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Comparative Study of Facial Height and Mental Index in Diabetic Subjects with Non-Diabetic Individuals

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KEYWORDS

Diabetes mellitus, Facial Height, Mental Index, Comparision, Outcome.

ABSTRACT:

It is often known that diabetes is one of the illnesses that is spreading the quickest in the globe. Diabetes is recognized to have negative consequences on the body, including renal impairment, disorders of the neurological system, arterial disease, and visual challenges. Diabetes may have negative consequences on the skeletal system, including altered microstructure, decreased bone density, and/or altered durability. Globally, the most common causes of morbidity and premature mortality are diabetes mellitus and low-trauma fractures related to diabetes. For this reason, more thought must be given to this topic of study.

Material and Method: The research work was carried out at the MPTMC, Department of Anatomy, Siddharthnagar, Uttar Pradesh, with aim to examine the face characteristics, namely Mental Index and face Height, between individuals with and without diabetes. A total of 152 people, 76 of whom were diabetes patients and the remaining 76 of whom were not, made up the research group. We also look at the hypothesis that diabetes is the cause of osteoporosis.

Results and conclusion: In the present study it was obtained that facial height was more in diabetic patients as compared to healthy individuals (both male and female) and mental index was less in diabetic patients in both male and female. This study's findings suggest that fragility of the bones and bone health are significantly impacted by diabetes.

INTRODUCTION

Diabetes Mellitus (DM), Hyperglycemia (fasting plasma glucose > 126 mg/dl and/or ≥ 200 mg/dl two hours after 75 g oral glucose), glycosuria, hyperlipidemia, negative nitrogen balance, and occasionally ketonemia are the hallmarks of this metabolic condition. Increased vessel wall matrix, cellular proliferation, and thickening of the capillary basement membrane are common pathological changes that lead to vascular complications such as lumen narrowing, early atherosclerosis, sclerosis of the glomerular capillaries, retinopathy, neuropathy, and peripheral vascular insufficiency [1,2,3]. There are two main forms of diabetes mellitus:

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Type I- Juvenile onset diabetes mellitus, also known as type I insulin-dependent diabetes mellitus (IDDM), Pancreatic islets are destroyed; most instances are autoimmune (type 1A), where antibodies that kill β cells are present in blood; but, in certain cases, idiopathic (type 1B)—no β cell antibody is discovered—pancreatic islet destruction occurs. Patients with type 1 diabetes are more likely to have ketosis and have circulatory insulin levels that are lower or extremely low. There is a lower genetic predisposition and a lower frequency of this kind [1,4,5,6].

Type II- Maturity onset diabetes mellitus, also known as type II noninsulin-dependent diabetes mellitus (NID DM), the amount of β cell mass is either unchanged or just slightly reduced; the level of insulin in the blood is either normal or elevated; there is no evidence of an anti-β-cell antibody; the condition is highly genetically predisposed; and it often manifests late in life (after middle age). More than 90% of diabetes cases are type 2 DM. Anomalous β cell gluco-receptor that causes them to react to elevated glucose levels or a relative β cell shortage [1]. Causes are-

- Anomalous β cell gluco-receptor that causes them to react to elevated glucose levels or a relative β cell shortage. Either way, there is a reduction in insulin secretion, which might lead to the failure of β cells [1].

- Decreased insulin sensitivity (relative resistance); peripheral tissues have fewer insulin receptors, or there is the "down regulation" of the receptors for insulin. In addition to being normoglycemic but hyperinsulinemia, many hypertensives also have dyslipidemia, elevated uric acid, and abdominal circumference obesity (metabolic syndrome). Consequently, there is a relative resistance to insulin, especially in the liver, muscle, and fat tissues. Angiopathy has been linked to hyperinsulinemia in and of itself [1].

- Relative insulin shortage is caused by obesity and excess hyperglycemic hormones (glucagon, etc.), which causes the β cells to lag behind [1,7,8].

Diabetes mellitus (Type 1 and Type 2) has an effect on bone health like the mandible, radius, hip bone, femur, vertebrae, etc. A person's facial shape can provide information about their chronological age, ethnic background, and gender.

Facial anthropometry is a scientific investigation of the physical measurements and dimensions that are of an individual's face [9,10,11]. Anthropometry is the scientific measurement of the physical attributes of the human body, namely the weight of the body, size of the body, and form. The term is derived from the Greek words anthropopos, which mean human, and metron, which means measure. It is crucial for the healthcare of the elderly population to comprehend the changes in body composition that come with age and the consequences of these changes. It may be convenient to develop prediction equations where variables are employed to offer insight into the health state because anthropometry is a non-invasive, portable, and user-friendly tool for medical professionals [12,13,14]. One important component in the pathophysiology of diabetes mellitus (DM) associated with oral illnesses is the quality of the alveolar bone. Therefore, the assessment of mandibular bone density is crucial for both diagnostic and treatment plans involving implant placement, grafting, and other periodontal procedures [15,16,17,18]. Sadly, there isn't much research examining the connection between diabetes and changes in mandibular bone mineral density (BMD). Therefore, the aim of the present study was to assess the change in bone mineral density of facial bones (Facial Height), including inferior maxillary bone (Mental Index), of diabetic patients compared to controls by using CT scan measures. In subsequent years, elderly diabetes patients' bone quality may be assessed using CT scan physical measurements as a method of detection.

MATERIALS AND METHODS

The research work was carried out at the MPTMC, Department of Anatomy in Siddharthnagar, Uttar Pradesh. A total of 140 people, 70 of whom were diabetes patients and the remaining 70 of whom were not, made up the research group. They were chosen at random from the Uttar Pradesh population. Prior to the measurement, written consent was obtained. The institutional research committee and ethics committee of IIMS&R was authorize the project. The study's inclusion criteria were as follows: a) individuals in good health and those with diabetes mellitus; b) participants aged 18 to 60 years; and exclusion criteria were as follow: a) individuals with

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severe trauma to the cranium or face-bone, orthodontic surgeries, any medical conditions involving the jaw bone, radiation therapy to the head and neck region, other systemic illnesses affecting the bones, postmenopausal women, and pregnant women.

Measurements

Each of the measurements was taken in an isolated setting with an attendant during an axial computed tomography scan (Siemens 32-slice CT scanner). Radiological software was used to measure facial parameters required.

Measurement of Facial Height- facial height was measured from Nasion (Point A) to Gnathion (Point B) [19,20,21].

Measurement of Mental Index- The mental index was measured by drawing a line perpendicular to the mandibular cortical thickness to the bottom of the mandible in the middle of the mental foramen [15].

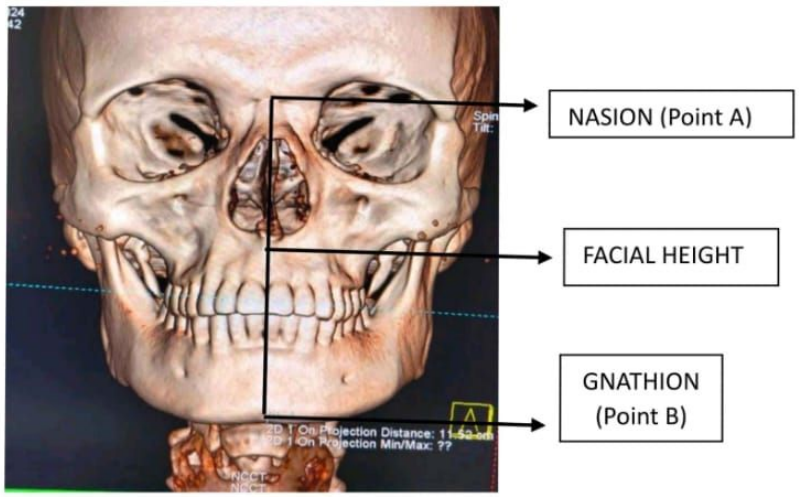

FIG.1 FACIAL HEIGHT

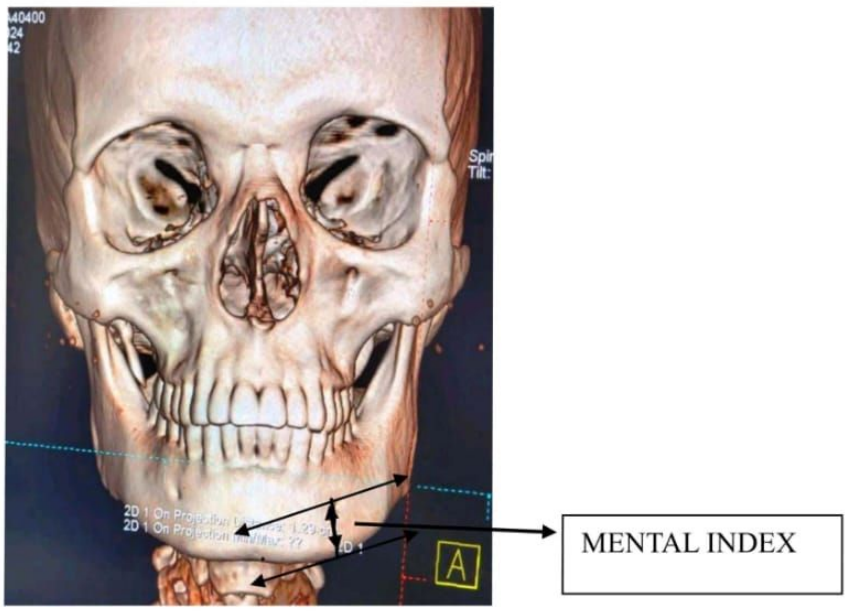

FIG. 2 MENTAL INDEX

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Depending on age, the complete sample was divided into five categories for the purpose of this research -Group I- 18 to 25 years of age, Group II- 26 to 33 years of age, Group III- 34 to 41 years of age Group IV- 42 to 49 years of age Group V- 50 to 60 years of age. Data was analysed statistically. p-value less than 0.05 considered to be is significant.

OBSERVATION AND RESULT

Table. 1 Facial Height of Diabetic and Non-Diabetic Male

Groups	N	Diabetic	N	Non-Diabetic	p-value
		Mean ± SD (mm)		Mean ±SD (mm)	
I	5	118.8± 2.52	5	117.33± 2.08	<0.007
II	7	114.17± 1.47	8	113± 1.58	<0.003
III	8	123± 2.74	8	119.50± 2.45	<0.0001
IV	8	109± 1.58	7	110± 1.58	<0.007
V	10	123± 2.74	10	120.00± 2.16	<0.0001
Total	38	115.43± 6.16	38	111.96± 5.36	<0.010

Table. 2 Facial Height of Diabetic and Non-Diabetic Female

Groups	N	Diabetic	N	Non- Diabetic	p-Value
		Mean ± SD (mm)		Mean ±SD (mm)	
I	4	110.19± 0.90	7	110.78± 1.05	<0.010
II	6	109.38± 0.86	8	107.20± 0.20	<0.0001
III	10	107.34± 1.33	10	105.21± 0.80	<0.0001
IV	16	104.32± 1.37	11	103.12 ± 0.83	<0.0001
V	2	112.55± 1.51	2	110.53± 0.99	<0.0001
Total	38	109.41± 4.12	38	106.91± 2.83	<0.002

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Table. 3 Mental Index of Right side of Diabetic and Non-Diabetic Male

Groups	N	Diabetic	N	Non- Diabetic	p-Value
		Mean ± SD (mm)		Mean ±SD (mm)	
I	5	12.92± 0.38	5	15.41± 0.77	<0.0001
II	7	13.75± 0.30	8	12.2± 0.58	<0.0001
III	8	15.17± 0.56	8	13.42± 0.73	<0.0001
IV	8	15.06± 0.43	7	11.86± 0.66	<0.0001
V	10	14.35± 0.41	10	17.44± 0.78	<0.0001
Total	38	14.08± 0.70	38	14.93± 1.44	<0.0016

Table. 4 Mental Index of Left Side of Diabetic and Non-Diabetic Male

Groups	N	Diabetic	N	Non- Diabetic	p-Value
		Mean ± SD (mm)		Mean ±SD (mm)	
I	5	12.50± 0.46	5	11.53± 0.95	< 0.0001
II	8	13.00± 0.31	8	13.72± 1.03	<0.0001
III	8	16.68± 0.78	8	15.65± 0.54	<0.0001
IV	7	15.28± 0.67	7	16.32± 0.43	<0.0001
V	10	14.33± 0.39	10	17.00± 0.59	<0.0001
Total	38	13.82± 1.11	38	14.57± 1.55	<0.010

Table. 5 Mental Index of Right Side of Diabetic and Non-Diabetic Female

Groups	N	Diabetic	N	Non- Diabetic	p-Value
		Mean ± SD (mm)		Mean ±SD (mm)	
I	4	14.32± 0.41	7	14.10± 0.27	<0.0072
II	6	12.95± 0.70	8	13.67± 0.16	<0.0001
III	10	13.22± 0.36	10	13.52± 0.28	<0.0001
IV	16	12.52± 0.19	11	13.08± 0.25	<0.0001

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V	2	12± 0.58	2	12.73± 0.34	<0.0001
Total	38	13.2± 0.72	38	13.54± 0.76	<0.048

Table. 6 Mental Index of Left Side of Diabetic and Non-Diabetic Female

Groups	N	Diabetic	N	Non- Diabetic	p-Value
		Mean ± SD (mm)		Mean ±SD (mm)	
I	4	13.03± 0.40	7	13.36± 0.53	<0.0023
II	6	13.18± 0.25	8	12.34± 0.44	<0.0001
III	10	12.46± 0.18	10	11.96± 0.19	<0.0001
IV	16	12.24± 0.43	11	11.56± 0.24	<0.0001
V	2	13.00± 0.64	2	11.26± 0.23	<0.0001
Total	38	12.36± 0.69	38	12.78± 1.02	<0.038

The mean facial height was 115.43 mm in the diabetic males, while the mean facial height was 111.96 mm in the non-diabetic males (Table 1). In group I, the mean facial height was 118.8 mm in the diabetic males, while the mean facial height was 117.33 mm in the non-diabetic males. In group II, mean facial height was 114.17 mm in the diabetic males, while mean facial height was 113 mm in the non-diabetic males. In group III, mean facial height was 123 mm in the diabetic males, while mean facial height was 119.50 mm in the non-diabetic males.

In group IV, mean facial height was 109 mm in the diabetic males, while mean facial height was 110 mm in the non-diabetic males. In group V, mean facial height was 123 mm in the diabetic males, while mean facial height was 120 mm in the non-diabetic males.

Mean facial height was 109.41 mm in the diabetic females, while mean facial height was 106.91 mm in the non-diabetic females (Table 2). In group I, the mean facial height was 110.19 mm in the diabetic females, while the mean facial height was 110.78 mm in the non-diabetic females. In group II, mean facial height was 109.38 mm in the diabetic females, while mean facial height was 107.20 mm in the non-diabetic females. In group III, mean facial height was 107.34 mm in the diabetic females, while mean facial height was 105.21 mm in the non-diabetic females.

In group IV, mean facial height was 104.32 mm in the diabetic females, while mean facial height was 103.12 mm in the non-diabetic females. In group V, mean facial height was 112.55 mm in the diabetic females, while mean facial height was 110.53 mm in the non-diabetic females.

The mean mental index of the right side was 14.08 mm and the mean mental index of the left side was 13.82 mm in the diabetic males, while the mean mental index of the right side was 14.93 and the mean mental index of the left side was 14.57 mm in the non-diabetic males (Table 3 and Table 4). In group I, the mean mental index of the right side was 12.92 mm and the mean mental index of the left side was 12.50 mm in the diabetic males, while the mean mental index of the right side was 15.41 mm and the mean mental index of the left side was 11.53 mm in the non-diabetic males. In group II, the mean mental index of the right side was 13.75 mm and the mean mental index of the left side was 13.00 mm in the diabetic males, while the mean mental index of the right side was 12.2 mm and the mean mental index of the left side was

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13.72 mm in the non-diabetic males. In group III, the mean mental index of the right side was 15.17 mm and the mean mental index of the left side was 16.68 mm in the diabetic males, while the mean mental index of the right side was 13.42 mm and the mean mental index of the left side was 15.65 mm in the non-diabetic males.

In group IV, the mean mental index of the right side was 15.06 mm and the mean mental index of the left side was 15.28 mm in the diabetic males, while the mean mental index of the right side was 11.86 mm and the mean mental index of the left side was 16.32 mm in the non-diabetic males. In group V, the mean mental index of the right side was 14.35 mm and the mean mental index of the left side was 14.33 mm in the diabetic males, while the mean mental index of the right side was 17.44 mm and the mean mental index of the left side was 17.00 mm in the non-diabetic males.

The mean mental index of the right side was 13.2 mm and the mean mental index of the left side was 12.36 mm in the diabetic females, while the mean mental index of the right side was 13.54 mm and the mean mental index of the left side was 12.78 mm in the non-diabetic females (Tables 5 and 6). In group I, the mean mental index of the right side was 14.32 mm and the mean mental index of the left side was 13.03 mm in the diabetic females, while the mean mental index of the right side was 14.10 mm and the mean mental index of the left side was 13.36 mm in the non-diabetic females. In group II, the mean mental index of the right side was 12.95 mm, and the mean mental index of the left side was 13.18 mm in the diabetic females, while the mean mental index of the right side was 13.67 mm and the mean mental index of the left side was 12.34 mm in the non-diabetic females. In group III, the mean mental index of the right side was 13.22 mm and the mean mental index of the left side was 12.46 mm in the diabetic females, while the mean mental index of the right side was 13.52 mm and the mean mental index of the left side was 11.96 mm in the non-diabetic females. In group IV, the mean mental index of the right side was 12.52 mm and the mean mental index of the left side was 12.24 mm in the diabetic females, while the mean mental index of the right side was 13.08 mm and the mean mental index of the left side was 11.56 mm in the non-diabetic females. In group V, the mean mental index of the right side was 12.00 mm and the mean mental index of the left side was 13 mm in the diabetic females, while the mean mental index of the right side was 12.73 mm and the mean mental index of the left side was 11.26 mm in the non-diabetic females. In this study, we obtained facial height more in diabetic patients than normal individuals and mental index less in diabetic patients as compared to normal individuals (both males and females). Facial height was higher in males (both diabetic and non-diabetic individuals) compared to females (both diabetic and non-diabetic individuals), and mental index was also higher in males as compared to females. (Both diabetic and non-diabetic individuals).

DISCUSSION

In the present study, mental index was obtained on right side and left side of diabetic males was 14.08 mm and 13.82 mm and mental index was obtained on right side and left side of non-diabetic males was 14.93 mm and 14.57 mm while in females mental index was obtained on right side and left side of diabetic females was 13.20 mm and 12.36 mm and mental index was obtained on right side and left side of non-diabetic female was 13.54 mm and 12.78 mm.

Limeira et al., 2017 [17] studied the mandibular cortical index in patients with type-1 diabetes mellitus in the Department of Dentistry, School of Dentistry, UEPB, Brazil, on 150 subjects, and they observed 3.57±0.53 mental index in females and 3.53±0.78 mental index in males.

David et al. [15] performed a study on radiomorphometric indices of the mandible in patients with diabetes mellitus in the department of oral and maxillofacial radiology at Amrita School of Dentistry, Kochi, Kerala, India, on 100 individuals, and they observed a mental index in type 2 diabetes mellitus of 2.82 ± 0.38; 2.82 ± 0.47 in type 2 diabetes mellitus patients on calcium and vitamin D supplementation; 2.73 ± 0.38 in type 1 diabetes mellitus patients.

Jang et al, 2018 [22] studied bone mineral density on patients with diabetes mellitus in the Korea National Health and Nutritional Survey, South Korea, on 37,753 subjects, and they observed males with diabetes and prediabetics had significantly higher mean BMD at all the measured sites than the control males, irrespective of diabetes mellitus duration. So finally, they concluded that diabetes mellitus was significantly associated with reduced femoral neck BMD.

Tuominen et al, 1999 [23] did a study on bone mineral density in type 1 and type 2 diabetes mellitus patients,

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department of medicine, Turku University Central Hospital District, Finland, on 639 diabetic patients, and they concluded lower BMD in type 1 diabetic patients compared to type 2 and control group. There is rapid loss of bone after the onset of type 1 diabetes mellitus.

Mathkhor et al, 2023 [24] performed a study on bone mineral density in type 2 diabetes mellitus patients, Department of Rheumatology, Basrah Teaching Hospital, Iraq, on 300 individuals (150 diabetic patients and 150 normal individuals), and they found out of 150 diabetic patients, 11 had osteoporosis and 21 had osteopenia in the lumbar spine compared to the control group. While 9 had osteoporosis and 17 had osteopenia in the left femoral neck region in diabetic patients as compared to the control group.

Saha et al, 2009 [25] performed a study on bone mineral content in type 1 diabetes mellitus patients, Department of Paediatrics, Tampere University Hospital, Finland, on 48 adolescents (26 diabetic girls and 22 diabetic patients), and they found that diabetes is linked to decreased bone mineral density and lower cross-sectional dimensions of bones. And they also concluded that diabetic boys were more affected than diabetic girls.

Chobot et al, 2010 [26] did their study on bone status in type 1 diabetic adolescents, Department of Paediatrics, Clinical Hospital, Germany, on 99 diabetic adolescents, and they found higher BMI in diabetic adolescents compared to the control group.

Our finding was similar to the finding of David et al., Limiera et al.; they showed a decrease in the mental index of diabetic patients. Mental index was found to be lower in both diabetic males and diabetic females compared to healthy peers.

CONCLUSION

This study's findings suggest that skeletal fragility and bone health are significantly impacted by diabetes. Compared to those with type 2 diabetes, those with type 1 diabetes have an increased risk of fractures in both genders. In a similar vein, despite distinct pathogenic pathways, this study also shows that people with type 1 and type 2 diabetes mellitus are more susceptible to osteoporosis and fractures than people without the condition. In conclusion, this research points that Mental Index (MI) was found less in diabetic patients, hence the Mental Index (MI), as potential valuable facial instruments for assessing the quantitative alterations in bone caused by diabetes mellitus and facial height parameter suggest that people who have higher facial height may be more prone to diabetes mellitus, further more study require to confirm this hypothesis. In order to identify future changes in the bones caused by diabetes, other sites (such as weight-bearing bones like the lumbar vertebra, femur, tibia, etc.) and facial parameters should also be taken into account. This is because these sites have received less research attention and have fewer statistical data. Although the precise genesis of the diabetic bone disease is yet unknown, further study is needed to understand the course of diabetes-induced alterations in bone tissue in order to create more reliable detection systems. As in step with the evaluation performed on the diabetes mellitus patients, in the Indian population, the subsequent parameters were discovered to be good sized. Know-how of such parameters is important for physicians and orthopaedicians. The bone of the diabetes mellitus patients can break effortlessly with a slight shock; hence it is necessary for the physician that they should advice the calcium and vitamin D supplementation to patients with diabetes mellitus right from the onset of the disease.

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CONFLICT OF INTEREST

No conflict of interest from all the authors.

INFORMED CONSENT

Written consent was taken from the subjects before the measurements.

ETHICAL CLEARANCE

This research article has received ethical clearance approval from the IIMS&R Institutional Research and Ethical Committee.

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