Original Research Article

BLOOD GLUCOSE AND HAEMATOLOGICAL CHANGES IN YOUNG ADULT FEMALES WITH STRIAE DISTENSAE IN OWERRI, NIGERIA.

ABSTRACT

Striae distensae is a skin condition that often causes cosmetic morbidity and psychological distress, particularly in young adult females. The aim of this study was to evaluate if there are alterations in blood glucose level and hematological profile of young adult females with Striae distensae in Owerri, Imo State. The study population consisted of 40 young adult females with striae distensae and 40 young adult females without striae distensae (controls). Five (5) ml of venous blood was collected from the subjects by venipuncture using sterile needle and syringes and about 2 milliliters was dispensed into fluoride oxalate container while 3 milliliters was dispensed into Ethylene Diamine Tetracetic Acid (EDTA) container. The samples were analyzed for blood glucose level and haematological profile. The test of significance was determined by student t-test. Pearson correlation was also determined and values with $P < 0.05$ were considered statistically significant. The result showed significantly lower mean levels of serum total WBC, Platelets, MCV, MCH, MCHC and PDW in young adult females with striae distensae (5.14 ± 1.02 x 10^9/L, 140.10 ± 45.74 x 10^9/L, 84.14 ± 5.58 fL, 28.25 ± 2.25 pg, 335.70 ± 6.20 g/L and 15.84 ± 0.59 respectively) when compared to controls (6.18 ± 1.32 x 10^9/L, 195.70 ± 85.79 x 10^9/L, 87.00 ± 4.71 fL, 29.82 ± 1.28 pg, 343.00 ± 5.69 g/L and 16.40 ± 0.39 respectively) ($P = 0.005$, $P = 0.026$, $P = 0.034$, $P = 0.005$, $P = 0.003$ and $P = 0.004$ respectively). Mean levels of Blood Glucose, Eosinophils and PCT were significantly higher in young adult females with striae distensae (101.85 ± 12.69 mg/dL, 2.01 ± 1.32 % and 2.00 ± 0.88 mL/L respectively) when compared to the controls (85.80 ± 12.12 mg/dL, 1.16 ± 0.17 %, 1.47 ± 0.48 mL/L respectively) ($P = 0.000$, $P = 0.010$ and $P = 0.040$respectively). There were non-significant differences in Neutrophils, Lymphocytes, Monocytes, RBC, Haemoglobin, HCT and MPV ($P = 0.385$, $P = 0.227$, $P = 0.732$, $P = 0.084$, $P = 0.612$, $P = 0.750$ and $P = 0.920$ respectively) in young adult females with striae distensae when compared to the controls. The data also showed non-significant correlation of blood glucose with WBC ($r = -0.195$, $P = 0.409$), RBC ($r = 0.267$, $P = 0.255$), HB ($r = -0.150$, $P = 0.529$) and platelets ($r = -0.056$, $P = 0.815$) in young adult females with striae distensae. There was a significant negative correlation of total WBC with Eosinophil ($r = -0.651$, $P = 0.002$) in young adult females with striae distensae. There was non-significant correlation of total WBC with Neutrophil ($r = 0.261$, $P = 0.266$), Lymphocyte ($r = -0.154$, $P = 0.517$) and Monocyte ($r = 0.024$, $P = 0.921$) in young adult females with striae distensae. In conclusion, the higher levels of blood glucose, eosinophils, MCHC and PCT parallels lower levels of total WBC, platelets, MCV, MCH and PDW observed in young adult females with striae distensae, which may be associated with the development of Striae distensae in this environment.

Key Words: striae distensae, blood glucose, hematological profile, young-adult-females, Nigeria.

INTRODUCTION

Striae distensae (SD) or **Stretch marks** are visible linear scars which develop in areas of dermal damage as a result of excessive stretching of the skin. It has an extimated prevalence of 50-80% **[1]**. Striae distensae generally develop in various physiological states such as pregnancy, growth spurt during puberty or rapid change in proportion of specific body regions such as in weight lifters, obese or weight loss **[2]**. They are also seen in pathological conditions with hypercortisolism like Cushing's syndrome and genetic disorders such as Marfan syndrome **[3]**.**[4]**. The origin of SD is thus multifactorial and exact etiopathogenesis of SD still remains controversial. Primary pathology lays in altered dermal connective tissue framework involving components of extracellular matrix (ECM) namely fibrillin, elastin, fibronectin and collagen **[5]**.

Blood Glucose is a monosaccharide and is the primary metabolite for energy production in the body. Glucose is transported into the cells by an active, energy-requiring process that involves a specific transport protein and requires a concurrent uptake of sodium ions **[6]**. In healthy individuals, blood glucose levels are carefully maintained in a narrow range secondary to a complex interplay between several hormones, which act on biochemical reactions such as glycolysis and glycogenolysis. Therefore, variation of blood glucose is often a manifestation of illness, as in the occurrence of hypoglycemia in liver failure. There is also interest in the observation that hyperglycemia may be a pro-inflammatory condition that promotes leukocytosis **[7]**.

Hematology Profile also known as Full Blood Count (**FBC)** is a set of medical laboratory tests that provide information of cells in humans blood. It indicates the counts of white blood cells, red blood cells and platelets, the concentration of hemoglobin, and the hematocrit (packed cell volume). The red blood cell indices, which indicate the average size and hemoglobin content of red blood cells, are also reported, and a white blood cell differential, which counts the different types of white blood cells, may be included **[8]**.

Hematology Profile or Full Blood Count (**FBC)** is often used in the general evaluation of a person's health and is one of the most commonly ordered clinical laboratory tests in medical patients. It has the potential, when interpreted carefully and in association to the clinical state, to provide useful information to assist in diagnosis and management **[9]**. Hematology Profile also known as Full Blood Count (**FBC)** includes both quantitative evaluation of erythrocytes, leukocytes and platelets as well as detection of morphological abnormalities that provide useful insights to various disease conditions. In healthy adults, leucocyte (white blood cells, WBC), erythrocyte (red blood cells, RBC) and platelet (PLT) count depends on many different factors. WBC count is influenced by age, gender, health status (eg trauma, infections, sepsis, age-related diseases etc), environmental factors, genetic inheritance, stress level, diet and lifestyle (eg chronic psychological stress) **[10]**.

The factors that lead to the development of striae are poorly understood. No general consensus exists as to what causes striae. One suggestion is that they develop as a result of stress rupture of the connective tissue framework **[11]**. It has also been suggested that they develop more easily in skin that has a high proportion of rigid cross-linked collagen, for example, in early adult life. Increased adrenal cortical activity has been implicated in the formation of striae, as in the case of Cushing syndrome **[12, 13]**. Additionally, the cellular and extracellular matrix (ECM) alterations

that mediate the clinical phenotype of stretch marks remain poorly understood **[14]**. There have been several detailed studies involving the effects and even temporary treatments for this problem **[15, 16]**, but the pathogenesis is still a mere speculation. It has been established that pattern forming processes of striae distensae have lots of similarities to those of wound healing which is mediated by platelets, for which a mechano-chemical model has been successfully devised and studied.**[17]**. This also serves as motivation for devising a link between the hematological profile and striae distensae formation. Besides, there is scarcity of report in blood glucose level and haematological profile of Striae distensae Sufferers worldwide and particularly in Nigeria. Therefore, this study was undertaken to investigate the role of the blood glucose level and the hematological profile in assessing the development and prognosis of Striae distensae in Owerri, Nigeria.

MATERIALS AND METHODS

Study Area

The study was conducted in Imo State University, Owerri, Nigeria.

Ethical Approval and Informed Consent

This study was approved by the Research Ethics Committee of Medical Laboratory Science Department, Faculty of Health Sciences, Imo State University Owerri, Nigeria. Each of the subjects signed informed consent form after the procedure of the study have been explained to them.

Study Population

By random sampling method, 40 young adult females within the range of 18 to 25 years who had striae distensae were selected from students of Imo State University, Owerri Nigeria. They were age matched with 40 young adult females without striae distensae who served as controls.

Inclusion Criteria:

I) Young adult females with striae distensae.

II) Subjects that gave informed consent.

III) Subjects within the age range of 18 to 25 years.

IV) Apparently healthy students.

3.5. Exclusion Criteria:

I) Subjects having other skin diseases like eczema.

II) Subjects having chronic diseases.

III) Subjects that did not give their informed consent.

Specimen Collection and Processing

Five **(**5ml) of venous blood was collected from the subjects by venipuncture using sterile needle and syringes. About 2 milliliters was dispensed into fluoride oxalate container while 3 milliliters were dispensed into Ethylene Diamine Tetracetic Acid (EDTA) container. The containerswere properly labelled before commencement of analytical procedures. They were stored refrigerated at 2-8 °C until analysed within 5 hours after collection.

Analytical Methods

All reagents used were commercially prepared and procured and the manufacturer's standard operating procedures were strictly followed. Blood glucose was determined employing Glucose GOD-PAP method **as described by** Ambade et al., (1998**) [18]** using reagent kits (Cat no GL364) manufactured by Randox diagnostics. Glucose oxidase (GOD) catalyzes the oxidation of

glucose to give hydrogen peroxide (H2O2) and gluconic acid. In the presence of the enzyme peroxidase (POD), the hydrogen peroxide is broken down and the oxygen released reacts with 4-aminophenazone (4-aminoantipyrine) and phenol to give a pink colour. The absorbance of the colour produced is measured in a colorimeter using a green filter 520 nm (Ilford No. 604) or in a spectrophotometer at 515 nm. Hematological profile was determined by the automation method as previously described by Yun-A et al, (2013) **[19]** using ***Mindray BC 6800 Automated Hematology Analyzer (Mindray, China), supplied by*** Med Sing Long Global Group Co LTD, GuangZhou City, China)

Statistical Analysis

IBM SPSS version 21 was employed in statistical analysis. All values were expressed as mean ± standard deviation, the test of significance was determined by student t-test. Pearson correlation was also determined. Values with $P < 0.05$ were considered statistically significant.

RESULTS

Blood Glucose, Total WBC, Neutrophils, Lymphocytes, Monocytes, Basophils, Eosinophils, RBC, HB and Platelets in Young Adult Females with Striae Distensae Versus Controls in Owerri, Imo State.

There were significant decreases in the mean levels of serum total white blood cells and Platelets ($P = 0.005$ and $P = 0.026$ respectively) in young adult females with striae distensae when compared to controls. Blood Glucose and Eosinophils were significantly increased in young

female adult striae distensae sufferers (P = 0.000 and P = 0.010 respectively) when compared to the controls.

There were non-significant differences in Neutrophils, Lymphocytes, Monocytes, Red blood cells and Haemoglobin (P = 0.385, P = 0.227, P = 0.732, P = 0.084 and P = 0.612 respectively) in young adult females with striae distensae when compared to the controls.

The mean levels of Basophil in young adult females with striae distensae and controls was zero, hence it was not highlighted in the table (Table 1).

Blood HCT, MCV, MCH MPV, PDW and PCT in Young Adult Females with Striae Distensae Versus Controls in Owerri, Imo State.

There were significant decreases in the mean levels of Mean Cell Volume, Mean Cell Haemoglobin, Mean Cell Haemoglobin Coefficient and Platelet Distribution Width (P = 0.034, P = 0.005, P = 0.003 and P = 0.004 respectively) in young adult females with striae distensae when compared to controls. The mean level of Platecrit was significantly increased in young adult females with striae distensae (P = 0.040) when compared to the controls.

There were non-significant differences in Hematocrit and Mean Platelet Volume (P = 0.750 and P = 0.920 respectively) in young adult females with striae distensae when compared to the controls (Table 2).

Pearson Correlation of Blood Glucose with WBC, RBC, Hb and Platelets in Young Adult Females with Striae Distensae in Owerri, Imo State.

There was non-significant correlation of blood glucose with White blood cells (r = -0.195, P = 0.409), Red blood cells (r = 0.267, P = 0.255), Haemoglobin (r = -0.150, P = 0.529) and Platelets (r = -0.056, P = 0.815) in young adult females with striae distensae in Owerri, Imo state (Table 3).

Pearson Correlation of WBC with Neutrophil, Lymphocyte, Monocytes and Eosinophil in Young Adult Females with Striae Distensae in Owerri, Imo State.

There was a significant negative correlation of Total White blood cells with Eosinophil (r = -0.651**, P = 0.002) in young adult females with striae distensae in Owerri, Imo State.

There was non-significant correlation of Total White blood cells with Neutrophil (r = 0.261, P = 0.266) Lymphocyte (r = -0.154, P = 0.517) and Monocyte (r = 0.024, P = 0.921) in young adult females with striae distensae in Owerri, Imo State (Table 4).

Table 1: Blood Glucose, Total WBC, Neutrophils, Lymphocytes, Monocytes, Basophils, Eosinophils, RBC, HB and Platelets in Young Adult Females with Striae Distensae and Controls

Variables	**Young Adult Females with Striae Distensae**	**Controls**	**T-Values**	**P- Values**
(Mean ± SD)	**(n = 20)**	**(n = 20)**		
Blood Glucose (mg/dL)	101.85 ± 12.69	85.80 ± 12.12	4.465	0.000
Lower 95% C.I	95.91	80.12		
Upper 95% C.I	107.78	91.47		
Total WBC (10^9/L)	5.14 ± 1.02	6.18 ± 1.32	-3.138	0.005

Lower 95% C.I	4.66	5.55		
Upper 95% C.I	5.62	6.80		
Neutrophils (%)	48.84 ± 7.22	47.24 ± 4.70	0.889	0.385
Lower 95% C.I	45.45	45.03		
Upper 95% C.I	52.22	49.44		
Lymphocytes (%)	43.44 ± 6.94	45.74 ± 5.92	-1.249	0.227
Lower 95% C.I	40.19	42.96		
Upper 95% C.I	46.68	48.51		
Monocytes (%)	5.71 ± 1.82	5.86 ± 1.63	-0.348	0.732
Lower 95% C.I	4.85	5.09		
Upper 95% C.I	6.56	6.62		
Eosinophil (%)	2.01 ± 1.32	1.16 ± 0.17	2.872	0.010
Lower 95% C.I	1.38	1.07		
Upper 95% C.I	2.63	1.24		
RBC (10^12/L)	4.53 ± 0.54	4.33 ± 0.39	1.823	0.084
Lower 95% C.I	4.28	4.15		
Upper 95% C.I	4.79	4.52		
Hb (g/dL)	12.77 ± 1.45	12.94 ± 1.31	-0.516	0.612
Lower 95% C.I	12.09	12.32		
Upper 95% C.I	13.44	13.55		
Platelets (10^9/L)	140.10 ± 45.74	195.70 ± 85.79	-2.420	0.026
Lower 95% C.I	118.69	155.54		
Upper 95% C.I	161.50	235.85		

Table 2: Blood HCT, MCV, MCH MPV, PDW and PCTin Young Adult Females with Striae Distensae Versus Controls in Owerri, Imo State.

Variables	**Young Adult Females with Striae Distensae**	**Controls**	**T-Values**	**P- Values**
(Mean ± SD)	**(n = 20)**	**(n = 20)**		

HCT (%)	38.06 ± 4.28	37.76 ± 4.11	0.323	0.750
Lower 95% C.I	36.05	35.83		
Upper 95% C.I	40.06	39.68		
MCV (fL)	84.14 ± 5.58	87.00 ± 4.71	-2.278	0.034
Lower 95% C.I	81.52	84.79		
Upper 95% C.I	86.75	89.20		
MCH (pg)	28.25 ± 2.25	29.82 ± 1.28	-3.158	0.005
Lower 95% C.I	27.19	29.21		
Upper 95% C.I	29.30	30..42		
MCHC (g/L)	335.70 ± 6.20	343.00 ± 5.69	-3.451	0.003
Lower 95% C.I	332.79	340.33		
Upper 95% C.I	338.60	345.66		
MPV (fL)	10.16 ± 1.13	10.12 ± 0.80	0.102	0.920
Lower 95% C.I	9.63	9.74		
Upper 95% C.I	10.68	10.49		
PDW (-)	15.84 ± 0.59	16.40 ± 0.39	-3.255	0.004
Lower 95% C.I	15.56	16.21		
Upper 95% C.I	16.11	16.58		
PCT (mL/L)	2.00 ± 0.88	1.47 ± 0.48	2.211	0.040
Lower 95% C.I	1.58	1.24		
Upper 95% C.I	2.41	1.70		

Table 3: Pearson Correlation of Blood Glucose with WBC, RBC, Hb and Platelets in Young Adult Females with Striae Distensae in Owerri, Imo State.

Dependent Variables	**n**	**r- value**	**p- value**

WBC	20	-0.195	0.409
RBC	20	0.267	0.255
Hb	20	-0.150	0.529
Platelets	20	-0.056	0.815

Table4

Pearson Correlation of WBC with Neutrophil, Lymphocyte, Monocytes and Eosinophil in Young Adult Females with Striae Distensae in Owerri, Imo State.

Dependent Variables	n	r- value	p- value
Neutrophil	20	0.261	0.266
Lymphocyte	20	-0.154	0.517
Monocyte	20	0.024	0.921
Eosinophil	20	-0.651**	0.002

DISCUSSION

Striae distensae, a common skin condition, do not cause any significant medical problem; however, striae can be of significant distress to those affected **[20].** In this study, the mean value of blood glucose was significantly higher in young adult females with striae distensae when compared to the controls. There is paucity of report to support the relationship of blood glucose with Striae distensae. However, it has been noted that blood glucose is a major risk factor for obesity and cardiovascular diseases, of which emerging scientific evidences signify close association with some skin diseases **[21, 22]**. The scientific link between glucose and Striae distensae is a subject of on-going investigations. The induction of chronic inflammation was initially thought as the bridging gap **[23.22]**, but oxidative stress induction and the role of endocrine abnormalities were lately included as possible links between certain skin diseases, obesity and other components of Metabolic disorders such as diabetes mellitus **[23.22]**.

The mean levels of Eosinophils and PCT were significantly higher in young adult females with striae distensae when compared to the controls in this study. Eosinophils are frequently observed in cutaneous inflammation, but little is known of their significance in the pathophysiology of cutaneous disease. Recent studies of the structure, content, and activities of the eosinophil have

shown that it has potent toxic proteins with the potential to mediate tissue damage **[24,25,26]**. Furthermore, immunofluorescent localization of eosinophil granule proteins has shown that eosinophils disrupt in tissue and deposit toxic granule proteins. The deposition of granule proteins in several diseases is vastly out of proportion to the number of identifiable cells and indicates that eosinophil involvement in cutaneous disease cannot be judged by the number of intact eosinophils in the tissue. Specifically, deposition of eosinophil granule proteins outside of eosinophils has been observed in eczematous lichenified disorders with elevated serum levels of immunoglobulin E **[27,28,29]**.

According to data from this study, there were significantly lower mean levels of WBC, Platelets, MCV, MCH, MCHC and PDW in young adult females with striae distensae when compared to controls. There is paucity of similar findings in the past, though Platelet Rich Plasma (PRP) has been suggested in other studies as a treatment approach to Striae distensae [16]. Platelet-rich plasma has these wound-healing properties, affecting endothelial cells, erythrocytes, and collagen, which potentially aids in the healing of the localized chronic inflammation believed to be a factor in the aetiology of striae distensae. This further suggests a decrease in platelets in Striae distensae sufferers, hence the need for a Platelet Rich Plasma therapy **]30,31]**

The observed lower total WBC count in young female adults with striae distensae in this study may be due to presence of striae distensae in these subjects. Decreased WBC count is seen when supply is depleted by infection or treatment such as chemotherapy or radiation therapy, or when a hematopoietic stem cell abnormality does not allow normal growth or maturation within the bone marrow, such as myelodysplastic syndrome or leukemia. Decrease in WBC is most often due to a lower number of neutrophils, referred to as neutropenia, but in this study, it is observed

that the decreased WBC count is due to lower mean levels of lymphocytes and monocytes **[32,33].**

This study also showed non-significant differences in Neutrophils, Lymphocytes, Monocytes, RBC, Haemoglobin, HCT and MPV in young adult females with striae distensae when compared to the controls.

Conclusion

Higher levels of blood glucose, eosinophils, MCHC and PCT parallels lower levels of total WBC, platelets, MCV, MCH and PDW observed in young adult females with striae distensae. These alterations may be associated with the development of Striae distensae in this environment.

Recommendations

Expanding the scope of the study to include histological and other biochemical studies might show a bigger picture and understanding of striae distensae among young adult females.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

ETHICAL APPROVAL AND CONSENT

The study protocol was approved by the Department of Medical Laboratory Science, Imo state University, Owerri, Nigeria, Research Ethics Committee with reference number

MLS/IMSU/REC/2021/05. Written informed consent was obtained from all study participants prior to their enrolment and collection of blood samples in accordance with the "1964 Helsinki declaration" and its later amendments in 2000.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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