*Research Article*

# Assessment of Vestibular dysfunction in prediabetic and recently diagnosed diabetic patients

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## Abstract

**Introduction:** Diabetes mellitus is an endocrine disorder caused by inherited and/or acquired deficiency in production of insulin by the pancreas, or by the ineffectiveness of the insulin produced which results in increased concentration of glucose in the blood. **Aim of the study:** The aim of our study is to evaluate the vestibular dysfunction present in prediabetic and recently diagnosed diabetic patients in comparison to the apparent healthy individuals group. To evaluate the relationship between circulating irisin and endocan levels and hyperglycemia in the same study groups. **Patients and Methods: Subjects:** The current study, Acase control study was conducted on 80 persons, 11males (13.8%) and 69 females (86.2%) of the same age group (25-60 yrs) were selected from outpatient clinic of diabetes of Internal Medicine Department at Minia University Hospital from October 2017 to June 2018. **Results:** The current study, Across sectional study was conducted on 80 persons, 11males (13.8%) and 69 females (86.2%) of the same age group (25-60 yrs) were selected from outpatient clinic of diabetes of Internal Medicine Department at Minia University Hospital from October 2017 to June 2018. We recommend using endocan and irisin in follow up of glycemic control and early detection of complications.
**Key words:** Vestibular dysfunction, prediabetic, diabetic

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## Introduction

Diabetes mellitus is an endocrine disorder caused by inherited and/or acquired deficiency in production of insulin by the pancreas, or by the ineffectiveness of the insulin produced which results in increased concentration of glucose in the blood, which in turn damage many of the body's systems in particular the blood vessels and nerves[1].

In 2017, the International Diabetes Federation estimated that 425 million people aged 20-79yrs with diabetes in the world. That number is projected to rise to 629 million by 2045.The majority of the DM burden in Africa appears to be type 2 DM, with less than 10% of DM cases being type 1 DM[2]. In Egypt is around 15.6% of all adults aged 20 to 79yrs[3].

Diabetes is classified to type 1 and type2, Type 1 diabetes mellitus (T1DM) is an autoimmune disorder resulting from lymphocyte-mediated destruction of insulin producing β cells, whereas, Type2 diabetes mellitus (Formerly non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes) is a metabolic disorder that is characterized by high blood sugar in the context of insulin resistance and relative lack of insulin secretion[4].

Individuals with Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) are described as "Pre-diabetes" indicating the relatively high risk for development of diabetes in these patients[5].

Diabetes cause many complications, macro-vascular complications linked to arteries that nourish the myocardium, brain and limbs; as well as micro vascular complications, such as retinopathies, nephropathies, and neuro-pathies[6].

### Aim of the study
- The aim of our study is to evaluate the vestibular dysfunction present in prediabetic and recently diagnosed diabetic patients in comparison to the apparent healthy individuals group.

- To evaluate the relationship between circulating irisin and endocan levels and hyperglycemia in the same study groups.

## Patients and Methods
### Subjects:
The current study, Acase control study was conducted on 80 persons, 11males (13.8%) and 69 females (86.2%) of the same age group (25-60 yrs) were selected from outpatient clinic of diabetes of Internal Medicine Department at Minia University Hospital from October 2017 to June 2018 .

**This study subject comprises the following groups:**

### Group I:
29 recently diagnosed diabetic patients, 6 males (20.7%) and 23females (79.3%) their ages range between (25-60 yrs), This group was selected according: to **criteria of ADA 2017** :

- Hb A1C ≥ 6.5%.
- FPG ≥ 126 mg/dl.
- Random plasma glucose at any time of day without regard to time since last meal ≥ 200mg/dl plus symptoms suggestive of DM as (polyuria, polydepsia,and unexplained wt loss.).
- Two-hour plasma glucose (2hPG) ≥ 200 mg/dl.

### Group II:
26 prediabetic patients, 2males (7.7%) and 24 females (92.3%) their ages range between (25-60 yrs), this group was selected according: to **criteria of ADA 2017**:

1. Screen all adults for prediabetes starting at age 45 and all adults of any age who are overweight (BMI ≥25) + one of the risk factor,(Habitual physical inactivity first degree relative with diabetes history of gestational diabetes mellitus., Polycystic ovary syndrome,H.T.N:140/90 or on medications, HDL ≥35 mg/dl or triglyceride ≥250 mg/dl, Hb A1C ≥ 5.7 – 6.4%,Impaired Fasting Blood Glucose (IFG) =FPG 100-125 mg/dl, Impaired

Glucose Tolerance (IGT) = 2hPG140 -199 mg/dl,Other clinical conditions associated with insulin resistance e.g. obesity, High risk ethnic population, For all patients, start testing at age 45yrs, If results normal, repeat test at 3 year intervals or more frequently if high risk (i.e. prediabetes).

### Group III:
25 of apparently healthy subjects (free of any acute or chronic medical disease) who serve as a control group 3males (12%) and 22 females (88%) their ages range between (25-60 yrs). This group was selected according to the following criteria,(Bilateral normal hearing sensitivity, bilateral normal tympanograms with intact acoustic reflex. No history suggestive for vestibular disorders as vertigo, dizziness or sense of imbalance, no current or history of middle ear disease, no history of medical disorders known to affect hearing as diabetes and hypertension,no history of ototoxic drug usage, exposure to noisy environment for long duration,no history of mobility problem that interfere with head movement, Patient not diabetic according to criteria of ADA 2017,Hb A1C < 5.7%, FPG < 100 mg/dl, 2hPG < 140 mg/dl).

## Results
The current study, Across sectional study was conducted on 80 persons, 11males (13.8%) and 69 females (86.2%) of the same age group (25-60 yrs) were selected from outpatient clinic of diabetes of Internal Medicine Department at Minia University Hospital from October 2017 to June 2018.

**Table (1):** The table shows comparison between 3 groups regarding VNG. The results showed that right ear and left ear caloric was statistically smaller in prediabetic and diabetic group compared to control group while there was no statistical significant difference between diabetic and prediabetic group.

**Table (1):Comparison between the three groups regarding VNG**.

| Variables | Diabetic n=29 | Pre-diabetic n=25 | Control n=25 | P value | | | |
|---|---|---|---|---|---|---|---|
| | | | | P | I vs II | I vs III | II vs III |
| right ear Median (IQ) | 23 20.5-28 | 25 22-29 | 33 28.5-40 | <0.001* | 0.2 | <0.001* | <0.001* |
| left ear Median (IQ) | 25 20-27.5 | 26.5 24-28 | 34 29-40 | <0.001* | 0.2 | <0.001* | <0.001* |

- Kruskal Wallis test for non-parametric quantitative data (expressed by median) between the three groups followed by Mann Whitney test between each two groups
- *: Significant level at P value <0.05.

**Table (2): Percentage of Vestibular Dysfunction in the studied groups:**

| Studied groups | cVEMP amplitude | oVEMP amplitude |
|---|---|---|
| Diabetic group n=29 | (n=23)80% | (n=23)80% |
| Prediabetic group n=25 | (n=22) 90% | (n=19)76% |

## Discussion

Diabetes mellitus (DM) is a chronic serious metabolic disease which is a growing problem worldwide with many complications, in 2017 the International Diabetes Federation (IDF) estimated that 425 million people (aged 20-79 yrs) with diabetes in the world. That number is projected to rise to 629 million by 2045. The majority of the DM burden in Africa appears to be type 2 DM, with less than 10% of DM cases being type 1 DM[7].

Diabetes cause many complications, macrovascular complications linked to arteries that nourish the myocardium, brain and limbs; as well as microvascular complications, such as retinopathies, nephropathies, and neuropathies[8].

Diabetes is the leading cause of blindness, end stage renal disease (ESRD), cardiovascular diseases, neuropathy and non-traumatic amputation, Also Prediabetes includes individuals with impaired glucose metabolism, has been associated with various complications of diabetes mellitus (DM)[8]. On explanation of microvascular damage in diabetes, chemical reactions between by-products of sugars and proteins, which form irreversible cross-linked protein derivatives called advanced glycation end products, these derivatives affect the surrounding tissues, causing thickening of collagen and endothelium[9].

## Conclusion and Recommendations

Vestibular test results can be affected by metabolic factors. Whenevaluating the vestibular system, vestibular involvement can be detected in diabetic patients despite use of strict controls. To date, diabetic micro vascular complications have been defined as retinopathy, nephropathy, and neuropathy. In this study we introduced a new complication, 'subclinical vestibular neuropathy', which should be further investigated in novel prospective and experimental studies.

Endocan and irisin two new biomarkers for diagnosis of diabetes and early detection of complications.
We recommend using endocan and irisin in follow up of glycemic control and early detection of complications.

Tight control of diabetes and glucose level in impaired glucose tolerance to decrease complications and disease progression.
Hearing loss in diabetic patients with retinopathy and peripheral neuropathy increasing risk of falls fractures and death.

Audiovestibular dysfunction is an early complications in diabetes and impaired glucose tolerance, we recommend early screening as other complications to improve quality of life and decreasing falls and imbalance .

We recommend regular follow up of diabetic patients affected with hearing loss and vestibular dysfunction every 6 months and those not affected every 1year .

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