ECRONICON OPEN ACCESS

EC DIABETES AND METABOLIC RESEARCH

Research Article

Skin Thickness can Predict the Progress of Diabetes Type 2: A New Medical Hypothesis

Ahed J Alkhatib[1,2]*, Amer Mahmoud Sindiani[3], Khaled Ibrahim Funjan[4] and Eman Hussein Alshdaifat[5]

[1]Department of Legal Medicine, Toxicology and Forensic Medicine, Jordan University of Science and Technology, Jordan

[2]International Mariinskaya Academy, Department of Medicine and Critical Care, Department of Philosophy, Academician Secretary of Department of Sociology, Jordan

[3]Department of Obstetrics and Gynecology, Faculty of Medicine, Jordan University of Science and Technology, Jordan

[4]Faculty of Medicine, Al Balqa Applied University, Jordan

[5]Department of Obstetrics and Gynecology, Faculty of Medicine, Yarmouk University, Jordan

***Corresponding Author:** Ahed J Alkhatib, Department of Legal Medicine, Toxicology and Forensic Medicine, Jordan University of Science and Technology, Jordan.

Received: June 01, 2020; **Published:** July 28, 2020

Abstract

Diabetes is associated with systematic alterations such as skin changes. The main objectives of the present study were to analyze data posted in Kaggle regarding skin thickness among diabetic women patients, and to evaluate the assumption that skin thickness may be a predictor of diabetic status of women patients. The author retrospectively used dataset posted in Kaggle. The Indian dataset of diabetes was analyzed in this study. The data consisted of 392 female patients with diabetes. The analysis of data was carried out using SPSS version 21. The impacts of study variables on skin thickness were determined based on One Way ANOVA test. Significance was considered at $\alpha \leq 0.05$. Study findings showed that skin thickness decreased as a result of diabetic progression. Skin thickness was significantly influenced by insulin level, but not glucose level. Taken together, the results of the present study showed that skin thickness may be a new predictor of the progression of diabetes in women patients, and further studies are required to establish this assumption.

Keywords: *Skin Thickness; Insulin; Glucose; Diabetes; Dataset; Kaggle*

Introduction

The human skin is the external covering of the body and is the biggest organ of the integumentary framework. The skin has up to seven layers of ectodermal tissue and protects the hidden muscles, bones, tendons and inward organs [1]. The descriptive word cutaneous truly signifies "of the skin" (from Latin cutis, skin) [1].

The thickness of the skin varies extensively over all pieces of the body, and among people and the youthful and the old. A model is the skin on the lower arm which is on normal 1.3 mm in the male and 1.26 mm in the female [2]. The normal square inch (6.5 cm^2) of skin holds 650 perspiration organs, 20 veins, 60,000 melanocytes, and in excess of 1,000 nerve endings [1]. The normal human skin cell is around 30 micrometers in width, yet there are variations. A skin cell as a rule ranges from 25 - 40 micrometers (squared), contingent upon an assortment of variables. Skin is made out of three essential layers: the epidermis, the dermis and the hypodermis [2].

Collier., *et al*. [3] conducted a study about skin thickness that is essentially controlled by collagen content and is expanded in insulin-dependent diabetes mellitus (IDDM). authors estimated skin thickness in 66 IDDM patients matured 24-38 yr and researched whether it corresponded with long haul glycemic control and the nearness of certain diabetic intricacies. With univariate investigation, skin thickness was expanded and altogether identified with term of diabetes (P<.001), past glycemic control (P < .001), retinopathy (P < .001), cheiroarthropathy (P < .001), and vibration perception threshold (P < .05). There was a negative relationship between's constrained expiratory volume at 1s (P < .05) and crucial limit (P < .05) with term of diabetes. Neither skin thickness nor lower leg arteriomedial wall calcification connected with anomalous autonomic work tests. At the point when adjusted for length of diabetes, there was a weak correlation between's skin thickness and glycemic control (P < .05). However, no relationship with retinopathy, cheiroarthropathy, and vibration-perception threshold was identified. This examination affirms that there are far reaching connective tissue changes in diabetes mellitus, in spite of the fact that the natural chemistry needs further clarification.

Diabetes mellitus is associated with changes in biochemical and morphological characteristics in collagen and elastin [4-6]. Nonenzymatic glycosylation (NEG), including various proteins, occurs in diabetes, and glycosylated hemoglobin and glycosylated serum proteins are routinely utilized in glycemic control [7,8]. Collagen is the most considered protein in regards to the progression of NEG, due to the straightforwardness with which it very well may be inspected in skin biopsies, and on account of its significance as a protein that is available in a few tissues subject to difficulties in diabetes, e.g., vascular cellar layer, blood vessel wall, and lung [7-9].

Skin thickness (epidermal surface to dermal fat interface), which is principally dictated by collagen content, is more prominent in IDDM patients who have been diabetic for > 10 yr [10]. This perhaps reflects expanded collagen crosslinkage and decreased collagen turnover [5,6].

Jain., *et al.* [11] conducted a study to evaluate skin and subcutaneous tissue thickness in type 2 diabetic patients as this data might be helpful for insulin infusion procedure. Their findings showed that at arm and thigh, the mean skin thickness was more in males when compared with females in the persons with BMI < 23 kg/m^2 (P < 0.05). At midsection, skin thickness was more in males with the BMI 19 - 23 kg/m^2 (P < 0.05). Over all the BMIs, means of skin and subcutaneous thickness at arm were more in females (P < 0.05) with the exception of BMI > 25 kg/m^2 where thickness in males and females were similar. At thigh, the skin in addition to subcutaneous tissue thickness was more in females (P < 0.05), over all BMI ranges. At midsection, thickness was more in females for the BMI ranges 17 - 19 kg/m^2 and 23 - 25 kg/m^2, while it was practically identical over every single different BMI ranges (P > 0.05).

Study Objectives

The main objectives of the present study are to analyze data posted in Kaggle regarding skin thickness among diabetic women patients, and to evaluate the assumption that skin thickness may be a predictor of diabetic status.

Methods and Subjects

Study design

we retrospectively used dataset posted in Kaggle [12].

Data source

The data was obtained from online source [12]. The Dataset of diabetes, taken from India was analyzed in this study. The data consisted of 392 female patients with diabetes. Study variables: The following variables were included in this study: glucose, insulin, age, blood pressure, and skin thickness. Study sample: Study sample included 392 diabetic women.

Statistical analysis

The analysis of data was carried out using SPSS version 21. Data was presented as means and standard deviations in table formats.

Results

General characteristics of diabetic patients

As seen in table 1, general characteristics of women patients are summarized. The mean level of glucose is 122.63 ± 30.86 (mg/dl), the mean insulin level is 156.06 ± 118.42 µU/ml. the mean level of BMI is 33.09 ± 7.03 kg/m^2, the mean age of patients is 30.86 ± 10.20 years. The mean level of skin thickness is 29.15 ± 10.51 mm. using One Way AOVA test, skin thickness was significantly impacted by variables mentioned in table 1 ($p < 0.05$ for all variables).

Variable	Mean (M)	Standard deviation (SD)	Significance
Glucose (mg/dl)	122.63	30.86	0.030
Insulin (µU/ml)	156.06	118.42	0.013
BMI (kg/m^2)	33.09	7.03	< 0.001
Age (years)	30.86	10.20	0.004
Skin thickness (mm)	29.15	10.51	-

Table 1: *General characteristics of women patients and their impacts on skin thickness (N = 392).*

General characteristics of normal women sample

As seen in table 2, glucose level of normal patients is 94 ± 10.70 mg/dl. The mean insulin level is 91.80 ± 53.06 µU/ml. BMI mean level is 31.33 ± 8.24 kg/m^2, the mean age is 27.44 ± 7.67 years, and the mean level of skin thickness is 26.77 ± 19.34 mm. Skin thickness was not statistically impacted by glucose level ($p = 0.262$), but it was statistically significantly influenced by insulin ($p = 0.034$), BMI ($p< 0.001$), and age ($p < 0.001$).

Variable	Mean (M)	Standard deviation (SD)	Significance
Glucose (mg/dl)	94..00	10.70	0.262
Insulin (µU/ml)	91.80	53.06	0.034
BMI (kg/m^2)	31.33	8.24	<0.001
Age (years)	27.44	7.67	<0.001
Skin thickness (mm)	26.77	19.34	-

Table 2: *General characteristics of normal women samples and their impacts on skin thickness (N = 163).*

General characteristics of pre-diabetic patients

As seen in table 3, the mean level of glucose is 118.32 ± 4.95 mg/dl, the mean level of insulin is 69.16 mg/dl ± 81.46 µU/ml, the mean level of BMI is 31.33 ± 8.23 kg/m^2, the mean age is 32.71 ± 10.94 years, the mean skin thickness is 19.34 ± 16.77 mm. Among pre-diabetic women, skin thickness was only affected by insulin level ($p < 0.001$).

Variable	Mean (M)	Standard deviation (SD)	Significance
Glucose (mg/dl)	118.32	4.59	0.833
Insulin (µU/ml)	69.16	81.46	< 0.001
BMI (kg/m^2)	31.33	8.23	0.313
Age (years)	32.71	10.94	0.995
Skin thickness (mm)	19.34	16.77	-

Table 3: *General characteristics of pre-diabetic women patients and their impacts on skin thickness (N = 79).*

General characteristics of diabetic patients

As shown in table 4, among women diabetic patients, the mean glucose level is 153.30 ± 21.34 mg/dl. The mean insulin level is 134.90 ± 164.31 µU/ml. The mean of BMI is 34.30 ± 7.80 kg/m^2. The mean age is 36.64 ± 12.93 years. The mean skin thickness is 21.94 ± 17.79 mm. Skin thickness is significantly influenced by insulin level ($p < 0.001$) and BMI ($p = 0.006$).

Variable	Mean (M)	Standard deviation (SD)	Significance
Glucose (mg/dl)	153.30	21.34	0.093
Insulin (µU/ml)	134.90	164.31	< 0.001
BMI (kg/m^2)	34.30	7.80	0.006
Age (years)	36.64	12.93	0.368
Skin thickness (mm)	21.94	17.79	-

Table 4: *General characteristics of diabetic women patients and their impacts on skin thickness (N = 163).*

Discussion

In the present study, we tracked changes in skin thickness in diabetic patients. As the results showed in table 1, the means and standard deviations were computed for all women patients as posted in Kaggle [12]. In table 1, the values were taken before categorizing patients according to diabetic status. Skin thickness as the dependent variable was shown to be influenced by study variables including glucose level, insulin level, BMI and age ($p < 0.05$, for mentioned variables). The implication of these findings here is that taking the whole sample without categorization gives values that are crude in its nature, but may give superficial perspectives that may be changed after categorization of data as will be seen later in this section.

In table 2-4, the women patients were categorized as normal, pre-diabetic, and diabetic. In normal women patients, skin thickness was the highest. In pre-diabetic women patients, skin thickness decreased to the lowest level. In diabetic group, skin thickness was close to that in pre-diabetic group. These results showed that diabetes acts to decrease skin thickness. In general, these results did not agree with previous studies in which diabetes increases skin thickness [7,8,10]. However, if we take into consideration the mean level of skin thickness in table 1, then, we would agree with other authors.

The mean level of glucose varied as seen in table 1-4 in a logic pattern as expected and agreed with other studies [3-6]. The mean level of insulin was the highest in general patients as seen in table 1, it was further decreased in normal patients, and pre-diabetic patients. In diabetic group, the mean insulin level was elevated. This result supports our previous findings extracted from Frankfurt dataset in diabetic patients [13]. The results showed that the mean levels of BMI were close in the four groups and revealed obesity status [14].

We tested the impact of study variables on skin thickness, and found that when all patients were included in one criteria, all study variables, age, insulin, glucose, and BMI had significant impact on skin thickness ($p < 0.05$) for all variables. When patients were categorized into normal persons without diabetes, according to glucose level, the results showed that all variables had significant impacts on skin thickness ($p < 0.05$), except for glucose ($p = 0.262$). In pre-diabetic group, insulin had significant impact on skin thickness ($P < 0.001$). In diabetic group, insulin and BMI had significant impacts on skin thickness. Taken together, the results of this study showed that several considerations to be taken into account such as data pooling may lead to misinterpretation of the results. We think that splitting and categorization of the data lead to better understanding and making perception about conflicts of the results.

Conclusion

The results of the present study showed that skin thickness may be considered as a predictor of diabetes type 2, and it is impacted by insulin rather than glucose. Skin thickness can help as rapid, inexpensive and simple method in the predication for diabetes, with respect other indicators and symptoms.

Bibliography

1. Human skin.
2. Wilkinson PF and Millington R. "Skin (Digitally printed version edition.)". Cambridge: Cambridge University Press (2009): 49-50.
3. Andrew Collier., *et al*. "Relationship of Skin Thickness to Duration of Diabetes, Glycemic Control, and Diabetic Complications in Male IDDM Patients". *Diabetes Care* 989 12 (1989): 309-312.
4. Sternberg M., *et al*. "Connective tissue in diabetes mellitus: biochemical alterations of the intercellular matrix with special reference to proteoglycans, collagens and basement membranes". *Diabetes and Metabolism* 11 (1985): 27-50.
5. Brownlee M., *et al*. "Non-enzymatic glycosylation and the pathogenesis of diabetic complications". *Annals of Internal Medicine* 101 (1984): 527-537.
6. Kennedy L and Baynes JW. "Non-enzymatic glycosylation and the chronic complications of diabetes: an overview". *Diabetologia* 26 (1984): 93-98.
7. Williamson JR and Kilo C. "Capillary basement membranes in diabetes". *Diabetes* 32.2 (1983): 96-100.
8. Pillsbury HC., *et al*. "Arterial pulse waves and velocity and systolic time intervals in diabetic children". *American Heart* 87 (1974): 783-790.
9. Jarrett RJ., *et al*. "Diabetes, hyperglycaemia and arterial disease". In Complications of Diabetes. 2nd edition. Keen H, Harret RJ, Editions. London, Arnold (1982): 179-203.
10. Collier A., *et al*. "Change in skin thickness associated with cheiroarthropathy in insulin-dependent diabetes mellitus". *British Medical* 292 (1986): 936.
11. Jain SM., *et al*. "Evaluation of skin and subcutaneous tissue thickness at insulin injection sites in Indian, insulin naïve, type-2 diabetic adult population". *Indian Journal of Endocrinology and Metabolism* 17 (2013): 864-870.
12. Pima Indians Diabetes Database.
13. Ahed J Alkhatib and Suha K Ababneh. "Analysis of large data (Frankfurt hospital) of 2000 diabetic patients revealed high insulin levels associated with increased hyperglycemic states". *Indian Journal of Pharmaceutical Sciences* 6.4 (2019): 2014-1018.
14. COVID-19: Obesity May Increase Risk for Severe Illness.

Volume 4 Issue 8 August 2020