Assessment of diabetic patients by using MNSI questionnaire suffering with vitamin b12 deficiency along with peripheral neuropathy condition

***Mohammed Q. Sultan*[1], Hussein JAlkhfaji [2]**

[1]College of Dentistry, Al-Ayen University, Thi-Qar, Iraq.

[2]Department of Anesthesia, College of Health and Medical Technology, Al-Ayen University, Iraq

INTRODUCTION

Diabetics is a non-communicable, chronic disease which occurs due to reduced production of insulin in our body, where Insulin is one of the main hormone that regulates the blood glucose. Among various complications of diabetics, peripheral neuropathy is more common nowadays. Around 17 million populations around globe are most likely diagnosed with diabetics, and still increasing rapidly. Hence diabetic can be considered as a serious problem which effects the lifestyle of humans.

World health organization

According to World Health Organization (WHO), there is increased percentage of (13%) of mortality rate in lower middle countries due to diabetes. Statistically more than 8% of the young age adults were diagnosed with diabetics and whereas 2019 statistics report that there is more death seen due to cause of diabetics and few other CVS related and kidney failure disease by diabetics were also seen. Meanwhile between the years 2000 to 2019, between the group of 30 and 70 there is a 22% of death decrease throughout globally from non-communicable diseases[2]. This shows that there is increase in the mortality rate from diabetes. There is also increase in the prevalence in the middle and high income and economic countries.

According to Food & Drug Administration (FDA), intake of minerals and vitamins on daily basis for any individual, there is a chance of reduce in having any complication. Incase if there is any deficiency in vitamins, the individual should be taking the supplement to help the body for normal function, and these supplements will be helpful. It has been noticed or more likely seen that there is a more amount of deficiency of vitamin D or B12, calcium in people whose skin tone or more fair. So in such cases supplements like vitamin b12 will be helpful for patients suffering from diabetics[3]. It has been noticed that patients taking metformin for the condition diabetics are diagnoses as they are having vitamin B12 deficiency.

Micronutrients are essential for the basic function of the human body, these micronutrients are not synthesized in the body, and they must be derived from the food we eat and vitaminies. Recommendations from American Diabetes Association (ADA), suggests that metformin is the drug of choice for the regulation of glucose in the body. There are studies from both interventional and observational that suggests that this deficiency of Vitamin B12 is due to the consumption of the drug called metformin[4].

Diabetic peripheral neuropathy is one of the condition that affects the limbs of the body for few patients and some of the patients report that there are mild symptoms like pain at the limbs. Number of studies have reported that Vitamin B12 deficiency is due to the more consumption of metformin continually. Studies report that conditions related to neurocognitive manifestations are associated with deficiency of vitamin B12[5, 6].

Methods like sensitivity and specificity are available for diagnosis purpose of the diabetic neuropathy, but the optical methods is still unknown. Whereas studies related to electro diagnostic have higher sensitivity and specificity in the diagnosis of diabetic neuropathy[7, 8].One of the best method used in diagnosis of peripheral neuropathy is diabetic neuropathy screening instrument of Michigan [9, 10, 11].

Routine evaluation of patients with for Vitamin B12 deficiency was suggested by The American Diabetes Association as a routine checkup for consumption of metformin as the recent studies suggest[12]. Michigan Neuropathy Screening Instrument (MNSI) is an instrument (questionnaire) used to assess peripheral neuropathy in diabetes patients. This questionnaire consists of two sections:

1. 15 questions for the patient to answer
2. Physician examination with inspection and assessment

The main Purpose and aim of the study was to assess the diabetic patients by using MNSI questionnaire

suffering with vitamin b12 deficiency along with peripheral neuropathy condition.

MATERIALS AND METHODS

Cross sectional study was conducted to assess the diabetic patients by using MNSI questionnaire suffering with vitamin b12 deficiency along with peripheral neuropathy condition. Connivance sampling was used to collect the data. Demographic data were also collected for the evaluation purpose. This present study was performed at various diabetic clinic of Vijayawada, Andhra Pradesh. Data collection for the present study was carried out for a period of 6 months i.e. March 2022 to August 2022. Questionnaires were distributed randomly to various diabetic clinics that were willing to conduct the study; the details present in the MNSI questionnaire were explained clearly in the local language to both doctor and assistant for the ease of the patient to understand and to fill it. Informed consent was obtained from the patients.

Inclusion criteria:

- Age criteria more than 28yrs old patients were included in the study
- Patients undergoing for the treatment of diabetic were included in the study
- Subjects who were will to fill the Questionnaire were included in the study
- Subjects taking metformin as the line of drug for diabetics for more than 3months were included in the study

Exclusion criteria:

- Subjects who were unwilling to participate in the study were excluded
- Subjects with multiple disease were excluded from the study
- Subjects who were not taking metformin as line of choice of drug for diabetics were excluded from the study.

Statistical analysis:

The obtained were transferred in excel sheet and SPSS24 version was used for analysis. Total number of 130 patients was achieved during the sampling with a margin of error 95% confidence interval. Descriptive data with percentages were used along with mean, standard deviations. $P < 0.05$ was considered to be statistically significant.

RESULTS

In Table 1 Out of total 30% of the total population, revels the levels of vitamin B12 that (48subjects; 95% CI: 22-36%). **21% of subjects revels that the** prevalence of borderline levels of Vitamin B12 which is 35subjects of all. Whereas 13 cases has low levels of prevalence i.e 7.5%

In table 2 it been identifies that vitamin B12 values are low in 9 men (13% 95% CI) and 16 had borderline levels (23%; 95% CI), female subjects have high levels of vitamin B12, and 18 had borderline levels (19%; 95%) Subjects of age more than 70years, the levels of vitamin B12 were in borderline and low levels were found in 7 patients (13%; 95% CI).

Table 3 represents the correlation of vitamin B12 was not statistically significant when compared between age and levels of vitamin B12. Metformin dose was significantly inversely associated with vitamin B12 levels (Coefficient: −0.06; CI 95%: −0.10, −0.028). Length of metformin use was not significantly associated with vitamin B12 levels (Coefficient: 0.63; 95% CI: −0.36, 1.64) (Table 3).

In the present study, out of total subjects around 122 subjects were established the presence or absence of diabetic neuropathy and few of them were diagnosed with diabetic neuropathy.

Tables

Table 1: Participant demographic and clinical characteristics.

Variable	Age	Gender (Female)	Vitamin B12 levels	Metformin use time (months)	Metformin dose (mg)	Diabetic neuropathy
n	64 (12)	90 (55%)	410 (154)	108 (90)	1536 (614)	35 (21)

Table 2: Vitamin B12 deficiency according to sex and age.

	Total population	Men	Women	Less than 70 years	More than 70 years
Low B12 level	7.4% (95% CI: 7–12%)	12% (95% CI: 6–21%)	4% (95% CI: 1–10%)	5% (95% CI: 2–10%)	12% (95% CI: 5–22%)
Borderline B12 level	20.9% (95% CI: 15–27%)	23% (95% CI: 15–34%)	18% (95% CI: 12–28%)	20% (95% CI: 14–29%)	22% (95% CI: 13–34%)

Table-3: Show the correlation of vitamin B12 and Gender , diabetic , Age and drug

		Metformin dose	Gender (female)	Diabetic neuropathy	Age	Time from diagnosis	Time on metformin
Model A	Coefficient	−0.06	49.1	−116.9	−0.86	−5.2	0.63
	95% CI	−0.10, −0.028	2.3–95.8	−165.8, −68.0	−2.7, 1.0	−16.8, 6.3	−0.36, 1.64
	P value	0.001	0.040	0.000	0.362	0.374	0.210
Model B	Coefficient	−0.061	54.7	−110.8	-	-	-
	95% CI	−0.09, −0.024	9.0–100.4	−162.0, −59.7	-	-	-
	P value	0.001	0.019	0.000	-	-	-

Table-4: Diabetic neuropathy according to vitamin B12 levels.

Vitamin B12 level		Low	Borderline	Normal
Diabetic Neuropathy	Present	8 (23%; 95% CI: 12–40%)	8 (23%; 95% CI: 12–40%)	12 (35%; 95% CI: 21–52%)
	Absent	4 (77%)	11 (59%)	72 (65%)
	Total	12 (100%)	25 (100%)	84 (100%)

DISCUSSION

Diabetics is a non-communicable, chronic disease which occurs due to reduced production of insulin in our body. Among various complications of diabetics, peripheral neuropathy is more common nowadays. Diabetic pheripheral neuropathy is a also a compleiation of diabeties mellitus. Diabetic Neuropathy is a serious complication of DM2 (type-II). Michigan Neuropathy Screening Instrument (MNSI) is an instrument (questionnaire) used to assess peripheral neuropathy in diabetes patients.

Authors Boulton A.J., Vinik A.I., Arezzo J.C., Bril V, Tesfaye S., Kempler P, Russell J.W., Zilliox L.A discussed in their studies that severe pain can be a symptom for Diabetic Neuropathy[13, 14, 15]. Diabetic foot sometimes in treatable condition, amputation is a choice too. Incase if there is any deficiency in vitamins, the individual should be taking the supplement to help the body for normal function, and these supplements will be helpful.

There are many studies conducted by Talaei A., Siavash M., Majidi H, Naik M.M., Mukaddam Q.I., Vasudevan D, Maladkar M., Rajadhyaksha G., Venkataswamy N, Mimenza-Alvarado A.J., Navarro S.A reported that deficiency or low levels of vitamin B12 leads to neurological disorders. Many stuids have conducted to check the effectiveness of the usages of supplementation of vitamin B12 [16, 17, 18, 19]. Likewise, there are studies that prove that there is no proper evidence to prove that a effect of Vitamin B12 supplement on improvements in peripheral nerve function. Few studies suggests that there was a great variation in terms of blood levels (150-450pmol/L), dose (25–2000 μg), duration (from 12 to 24 weeks), molecular form (cyano-, methyl-, or hydroxocobalamin) and mode of administration (orally or parenterally) of B12 [17,18,19,20,21]

Studies done by Aroda VR, Edelstein SL, Goldberg RB, Knowler WC, Marcovina SM et al, reported that in the prevalence if vitamin B12 deficiencyis ranging from 5to 40%. However there are

cut off points defined. These results are similar to Orchard TJ, Bray GA, Schade DS, Temprosa MG, White NH, et al [22]. In the present study, we observed vitamin B12 levels resulted in the increased symptoms like mainly pain. It is more observed in the old age group subjects over 60yrs old, and there are many studies, where they exhibit that low levels of vitamin B12 are increased. Studies conducted by Yaqub B.A., Siddique A., Sulimani R, Fonseca V., Lavery L.A., Thethi T.K, Farvid M.S., Homayouni F reported that Vitamin B12 levels are ranging in normal with little effects [21, 23, 24]. Iqbal Z, Azmi S, Yadav R, Ferdousi M, Kumar M, Khawaja N, Abu-Shennar J, et al, have reported that there a prevalence of diabetic neuropathy in the subjects suffering with diabetics [26.27]. Yang W, Cai X, Wu H &Ji L tried to get evidence for the association between diabetic neuroapathy and vitamin B12 deficiency, but there were no enough studies for the results [28-31].

Our study concludes that there is an inverse co relation between the vitamin B12 deficiency and diabetic neuropathy. In comparison with the gender, males were having high and the usage of the high dosages of metformin which resulted in the deficiency of B12 vitamin. Our present study concludes that the usage of metformin as a drug for the diabetic should be monitored frequently, especially with the consumption of the patients with diabetics. It's been concluded that subjects with the diabetic neuropathy were diagnosed due to vitamin B12 deficiency. Studies confirm that MNSI can be used in clinical practice too with caution

There are studies that confirm that MNSI is a simple, non-invasive and valid measure of distal symmetrical peripheral neuropathy when compared with gold standard diagnostic testing that includes neurological examinations performed by board-certified neurologists and standardized electrophysiology examinations. This MNSI can be used in clinical practice too with caution.

Limitations: Our study had certain limitations.

- Methods like sensitivity and specificity are available for diagnosis purpose of the diabetic neuropathy, but the optical methods is still unknown
- Diagnosis of few cases can be altered by the reliability of the diagnosis
- Bias might have occurred since the number of subjects included in the present study
- Information about the drug usage of metformin was not properly recorded for few subjects as the patients have changed the physician for personal reasons
- The methodology of this study did not permit the ability to establish a causal association between vitamin B12 deficiency and diabetic neuropathy.
- The above results cannot be generalized as the sample size achieved were small

Declaration of interest:

There are no known conflicts.

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