No Change, 2 for Extreme Changes, and a scale from 1 for January to 13 for None. The depression subscale of the Depression Anxiety Stress Scale, developed by Lovibond and Levibond (1995), comprises seven items. The scale employs a four-point Likert response format. The response categories ranged from 0, indicating never, to 3, indicating always. The scale values span from low to high; therefore, higher values indicate severe major depression, while lower values suggest the opposite. All elements are presented favorably. The original scale demonstrates a reliability range of .82 to .93.

Procedure

This research applies direct contact with the participants to collect information. The objectives, qualities, and importance of the study were explained to the relevant authorities, and official permission was obtained to collect

data among participants. The nature, aim, and importance of the study were explained to the participants, and informed consent was sought in order to proceed with the scales administration. The participants were assured that all information would be kept confidential and would only be utilized for the research purpose. The subjects retained their right to pull out of the research at any point in time during the research. The staff efficiently responded to queries of participants throughout the entire process, which included the time before, during, and after filling out the form. The estimated time of time required to take the surveys is 20-30 minutes. After the scales had been completed, the person who had done it over-reviewed it and attempted to resolve the inquiries that had remained in it either deliberately or unintentionally. The participants were collected individually, which gave a response rate of 75 percent. Three hundred and five questionnaires were shared, and three hundred of them were sent back to be analyzed. The information was shared by the participants willingly and was not coerced by any external factors. The participants' contributions to the study were ultimately acknowledged as substantial.

III. RESULTS

Table 1: **Psychometric Properties and Pearson Correlation among Study Variables**

Variables	*M*	*SD*	α	Range	1	2	3	4
1. Seasonal Attitude	*87.23*	*10.81*	.82	40-160	-	.31*	.30*	.27*
2. Major Depressive Disorder	7.81	3.57	.80	7-20		-	.28*	.20*
3. Seasonal Affective Disorder	10.42	4.05	.72	13-21			-	.23*
4. Winter Depression	12.04	2.34	.77	9-17				-

*p< .01

Table 1 shows that all the scales used in the present study have greater than .70 reliability coefficients, which indicate that the scales have satisfactory internal consistency. Results of the Pearson correlation indicate that seasonal attitude has a significant positive correlation with depression, seasonal affective disorder, and winter depression.

Table 2: Impact of Seasonal Attitude on the Prediction of Seasonal Affective Disorder, Depression, and Winter Depression among Adults

	Outcome Variables (B values)		
Predictor	Seasonal Affective Disorder	Depression	Winter Depression
(Constant)	8.49**	14.20**	14.20**
Seasonal Attitude	.32*	.48**	.56**
R^2	.34	.56	.45
F	14.80**	29.64**	18.22**

Note. B = Unstandardized regression coefficients
*p< .05, **p< .01

Table 2 shows the results of the linear regression analysis with depression as the predictor variable and SAD as the outcome variable. In seasonal affective disorders, the R^2 value of .34 indicates that 34% variance in the outcome variable can be accounted for by the predictors with F (1,298) = 10.80, p < .01. The results show that seasonal attitude is a significant positive predictor of seasonal affective disorder among adults. In depression, the R^2 value of .56 indicates that 56% of the variance in the outcome variable can be accounted for by the predictors with F (1, 298) = 29.64, p < .01. The results show that seasonal attitude is a significant positive predictor of winter depression among adults. In winter depression, the R^2 value of .45 indicates that 45% variance in the outcome variable can be accounted for by the predictors with F (1,298) = 18.22, p < .01. The results show that seasonal attitude is a significant positive predictor of winter depression among adults.

Table 3: Gender Differences in Seasonal Affected Disorder, Depression and Winter Depression among Adults

	Females		Males			
Variables	*M*	*SD*	*M*	*SD*	*t* (358)	Cohen's *d*
Seasonal Affective Disorder	13.47	1.69	9.68	0.93	23.72*	2.78
Depression	8.37	3.82	6.89	2.92	3.81*	.44
Winter Depression	10.89	4.33	9.64	3.43	2.82*	.32

*p< .01

Table 3 shows gender differences in seasonal affective disorder, depression, and winter depression among adults. Findings indicate significant mean differences on depression with t (348) = 3.81, p < .001. Results show that female adults (M = 8.37, SD = 3.82) significantly scored higher on depression as compared to male adults (M = 6.89, SD = 2.92). Findings indicate significant mean differences on SAD with t (348) = 23.72, p < .001. Results show that female adults (M = 13.47, SD = 1.69) significantly scored higher on SAD as compared to male adults (M = 9.68, SD = 0.93). Findings indicate significant mean differences on winter depression with t (348) = 2.82, p < .01. Results show that female adults (M = 10.89, SD = 4.33) significantly scored higher on winter depression as compared to male adults (M = 9.64, SD = 3.43).

Figure 1: Worse Conditions due to the Adverse Effects of Seasonal Changes in Pakistan

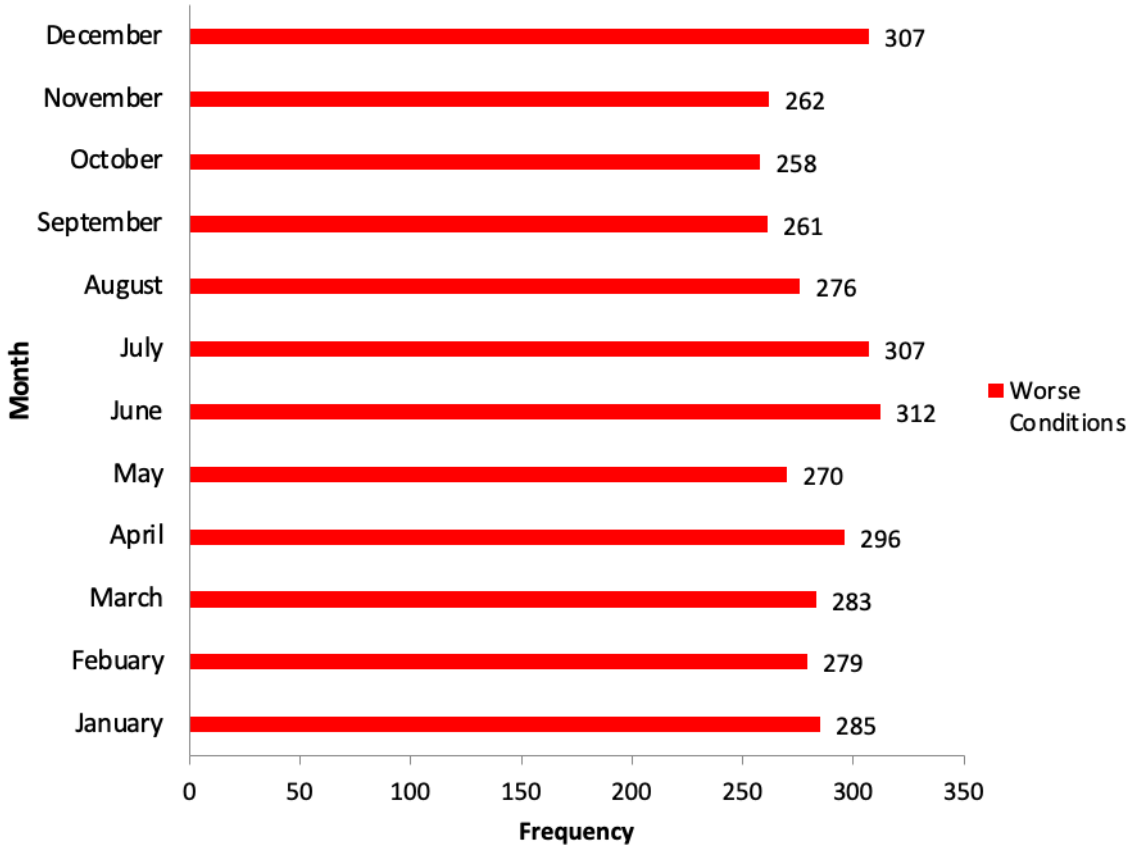


Figure 2: Best Conditions due to the Positive Effects of Seasonal Changes in Pakistan

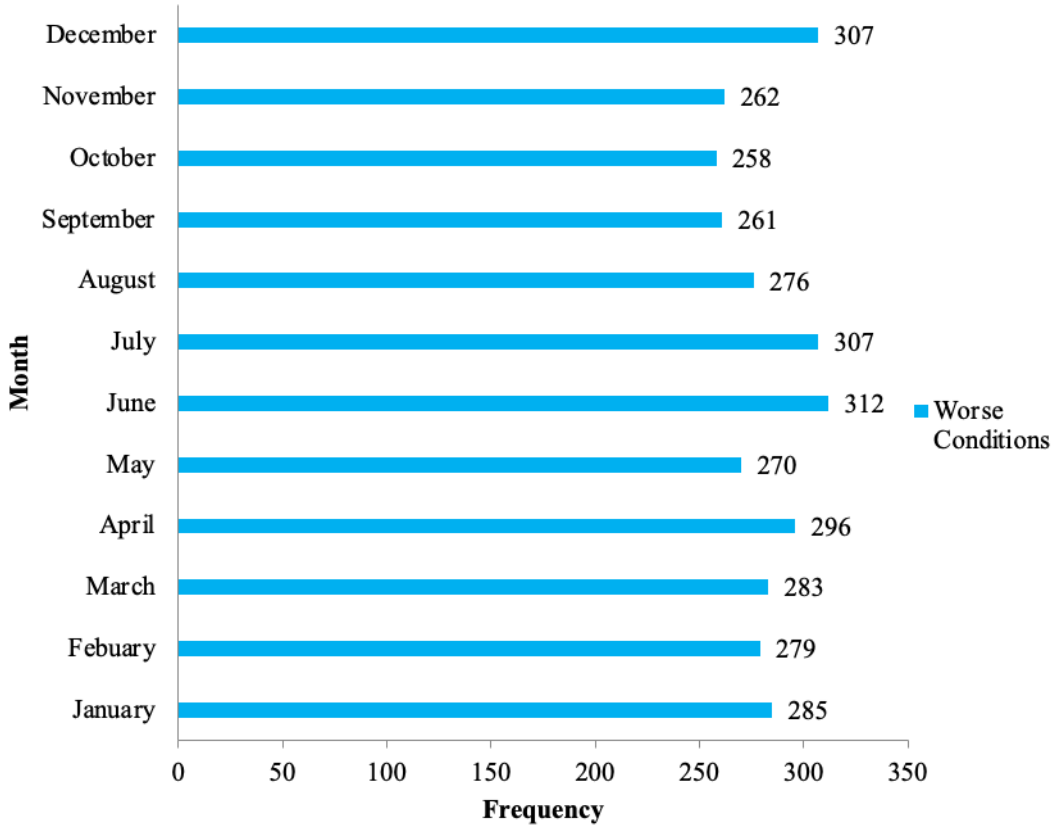
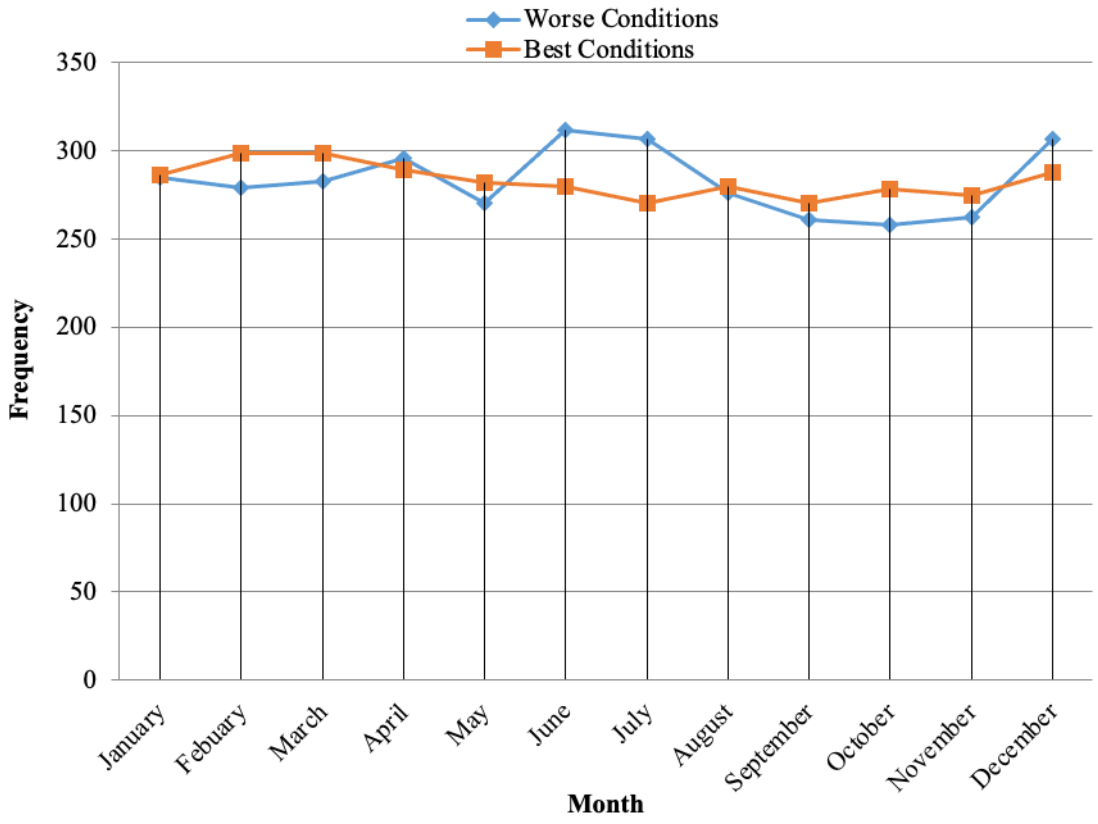


Figure 3: Worse conditions due to the Adverse Effects of Seasonal Changes in Pakistan



IV. DISCUSSION

The effect of seasonal disposition is significant and positive in forecasting seasonal affective disorder, depression, and depressive conditions during winter. The weather conditions also affect human emotional levels significantly, with numerous individuals stating that they feel happier during long daylight periods when it is sunny than during the few days that are short, damp, and dark (Marion et al., 1999). It is not only the idea of seasonal prevalence of specific psychological disorders, but the concept of seasonal prevalence in particular has also been widely popularized, particularly the affective disorders and their deplorable consequences in relation to suicides (Shiloh et al., 2005). Climate refers to a combination of meteorological practices and factors over a specific time that determine the weather patterns of a specific location on the surface of the earth (Emanuel, 2008). The modern definitions describe climate as a multifaceted system where several aspects interrelate with each other, such as the atmosphere, oceans, lithosphere, glacial and snow formations, and the biosphere, which also involves the presence of human factors (Thornthwaite, 1948). Traditionally, before the development of clinical research, it was suggested that most of the suicides occurred in the fall and winter, which is the season of reduced light contact, and that this factor contributed to the mood changes in people (Rapley, 2012). The human body proves to be significantly sensitive to changes in temperature and humidity, wind, air pressure, isolation, precipitation, and presence of positive or negative air and ion charges, particularly in cases where the factors undergo significant changes (Kaiser, 2007). The accumulated number of studies and more attentive research prove that the period of spring and early summer is the one characterized by the greatest levels of suicide (Marion et al., 1999).

Gender variations suggest that females are more vulnerable to high rates of seasonal affective disorder, depression, and winter-induced depression symptoms. Internet Seasonal Affective Disorder (SAD) is approximately four times more common among women at forty times higher than any males. Seasonal affective disorder (SAD) is more likely to affect adults as compared to children and adolescents. After 50 years, there is a chance that one will not develop Seasonal Affective Disorder (SAD). Seasonal Affective Disorder (SAD) has unique and unusual symptoms, and they differ greatly between men and women (Isaac et al., 1999). Research indicates that women with Seasonal Affective Disorder (SAD) tend to record tremendous improvement in their consumption, weight gain, and sleeping habits compared to their male counterparts who have the disorder (Leibenhaft et al., 1995). Such differences go beyond Seasonal Affective Disorder (SAD); not only women with non-seasonal depression (females in general) have demonstrated higher appetite, weight gain, and high carbohydrate requirement than males. The change in food habits and body mass during seasons, especially in winter, is attributed to insensitivity to insulin and thus reduced absorption of glucose by the cell membrane and high insulin levels in the blood. NIDDM is a type of diabetes that is marked by relational glucose and insulin metabolism, where the sensitivity of insulin is raised, resulting in an elevation in both insulin and glucose levels (Matchock et al., 2007). The results showed that the most unfavourable conditions over the seasons were in January, June, and December. People with the most intense symptoms of the winter seasonal affective disorder (SAD) can have symptoms ranging from September and April, whereas others may only exhibit the symptoms in the worst months of winter. Studies indicate that women are far more prone to experience incidents of Seasonal Affective Disorder (SAD) as compared to men, whose level of suspicion is four times higher. Handling reasons behind this gap are not clear yet; one of the concepts advocates that women might spend more time at home with their children (Rosenthal et al., 1984). Between the early 1980s and the early 2000s, people in Africa and Australia had demonstrated a strong sense of optimism and satisfaction during the winter season.

V. CONCLUSION

The study discovered that seasonal attitude plays a significant role in seasonal affective disorder, depression, and winter depression among the adult group, with women having higher scores. The conditions were also worse in January, June, and December. This interplay can be understood and provide a means to create an intervention to enhance the quality of life and mental health.

Disclosure Statement

No potential conflict of interest was reported by the author.

Funding
The author received no funding from any organizations.

VI. REFERENCES

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.).

Angst, J., Sellaro, R., Stassen, H. H., & Gamma, A. (2005). Diagnostic conversion from depression to bipolar disorders: results of a long-term prospective study of hospital admissions. *Journal of affective disorders*, *84*(2-3), 149-157.

Basnet, S., Merikanto, I., Lahti, T., Männistö, S., Laatikainen, T., Vartiainen, E., & Partonen, T. (2016). Seasonal variations in mood and behavior associate with common chronic diseases and symptoms in a population-based study. *Psychiatry research*, *238*, 181-188.

Bunney, W. E., & Bunney, B. G. (2000). Evidence for a compromised dorsolateral prefrontal cortical parallel circuit in schizophrenia. *Brain Research Reviews*, *31*(2-3), 138-146.

Emanuel, K. (2009). Wether and Earth's Atmosphere. *National Oceanic and Atmospheric Administrations Climate Prediction Center, Massachusetts*.

Fellinger, M., Waldhoer, T., Serretti, A., Hinterbuchinger, B., Pruckner, N., Koenig, D., ... & Fugger, G. (2022). Seasonality in major depressive disorder: effect of sex and age. *Journal of affective disorders*, *296*, 111-116.

Gatti, E. T. J. (2019). *Towards year-round participation: Three investigations into the relationships between weather and outdoor recreation* (Doctoral dissertation, The University of Utah).

Golden, R. N., Gaynes, B. N., Ekstrom, R. D., Hamer, R. M., Jacobsen, F. M., Suppes, T., ... & Nemeroff, C. B. (2005). The efficacy of light therapy in the treatment of mood disorders: a review and meta-analysis of the evidence. *American Journal of Psychiatry*, *162*(4), 656-662.

Grassly, N. C., & Fraser, C. (2006). Seasonal infectious disease epidemiology. *Proceedings of the Royal Society B: Biological Sciences*, *273*(1600), 2541-2550.

Hung, Y. J., Hsieh, C. H., Chen, Y. J., Pei, D., Kuo, S. W., Shen, D. C., ... & Chen, Y. C. (2007). Insulin sensitivity, proinflammatory markers and adiponectin in young males with different subtypes of depressive disorder. *Clinical Endocrinology*, *67*(5), 784-789.

Isaac, J. T. (2003). Postsynaptic silent synapses: evidence and mechanisms. *Neuropharmacology*, *45*(4), 450-460.

Jones, B. K., & Kerr, R. (2023). "If Winter Comes, Can Spring Be Far Behind?": Climate and Preference for Redemptive Narratives. *Ecopsychology*, *15*(4), 382-390.

Kasper, S., Wehr, T. A., Bartko, J. J., Gaist, P. A., & Rosenthal, N. E. (1989). Epidemiological findings of seasonal changes in mood and behavior. A telephone survey of Montgomery County, Maryland. *Archives of general psychiatry*, *46*(9), 823-833.

Lee, H. J., Rex, K. M., Nievergelt, C. M., Kelsoe, J. R., & Kripke, D. F. (2011). Delayed sleep phase syndrome is related to seasonal affective disorder. *Journal of Affective Disorders*, *133*(3), 573-579.

Leibenluft, E., Hardin, T. A., & Rosenthal, N. E. (1995). Gender differences in seasonal affective disorder. *Depression*, *3*(1-2), 13-19.

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy, 33*(3), 335–343. https://doi.org/10.1016/0005-7967(94)00075-U

Marion, S. A., Agbayewa, M. O., & Wiggins, S. (1999). The effect of season and weather on suicide rates in the elderly in British Columbia. *Canadian journal of public health*, *90*, 418-422.

Matchock, R. L., Dorn, L. D., & Susman, E. J. (2007). Diurnal and seasonal cortisol, testosterone, and DHEA rhythms in boys and girls during puberty. *Chronobiology international*, *24*(5), 969-990.

McConville, C., McQuaid, M., McCartney, A., & Gilmore, W. (2002). Mood and behaviour problems associated with seasonal changes in Britain and Ireland. *International journal of social psychiatry*, *48*(2), 103-114.

Mersch, P. P. A., Middendorp, H. M., Bouhuys, A. L., Beersma, D. G., & van den Hoofdakker, R. H. (1999). The prevalence of seasonal affective disorder in The Netherlands: a prospective and retrospective study of seasonal mood variation in the general population. *Biological psychiatry*, *45*(8), 1013-1022.

Mojtabai, R. (2014). Diagnosing depression in older adults in primary care. *New England Journal of Medicine*, *370*(13), 1180-1182.

Morken, G., Lilleeng, S., & Linaker, O. M. (2002). Seasonal variation in suicides and in admissions to hospital for mania and depression. *Journal of affective disorders*, *69*(1-3), 39-45.

Pagon, N., Grignolio, S., Pipia, A., Bongi, P., Bertolucci, C., & Apollonio, M. (2013). Seasonal variation of activity patterns in roe deer in a temperate forested area. *Chronobiology international*, *30*(6), 772-785.

Partridge, L., Deelen, J., & Slagboom, P. E. (2018). Facing up to the global challenges of ageing. *Nature*, *561*(7721), 45-56.

Rapley, C. (2012). The health impacts of climate change. *BMJ*, *344*.

Rasmussen, E. B. (2020). Making and managing medical anomalies: Exploring the classification of 'medically unexplained symptoms'. *Social Studies of Science*, *50*(6), 901-931.

Rohan, K. J., Roecklein, K. A., & Haaga, D. A. (2009). Biological and psychological mechanisms of seasonal affective disorder: a review and integration. *Current Psychiatry Reviews*, *5*(1), 37-47.

Rosenthal, N. E., Sack, D. A., Gillin, J. C., Lewy, A. J., Goodwin, F. K., Davenport, Y., ... & Wehr, T. A. (1984). Seasonal affective disorder: a description of the syndrome and preliminary findings with light therapy. *Archives of general psychiatry*, *41*(1), 72-80.

Sher, L. (2004). Etiology, pathogenesis, and treatment of seasonal and non-seasonal mood disorders: possible role of circadian rhythm abnormalities related to developmental alcohol exposure. *Medical hypotheses*, *62*(5), 797-801.

Shiloh, R., Shapira, A., Potchter, O., Hermesh, H., Popper, M., & Weizman, A. (2005). Effects of climate on admission rates of schizophrenia patients to psychiatric hospitals. *European Psychiatry*, *20*(1), 61-64.

Sigmon, S. T., Whitcomb-Smith, S., Boulard, N. E., Pells, J. J., Hermann, B. A., Edenfield, T. M., ... & Schartel, J. G. (2007). Seasonal reactivity: Attentional bias and psychophysiological arousal in seasonal and nonseasonal depression. *Cognitive Therapy and Research*, *31*, 619-638.

Sumaya, I. C., Rienzi, B. M., Deegan, J. F., & Moss, D. E. (2001). Bright light treatment decreases depression in institutionalized older adults: a placebo-controlled crossover study. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *56*(6), M356-M360.

Terman, J. S., Reme, C. E., & Terman, M. (1993). Rod outer segment disk shedding in rats with lesions of the suprachiasmatic nucleus. *Brain research*, *605*(2), 256-264.

Terman, J. S., Terman, M., Lo, E. S., & Cooper, T. B. (2001). Circadian time of morning light administration and therapeutic response in winter depression. *Archives of general psychiatry*, *58*(1), 69-75.

Terman, M., & Terman, J. S. (2010). Circadian rhythm phase advance with dawn simulation treatment for winter depression. *Journal of biological rhythms*, *25*(4), 297-301.

Thornthwaite, C. W. (1948). An approach toward a rational classification of climate. *Geographical review*, *38*(1), 55-94.

Tucker, P., & Gilliland, J. (2007). The effect of season and weather on physical activity: a systematic review. *Public health*, *121*(12), 909-922.

Woodhouse, P. R., Khaw, K. T., & Plummer, M. (1993). Seasonal variation of blood pressure and its relationship to ambient temperature in an elderly population. *Journal of hypertension*, *11*(11), 1267-1274.