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An Experimental Study on the Physiological and Mental Aspect for Diabetes in Adults

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Abstract: ***Diabetes has developed as a major worldwide open wellbeing issue. This is the study inquiring the dimension of factors among different group of diabetes patient using questionnaire method. Result shows an association between the diabetes and its etiological factors. The subject of this study work is known diabetic patients. Total 120 patient have participated in this study. We see that diabetes increases following by the age, between the age group 41-50 & 51-60 are more diabetic because of their low working activity, women are more in BMI so that female are more prone than men, half of diabetes patient are overweight. Maximum diabetes patient is sedentary worker, minimum percentage of diabetes patient are heavy worker. In our study we found that mostly non hospitalized diabetes patient is in depression. For hospitalized diabetes patient more are in abnormal anxiety and depression. We see that some studies support that mental stress is an influence on diabetes.***

Keywords: Diabetes, age, depression, physical activity level, mental stress

1. Introduction

Diabetes has developed as a major worldwide open wellbeing issue. In a low- and middle-income nation like India, it becomes catastrophic. (1) Diabetes mellitus is a collection of diverse illnesses. The blood glucose level is higher than usual in this condition. (2)

A serious chronic illness, diabetes is a long-term metabolic problem that develops when insulin production is below normal or when the insulin that is produced does not function efficiently. (3) Generally regarded as a spreading epidemic, diabetes affects people in almost every nation, age group, and economic sector on the planet. The International Diabetes Federation estimates that 415 million individuals worldwide suffered from diabetes in 2015, and by 2040, that figure is predicted to increase to nearly 640 million. According to estimates, 50% of diabetics are not aware that they have the disease, which raises the possibility of complications. Nonetheless, the financial and human expenses of diabetes treatment could be exorbitant. More than 12% of global health spending in 2015 went on treating diabetes and its effects, despite the fact that the illness claimed almost 5.0 million lives worldwide.(4) By 2045, there would be 134 million people living in India, up from the present 77 million. About 57% are still undiagnosed. (1)

One chronic autoimmune illness, type 1 diabetes mellitus, causes beta-cell death in the pancreas, which hinders the synthesis of insulin and causes blood sugar levels to rise. Its symptoms can appear much later, but it is most commonly observed in children and teenagers. Due to the lack of a known cure, type 1 diabetes must be prevented by enhancing quality of life. To avoid type 1 diabetes, one can utilize insulin injections and more advanced insulin therapy methods like insulin pumps and continuous glucose evaluation. Behavioural changes can stop beta-cell losses. (5)

There is a correlation between diabetes and mood disorders, and several theories have been put forth, all of which are closely related; for example, mood disorders are linked to unhealthy lifestyle choices such as smoking, not exercising, and eating too many calories; depression is linked to obesity, and obesity causes glucose intolerance; depression is linked to physiological abnormalities that may lead to insulin resistance and raise the risk of diabetes, such as abnormalities of the hypothalamus-pituitary-adrenal axis, the sympathetic nervous system, and proinflammatory cytokines; diabetes may increase the likelihood of sadness and anxiety because of the need to alter one's lifestyle, as well as the sense of loss and anxiety that comes with being diagnosed.(6)

Several studies suggest that other risk factors, including blood pressure, body weight, plasma lipid, and serum uric acid fluctuation, may potentially play a substantial role in the development of diabetic complications, in addition to glucose variability. Furthermore, since the present-day unpredictable nature of each risk factor is apparent, they could have further repercussions. (7)

A number of problems are linked to diabetes, including microvascular disease. Diabetes-related microvascular problems include diabetic kidney disease, diabetic retinopathy, and neuropathy. Macrovascular cardiovascular disease is linked to diabetes. (8) Diabetes can raise the risk of death, blindness, and kidney impairment while also lowering overall quality of life.(9)

Peripheral arterial disease, coronary artery disease, and stroke are a few more macrovascular complications. (10)

Exercise helps people with diabetes because it improves glucose management and lowers their risk of death and cardiovascular disease. Diabetes risk is decreased by moderate to intense physical activity. Daily physical activity helps diabetics without putting undue strain on their bodies. This includes both work-related and leisure activities like walking, gardening, and housework. Walking for at least 30 minutes a day can reduce diabetes problems by nearly 50%. Frequent non-exercise physical activity improves metabolic risk and motility. [11]

2. Objective

There are so many etiological factors of diabetes in this study. In this study the etiological factors is age, sex Socio Economic status, BMI, Physical Activity, Anxiety, Depression.

1) To assess the causative factor of Diabetes.
2) To identify relationship between mental stress and diabetes.
3) To observe the Physiological factor that emphasize the diabetes.
4) To observe low physical activity and diabetes relation, also observed age group and diabetes relation & physical activity based on age group.

3. Methods

The subject of this study is known diabetes patient. The number of the patient is 120. The questionnaire method are applied to collect.

3.1 Age group

We collect the patient's age and then it's categorized into 4 group's i.e. 20-30, 31-40, 41-50, 51-60.

3.2 Gender

We collect the patient's gender to ask them for face-to-face conversion.

3.3 BMI

At fast we collect weight (kg) & height (m) then we calculate BMI (weight in kg / height in meter^2).
Then we categorized the BMI in 4 group i.e. under weight, Normal, Over- weight, Obese.[12]

3.4 PAL

The physical activity of diabetes patient have been evaluated by questionnaire technique. We evaluated the physical activity of three groups as sedentary worker, moderate worker & heavy worker depending on their non-exercise activity & exercise activity.

3.5 Mental stress

We measured half of total patient mental stress through Hospital Anxiety Depression Scale (HADS)[13] These patients are hospitalized & admitted .The next half are normal diabetes patient, we measured them through the Becks Depression Inventory.[14]

4. Result & discussion

Age group

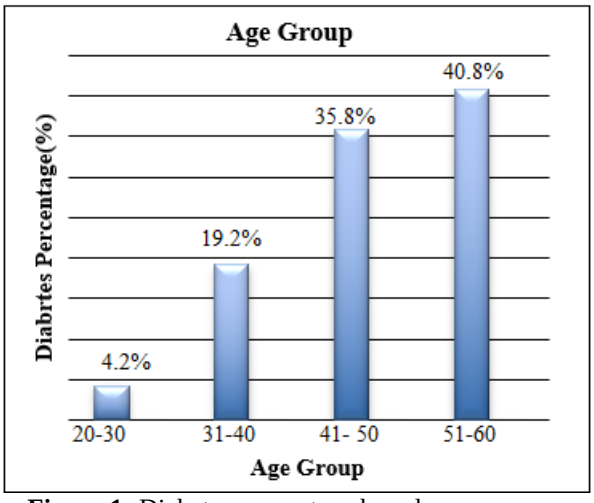

Figure 1: Diabetes percentage based on age group

It is evident from this figure-1 that the percentage of people with diabetes is rising with age. In the 20–30 age range, 4.2% of people have diabetes; in the 31–40, 41–50, and 51–60 age groups, the rates are 19.2%, 35.8%, and 40.8%, respectively.

It is projected that the prevalence of diabetes will rise sharply globally over the coming decades, with older adults suffering the greatest burden. Diabetes is a key risk factor for most geriatric syndromes, and adults with the disease have difficulty doing everyday physical activities. Mobility problems in the lower extremities are particularly apparent. [15]

Oxidative damage, aging, and insulin resistance are significantly correlated. A growing body of evidence suggests that oxidative stress is significantly elevated with aging, mostly due to a decline in antioxidant activity and an increase in pro-oxidant factors such as insulin and glucose levels. Additionally, the progressive rise in insulin resistance associated with aging is caused by a complex network of environmental, anthropometric, and neuro-hormonal factors. Notably, very long lifespans, like those of centenarians, are associated with low levels of insulin resistance and oxidative stress. The factor that causes these differences between centenarians and the elderly is unknown. Most likely, a certain genetic background plays a role. But the gene for insulin doesn't. [16]

The human body's energy equilibrium and carbohydrate metabolism are compromised as we age. As people age, their output of insulin decreases, leading to hyperglycaemia. Elderly AGE causes a decrease in pancreatic beta cell sensitivity. Moreover, pancreatic beta cells lose their sensitivity to incretins as people age. Glucagon secretion is less inhibited and postprandial insulin levels are lower due to incretins' decreased effectiveness. As people age, their insulin resistance increases, which can raise blood glucose levels. Age-related dysregulation of the Hypothalamic Pituitary Adrenal Axis (HPA axis) results in a higher prevalence of cortisol, which can contribute to hepatic insulin resistance. Age-related changes can reduce insulin receptors and the

glucose transporter GLUT-4, which lowers skeletal muscle's absorption of glucose. [17]

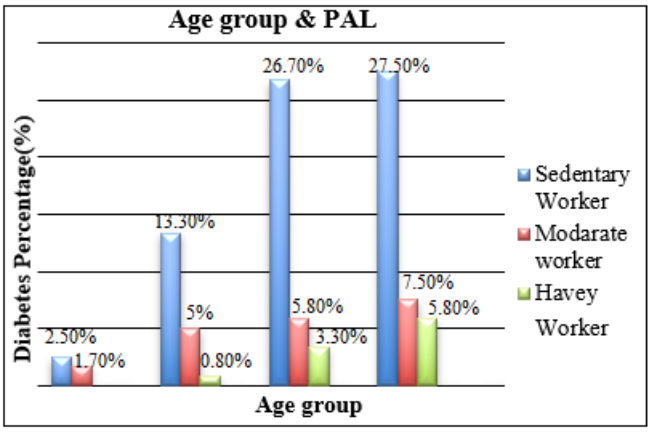

Figure 2: Diabetes percentage based on the age group and PAL

In figure-2 seen that the PAL (Physical Activity Level) in lower with age. The percentage of diabetes with age and PAL given bellow in a table:

		PAL		
		Sedentary Worker	Moderate worker	Heavy Worker
Age group	20-30	2.50%	1.70%	0
	31-40	13.30%	5%	0.80%
	41-50	26.70%	5.80%	3.30%
	51-60	27.50%	7.50%	5.80%

It has been shown that there is a 30–40% decrease in muscle mass in favour of fat tissue during the seventh decade of life. The decline in physical activity among the elderly accelerates this process. The use of potentially diabetogenic medications (diuretics, beta-adrenolytics, corticosteroids, psychotropic drugs, amiodarone), co-occurring obesity, aging-related increases in adrenergic tension, and decline in kidney function are additional factors that contribute to the impairment of glucose metabolism and diabetes in the elderly. Insulin sensitivity and glucose tolerance in the oldest age group are clearly better than those in the 60–84 age range, according to a longevity study that included a group of healthy centenarians. [17]

As people age, their beta cells' bulk and function decline, which may affect glucose homeostasis. Apoptosis and beta cell mass seem to play a similar role in human aging. Adults have low rates of both proliferation and apoptosis, which have little effect on the control of adult beta cell mass, especially as people age. Age alternation is occurring in GSSIS and/or in important regulatory processes such mitochondrial function. Among other things, electrical activity, ca2+ signalling, and cell-to-cell communication are all related to beta cell function. It seems that human pancreatic beta cells are more susceptible to aging. Reduced capacity for proliferation, weakened cellular identity, a higher percentage of senescent beta cells, and several changes in the cellular event that regulate GSSIS this can happen with the increase of age. Overweight and obesity high prevalence with the elderly then can response in metabolic stress.[18]

Gender

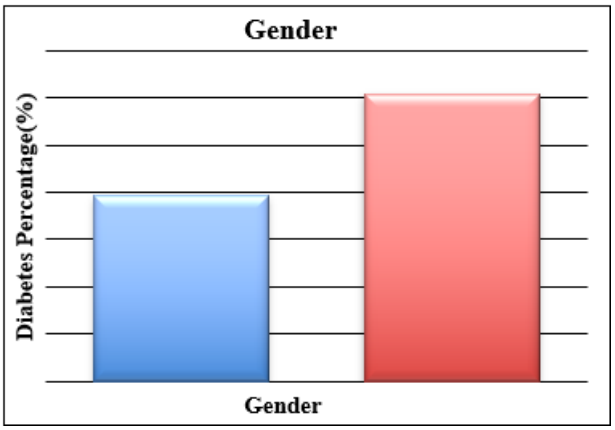

Figure 3: Percentage of diabetes based on gender

The percentage of diabetes patients and their gender group affiliation are displayed in Figure-3. There are two types of gender i.e. male & female. In this 39.2% are male & 60.8% female are diabetes.

There is convincing evidence that women are significantly more at risk for vascular illnesses caused by diabetes than males are, making diabetes a powerful risk factor for vascular disease. Unknown are the processes underlying women's elevated relative risk of vascular disease due to diabetes. Women may be more at risk for complications from diabetes than males due to sex-based disparities in the health care received for diabetes prevention, management, and treatment. [15]

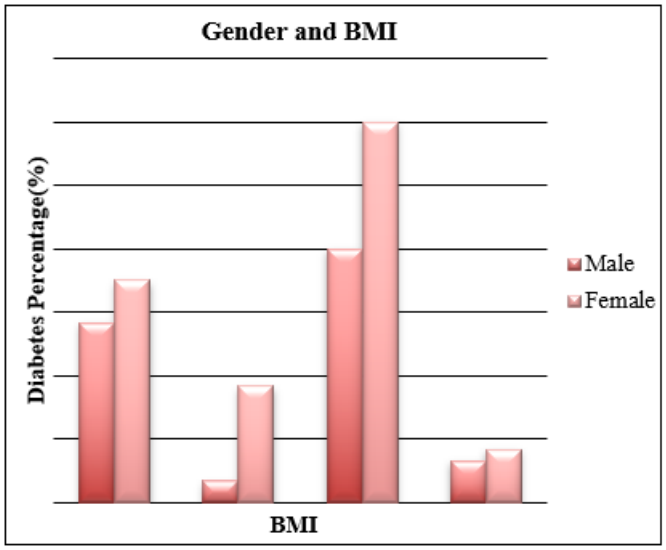

Figure 4: Percentage distribution of diabetes based on BMI & gender.

The percentage of diabetes patients by gender is displayed in the above figure-4 along with their BMI. In terms of BMI, 14.2% of men and 17.5% of women are underweight, 1.7% of men and 9.2% of women are in the normal category, 20% man and 30% of women are overweight and 3.3% man, 4.2% of women have diabetes.

Women's body composition differs from men's, their sex hormones have different effects on energy metabolism, and their BMI is higher. Women are more likely to be obese,

which can lead to diabetes. Psychosocial stress is higher in women. [19] Body composition and fat accumulation disparities between the sexes are known to increase the risk of sex-dimorphic diabetes.[20]

A higher percentage of visceral fat accumulation and obesity can result from oestrogen deficiency and compared to premenopausal women, menopausal women have a higher visceral fat mass.[21]

Conversely, most studies suggest that diabetic women are more obese than diabetic males and that there is a higher correlation between rising BMI and diabetes risk, even though the curvilinear relationships between rising BMI and diabetes risk are similar for both sexes.[22]

Different psychosocial factors can affect physical activity in men and women. Women do not engage in as much physical activity as men do, and this can result in cardiovascular diseases, type II diabetes, and gynaecological and breast cancer. Women's physical activity is influenced by psychosocial factors such as motivation, social support, and self-efficacy. This factor supports men's physical activity more than it does women's.[23]

BMI

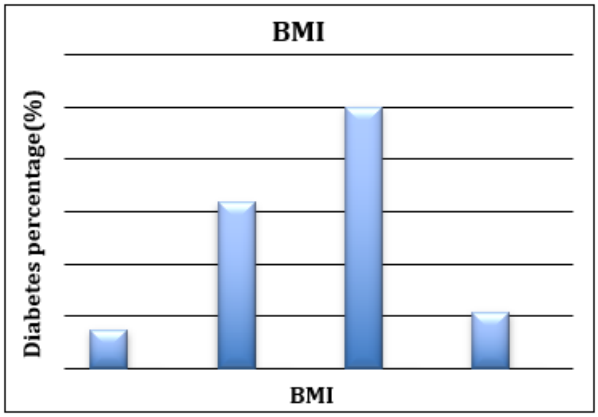

Figure 5: Percentage distribution of diabetes based on BMI

The figure-5 illustrates the proportion of diabetes patients in each BMI range. This data shows that 7.5% of people with diabetes are underweight, 31.7% of persons diabetes are normal, 50% overweight are diabetes patient, and 10.8% of those with diabetes are also obese.

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Many diseases, including diabetes mellitus, are mostly caused by the complex condition known as obesity. It significantly contributes to the development of diabetes, CVDs, and cancer. Changes in glucose metabolism and increased blood sugar are hallmarks of diabetes. Obesity and diabetes mellitus negatively impact the kidney, liver, and heart, among other body organs. Obesity-related inflammation of adipose tissue plays a role in immune system dysfunction. Damage to the retina's veins following extended exposure to high glucose levels causes diabetic retinopathy. Certain lipolytic functions are hindered by metabolic disorders including diabetes mellitus and obesity. It is very challenging to enhance public health since processed carbohydrates, saturated fat, and sugar-filled beverages all contribute to the development of obesity and diabetes mellitus. preventive measures to treat obesity, diabetes mellitus, and related conditions. When using pharmaceutical treatments to treat obesity and diabetes mellitus, lifestyle modifications may be helpful. [24] Over-eating can produce obesity and insulin resistance. The hormone leptin, which suppresses appetite, is produced by more adiposity. However, a genetic susceptibility to obesity and/or type 2 diabetes (T2D) when consuming too many calories is common in the community. Variations in the peroxisome proliferator-activated receptor-2 (PPAR-2) gene, for instance, may have a wide-ranging impact on the risk of insulin resistance and obesity. A tiny proportion of individuals who are heterozygous for the Pro12Ala variant of PPAR-are less likely to develop diabetes mellitus and become overweight than the majority of Pro homozygotes in the community. People who are overweight may have higher levels of non-estered fatty acids (NEFA) in their blood. Increases in adipose tissue cell size and/or number can result in an excess of certain hormones, including cytokinases and leptin. TNF-Alpha, or tumour necrosis factor-alpha, can lead to insulin resistance in cells. Adiponectin can improve insulin responsiveness while lipid-rich adiposities diminish it. Adipose tissue insulin resistance may raise lipase activity, which in turn may raise circulating NEFAs. High levels of circulating NEFAs can exacerbate insulin resistance in the liver and muscles. [25]

PAL

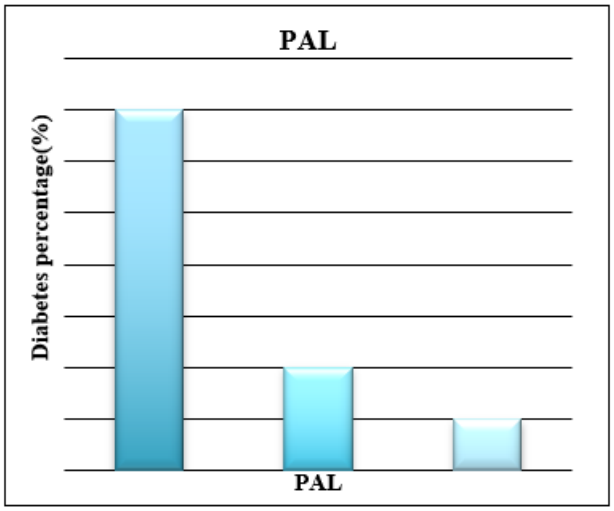

Figure 6: Percentage distribution of diabetes based on PAL

The percentage distribution of diabetes based on PAL is display figure-6. The figure-6 shown that 70% of the diabetes patient are sedentary worker, 20% diabetes patient are moderate worker, and 10% heavy worker.

In 2002, the American Diabetes Association released a statement detailing the possible advantages of exercise and physical activity for those with diabetes and pre-diabetes. The benefits of physical activity for health are rapidly growing. By enhancing blood circulation, reducing the risk of cardiovascular disease and stroke, increasing self-esteem, and maintaining appropriate blood glucose levels throughout the body, exercise improves many parts of the body and reduces the possibility of catastrophic events. Because the body uses hormone meditation to maintain normoglycemia, hypoglycaemia during physical activity is uncommon in non-diabetic individuals. [26]

Mental Stress

In our study we can measure the mental stress through two methods i.e. Hospital Anxiety and Depression scale that can measure the stress level on hospital admitted patient and backed scale can measure mental stress between normal patient.

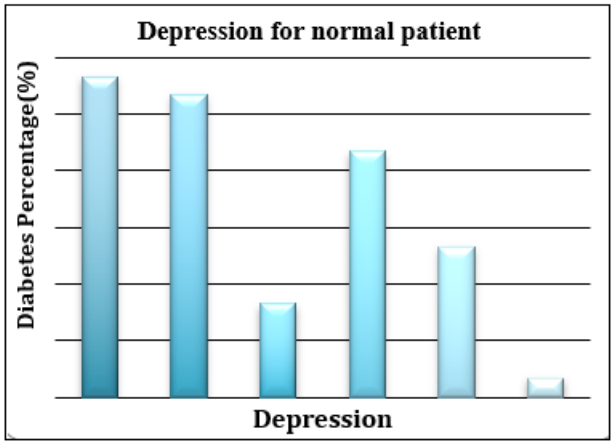

Figure 7: Percentage distribution of diabetes based on depression

The percentage distribution of diabetes patients with depression is shown in this figure-7. By using a backed scale, which has six distinct categories to gauge depression levels, we may assess the degree of depression in patients who are not hospitalized. This figure shows that 28.3% of people with diabetes have normal diabetes, 26.7% have mild mood disturbance depression, 8.3% have borderline depression, 21.7% have moderate depression, 13.3% have severe depression, and another 1.7%, which is a very small percentage, have extreme depression.

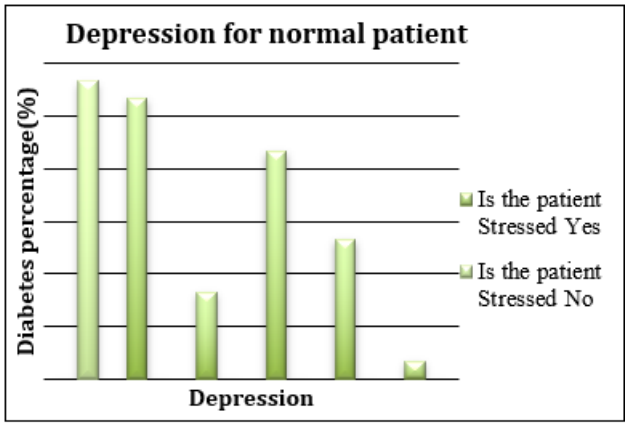

Figure 8: Percentage distribution based on depression

In this figure-8 we can see that only 28.3% diabetes patient are in normal and they can convey that they are not going any metal stress and other 71.7% statement that they are suffering any mental stress.

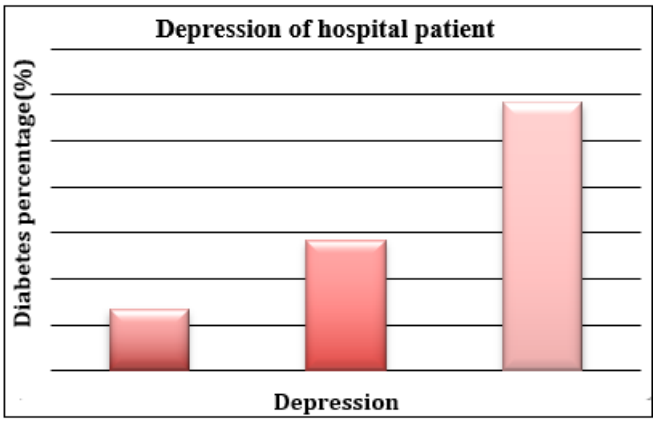

Figure 9: Percentage distribution of diabetes depends on hospitalised depression patient

This figure-9 shows diabetes patient percentage according to their depression level, this depression only for hospital admitted patient the data is collected through Hospital Anxiety Depression Scale (HADS). In our study 13.3% diabetes patient are in Normal, remaining 86.7% patient are in depression, 28.3% diabetes patient in borderline depression, remaining 58.3% are in abnormal depression diabetes patient.

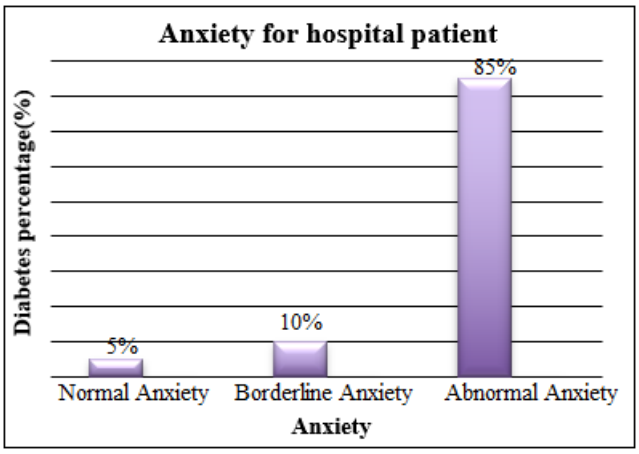

Figure 10: Diabetes percentage based on the hospitalized anxiety patient

In our study we also collect the anxiety level for hospital patient through HADS. In this figure we can see 5% of diabetes patient are in Normal, 10% people are in borderline anxiety, remaining 85% diabetes patient are suffering in abnormal anxiety.

An organism, whether human or animal, experiences "stress" when it fails to react effectively to perceived or real physical or emotional dangers. Diabetes can develop as a result of stress in a number of ways, including physiological and behavioural ones. Poor lifestyle choices have been linked to mental distress brought on by behaviour, including smoking, excessive alcohol consumption, insufficient exercise, and inadequate nutrition. However, physiological stress is linked to persistent activation of the sympathetic nervous system and the hypothalamic-pituitary-adrenal axis. This may lead to chronic stress reactions, such as depression, anxiety, mood disorders, and sleep problems. [27]

Stress disrupts the balance by causing a variety of flexible physiological and behavioural changes via the hypothalamic-pituitary-adrenal (HPA) axis and sympathetic nervous system. Stress disrupts the HPA axis, which in turn causes the body's equilibrium to become unbalanced. The hypothalamus, adrenal gland, and pituitary gland are all influenced by the HPA axis through a complicated chain of positive and negative systems. Through the HPA axis, stress increases the release of catecholamines and glucocorticoids. Decreased insulin secretion, insulin resistance, inflammation, skeletal muscle and adipocyte glucose absorption inhibition, hepatic gluconeogenesis stimulation, and adipocyte lipolysis are all ways that elevated glucocorticoid release impacts glucose metabolism. [28] Although it is still debatable whether oxidative stress causes or derives from anxiety, there is evidence that it contributes to the pathophysiology of anxiety disorders. However, in inflammatory diseases, there seems to be a stronger correlation between anxiety disorders and oxidative stress. In certain cases, oxidative stress brought on by disruption of physiological pathways causes neuroinflammation, which in turn triggers the development of an anxiety disorder. This connection is further supported by the fact that effective anxiolytics, such as fluoxetine, work by reducing inflammation to provide their antianxiety effects.

Neurodevelopment, epigenetic regulation, the neuroendocrine system, the immune system, and the impacts of oxidant exposure are some of the components that seem to play a role in the etiology of neuropsychiatric disorders. Analyzing the molecular pathways that may be connected to anxiety-related disorders can help us understand these illnesses either directly or indirectly. Animal models of anxiety have produced bidirectional findings.

Specifically, the Nrf2-Proteasome-signaling route could offer important information for treatment approaches that can bring back Nrf2-mediated redox equilibrium. However, certain studies in the literature point to a more positive potential for antioxidant therapy, while research on the molecular neurobiology of anxiety implies that antioxidant therapy for human anxiety disorders may be premature. Antioxidants and traditional anxiolytics taken together may actually be beneficial for treating anxiety-like conditions, although more study is obviously required to verify and evaluate these novel treatments.

The exact relationship between oxidative stress and anxiety disorders is complicated by the interaction of the environment, an individual's physiology, and the specific anxiety illness. A potential substitute for maintaining homeostasis and avoiding the allostatic stress associated with anxiety disorders is provided by recent studies on Nrf2 and the proteasome. Instead of reducing the oxidative load on biological systems, Nrf2-Proteasome targeted therapies aim to maintain the body's natural defence mechanisms. Combining existing medications with therapeutic applications that support the body's natural oxidative defence mechanisms, like Nrf2 and the Proteasome, may increase the efficacy of therapy for anxiety disorders. [29]

Some other study support that there is some relation between anxiety and diabetes. [30]

The mitochondria are the main source of oxidative stress in diabetes mellitus. The oxygen that is left over after some of the oxygen used in mitochondrial oxidative metabolism is reduced to water is transformed into oxygen free radical (O), a major ROS that is subsequently transformed into other ROS like ONOO-, OH, and H2O2. Insulin signalling is impacted by reactive oxygen species (ROS) and reactive nitrogen species (RNS) in two ways. One risk factor for type 2 diabetes is insulin resistance. On the one hand, insulin causes the RNS and ROS to develop in order to perform their full physiological role. Conversely, insulin signalling is negatively regulated by the RNS and ROS. [31]

5. Conclusion

This is the study inquiring the dimension of factors among different groups of diabetes patient using the questionnaire method. Result showed an association between the factors and the disease, diabetes. The subject of this study work is known diabetic patient. We collected a total of 120 patient, out of which 60 patient who are hospitalized were known diabetes patient and other normal known diabetes patient. In our result we saw that diabetes increase with following age, and also female patients are more prone to diabetes. Diabetes is the most common among the 41-50 & 51-60 age group people who are sedentary workers. Female are more in BMI value than man, some study shows that less BMI women are more diabetes. Half of diabetes patient are over weight. Maximum diabetes patient are sedentary worker, minimum percentage of diabetes patient are heavy worker. In our study we found that mostly non hospitalized diabetes patient are in depression. For hospitalized diabetes patient more are in abnormal anxiety and depression. We see that some studies support that mental stress is an influence on diabetes.

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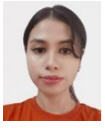

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