AlQalam
Alq J Med App Sci
https://journal.utripoli.edu.ly/index.php/Alqalam/index eISSN 2707-7179

Original article

Impact of Vitiligo on Fasting Blood Sugar and Thyroid Hormone Profile on Libyan Patients

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ARTICLE INFO

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Received*: 14-09-2024*
Accepted*: 18-11-2024*
Published*: 24-11-2024*

Keywords*. Vitiligo Disease, FBS, Thyroid dysfunction, Diabetes Mellitus.*

ABSTRACT

Vitiligo is a common acquired skin disease characterized by the development of circumscribed white patches of skin. It affects 1-2% of the general population. Autoimmunity plays a significant role in the pathophysiology of vitiligo. This study was intended to assess the prevalence and association of fasting blood sugar and thyroid function abnormalities among Vitiligo patients and healthy controls. A case-control study was carried out among thirty patients with a confirmed diagnosis of vitiligo (53.3% female and 46.7% male) who attended Tripoli Central Hospital (TCH) and Tajoura Hospital for follow-up, and a matched number of control subjects were recruited randomly. All blood samples were collected to assay for the FBS test, triiodothyronine (T3), thyroxin (T4), and thyroid-stimulating hormone (TSH). According to the recent data, the mean age of patients who were involved in this study was 34.4±16.51 years, while the mean age of onset was 20.13 ±14.19. Additionally, the data revealed that there were significant differences in FBS between vitiligo patients and healthy control groups (p-value = <0.001). Moreover, there were statistically significant differences between vitiligo patients and non-vitiligo subjects in T4 (p-value = 0.042). Furthermore, there was no significant correlation between the vitiligo phenotypes and thyroid hormone levels. P-value = 0.911 Chi-Square = 0.186. According to the results of the present study, it appears that vitiligo affects both sexes, especially women. It has also been noted that generalized vitiligo was more common, and there was no correlation between patterns of vitiligo and thyroid state.

Cite this article. *Elhwari A, Rajab N, Alhasoumi T, Alazabi F, Elahjal M. Impact of Vitiligo on Fasting Blood Sugar and Thyroid Hormone Profile on Libyan Patients. Alq J Med App Sci. 2024;7(4):1304-1310. https://doi.org/10.54361/ajmas.247457*

INTRODUCTION

Vitiligo is a multifactorial, acquired, progressive depigmenting illness marked by the development of confined white macules in the skin as a result of a persistent, rising loss of functioning melanocytes in the epidermis [1]. Additionally, hair and mucosal membranes that overlap may be affected [2,3]. Between 0.5 and 2% of people worldwide suffer from vitiligo; rates are similar for both sexes and are not influenced by ethnicity [4]. Vitiligo can occur at any age; manifestations usually start before the age of 20 in 50% of cases and, in 25% of cases, before the age of 14 [5]. The mean age of disease is between the ages of 20 and 30 years old, while it can occur in younger people and the elderly.

Geographically, vitiligo prevalence is quite variable around the world. It is higher in Africa (0.4%), Europe (0.4%), and Oceania (1.2%) than it is in North America (0.2%) and Asia (0.1%) [6].

Although the specific pathophysiology of vitiligo is unknown, it is generally agreed that melanocyte dysfunction—a histochemical abnormality in melanocytes—is the cause of vitiligo [7, 8]. According to numerous theories encompassing autoimmune, biochemical, oxidant-antioxidant, and melanocyte growth factor deficiency or absence, vitiligo is generally regarded as a multifactorial illness with a complex pathophysiology [9]. Additionally, further investigations suggested that the pathophysiology of vitriglio could be related to the accumulation of a neurochemical substance that inhibits the formation of melanin [10]. Several factors have been linked to the development of vitiligo; it can also be linked to a family history or a trigger event, such as stress, chemical exposures, or using specific medications [11].

Vitiligo sickness can start anywhere in the body, even though the hands, face, and fingers are frequently the first parts of the body to exhibit symptoms. Multiple manifestations are possible for clinical vitiligo. Depigmented lesions distributed in a clinically unilateral segmental pattern are known as segmental vitiligo or SV. It has a weaker correlation with autoimmune illnesses due to its early start and rapid stabilization [12, 13]. Non-segmental vitiligo (NSV), which is the most common type of vitiligo, is different from other types due to its symmetric distribution and association with autoimmune illnesses [13]. Mixed vitiligo (MV) is the result of the coexistence of segmental vitiligo (SV) and non-segmental vitiligo (NSV) [12].

Vitiligo has been associated with several comorbid conditions, such as thyroid disease (Graves' disease and Hashimoto's thyroiditis) and skin, joint, and bowel conditions [14]. Thyroid diseases appear to be the most common related disorder in vitiligo patients, with a reported incidence of 0.01% to 0.06% [4]. In fact, vitiligo-affected patients show circulating autoantibodies directed towards specific melanocyte antigens such as TYR, tyrosinase-related protein-1 (TRP-1), TRP-2, Pmel17 (or gp100), and the type 1 membrane receptor for melanin-concentrating hormone, whose serum level is associated with the disease severity. In early lesions, CD8+ cytotoxic T lymphocytes have been found close to melanocytes, and a perivascular lymphocytic infiltrate could be appreciated at the expanding edge of active skin lesions [4].

Vitiligo is one of the many conditions linked to diabetes mellitus. Diabetic mellitus (DM) is a chronic illness characterized by hyperglycemia, which is a result of impaired glucose metabolism. T-cell destruction and oxidative stress have been identified as pathogenic processes in both diabetes mellitus and vitiligo [15]. Diabetes could be divided into two categories. Diabetes mellitus type 1 (T1DM), known as juvenile-onset diabetes, is identified by the autoimmune destruction of insulin-producing beta cells in the pancreas, and diabetes mellitus type 2 (T2DM), also referred to as adult-onset diabetes, is a chronic, progressive condition characterized by insulin-resistant hyperglycemia [16].

Diabetes mellitus is usually complicated by numerous cutaneous illnesses and is seen in about 30% of diabetics. Cutaneous manifestations vary in type 1 and type 2 diabetes. Type 2 diabetes is often linked with skin infections, while Type 1 is associated with autoimmune-related lesions. Furthermore, Type 2 diabetes is associated with more complications in comparison to Type 1, but the prevalence of cutaneous disorders seems to be unchanged [3]. This study aimed to compare vitiligo patients with non-vitiligo subjects regarding sex, average age, fasting blood sugar levels, and thyroid hormone profiles. Additionally, it sought to explore the relationship between thyroid status and vitiligo phenotypes, as well as the correlation between gender and vitiligo phenotypes in Libyan patients.

METHODS

Study settings and population

A case-control study was conducted simultaneously in the dermatology department of both TCH and Tajoura Hospital over a period of three months from July to September 2024. The study encompassed all eligible cases of various types of vitiligo that presented at the centers. It included thirty vitiligo patients (53.3% females and 46.7% males) and thirty control subjects (83.3% females and 16.7% males). Exclusion criteria were a known thyroid disease, history of thyroid surgery, current thyroid medication, and pregnancy. Furthermore, ethical approval has been received from both TCH and Tajoura Hospital.

Data collection

Prior to the study, informed written consent was secured from each patient and control. Participants underwent a brief interview during which data were gathered using a questionnaire designed to collect pertinent information including age, sex, age at onset, duration, associated diseases, family history of vitiligo, and personal or family history of systemic diseases commonly associated with vitiligo, such as thyroid dysfunction and diabetes.

Sample collection

For fasting blood sugar, patients were instructed to fast overnight and to visit the next day for a blood sample. All patients and controls were subjected to fasting plasma screening using the oxidase alongside method. The expected values for normal fasting blood glucose concentration are between 70 mg/dL (3.9 mmol/L) and 100 mg/dL (5.6 mmol/L). If it's 126 mg/dL (7 mmol/L) or higher on two separate tests, you have diabetes.

The thyroid function test was measured by use of radioimmunoassay (RIA) according to standard protocols (COBAS, Roche Diagnostics GmbH, Germany). A sample of 5 ml of whole blood was taken for triiodothyronine (T3), thyroxin (T4), and thyroid-stimulating hormone (TSH) and drawn into a serum separator tube (SST), and then the samples were centrifuged to obtain serum samples. For the thyroid function test, the range values were total T4 (normal range: 70–180 nmol/L), total T3 (normal range: 1.3–3.3 nmol/L), and TSH (normal range: 0.3–4.2 mIU/l). Hypothyroidism is diagnosed when thyroid function tests show a raised TSH with or without low T3/T4 levels. Hyperthyroidism was diagnosed if T3/T4 levels were elevated and TSH levels were low.

Data analysis

Data analysis was performed using SPSS software version 27. Descriptive statistics were used to describe the demographic characteristics of the participants. Numerical data were presented as mean ± standard deviation or median as appropriate, while qualitative data were expressed as percentages (%) and frequencies. Mann-Whitney U test was performed to compare FBS, T3, T4, and TSH levels in blood between vitiligo patients and healthy subjects, and a Chi square test was employed to study the association between gender and vitiligo phenotypes. A p value less than 0.05 was considered statistically significant.

RESULTS

In this study, sixty individuals were recruited from the dermatology department of Tajoura Hospital and TCH to assess their T4, T3, TSH, and FBS levels. Participants included both genders, with females representing 68.3% of the 60 candidates. Their ages varied from 12 to 72 years, with a mean age of 39 ± 16.90 years. The data indicates that the highest incidence rate of vitiligo, approximately 43.3%, occurs in patients aged between 28 and 43. In contrast, patients aged between 44 and 75 exhibit the lowest incidence rate at 23.3%. The participants' ages ranged from 12 to under 75 years, with the average age of the patients in this study being 34.4±16.51 years. The average age of onset was 20.13±14.19 years, and females represented 53.3% of the cases.

In the statistical analysis, focal and segmental vitiligo were categorized as localized vitiligo, while acrofacial and generalized vitiligo were classified as generalized vitiligo. A significant majority, about 76.7%, of the vitiligo patients had generalized vitiligo, which was the most common form, whereas only 23.3% had localized vitiligo, the least common form.

Table 1 indicates that most vitiligo patients possess a normal fasting blood sugar (FBS) level (63.3%), whereas the majority of healthy individuals have FBS levels above the normal range (70%). Additionally, the data demonstrate significant differences in FBS levels between vitiligo patients and the healthy control group (p-value < 0.001).

Table 1. Prevalence and comparison of fasting blood sugar among vitiligo patients and non- vitiligo individuals

FBS (mg/dl)	Normal No.(%)	Low No.(%)	High No.(%)	Mann-Whitney U	p. value
Case (30)	19(63.3%)	1(3.3%)	10(33.3%)	222	**< 0.001***
Control (30)	9 (30%)	0	21(70%)		

Table 2 presents the prevalence and comparison of thyroid hormone levels between vitiligo patients and a non-vitiligo control group. The data shows that the majority of the 30 vitiligo cases had normal T3, T4, and TSH levels. However, 43.3% of the Vitiligo patients exhibited low levels of the T4 hormone. Furthermore, there was a statistically significant difference in T4 levels between vitiligo patients and non-vitiligo individuals (p-value = 0.042). Conversely, no significant differences were found in T3 and TSH levels between the Vitiligo patients and the healthy control group, with p-values of 0.261 and 0.824, respectively.

Table 1. Prevalence and comparison of thyroid dysfunction in vitiligo patients and healthy controls

Parameters	Group	Normal No.%	Low No. %	High No. %	Mann-Whitney U	p. value
T3 (nmol/L)	Case	20(66.7%)	8(26.7%)	2(6.7%)	374	0.261
	Control	25(83.3%)	4(13.3%)	1(3.3%)		
T4 (nmol/L)	Case	17(56.7%)	13(43.3%)	0	312.5	0.042*
	Control	22(73.3%)	8(26.7%)	0		
TSH (mlU/L)	Case	27(90%)	0	3(10%)	435	0.824
	Control	25(83.3%)	1(3.3%)	4(13.3%)		

The results show that there is no significant link between the state of thyroid hormones and vitiligo phenotypes. Patients with either generalized or localized vitiligo have similar distributions of normal thyroid hormone levels. The Pearson Chi-Square value is 0.186, with a P-value of 0.911 (degrees of freedom = 2, sample size = 30) as illustrated in figure 1.

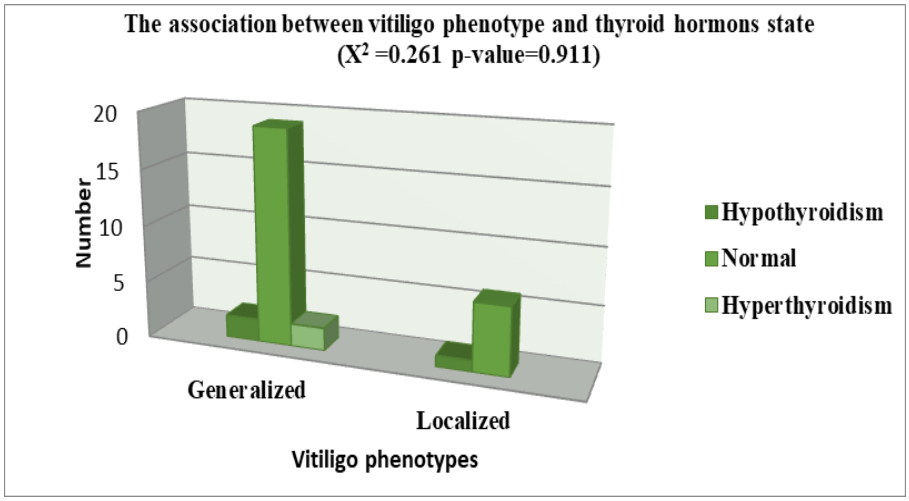

Figure 1. Relationship of type of Vitiligo with thyroid state.

The present results indicate no significant correlation between gender and vitiligo phenotypes, as both males and females exhibit a similar distribution with a P-value of 0.84 (df = 1, n = 30). The generalized phenotype is more prevalent among females and less so in males, as depicted in figure 2.

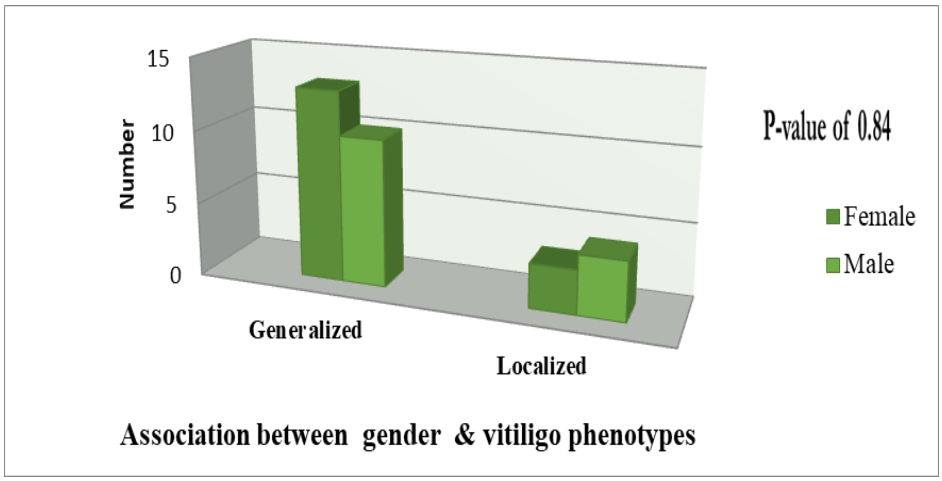

Figure 2. Association between gender and Vitiligo phenotypes.

DISCUSSION

Vitiligo is a common acquired non-contagious disorder that causes loss of pigment in the skin. It affects 1-2% of the general population, resulting in a defect in melanocytes [4]. Generalized vitiligo is commonly linked to other autoimmune disorders, such as autoimmune thyroid diseases (Hashimoto's thyroiditis and Graves' disease), rheumatoid arthritis, adult-onset type 1 diabetes mellitus, psoriasis, systemic lupus erythematosus, and Addison's disorder [17]. This study highlights thyroid disorders and glucose levels in people with vitiligo. In the current study, random samples were collected from vitiligo patients at TCH and Tajoura Hospital. We classified the patients based on their gender, age, blood sugar levels, thyroid disorders, and disease types.

According to obtained data, recent findings reveal that females constituted a higher percentage, accounting for 53.3%, compared to males at 46.7%. These results are in line with a 2019 American study that found a similar distribution, with females making up 57.5% [18]. Furthermore, the findings agree with research from northern India involving 945 vitiligo patients, comprising 496 women and 449 men [19].

Vitiligo can develop at any age, ranging from childhood to adulthood, though it predominantly appears in the second and third decades of life. The condition exhibits a bimodal distribution, typically manifesting with an early onset around 7.3 years of age and a later onset near 40.5 years [20, 21]. The current study indicates that the most common age range for vitiligo patients is 28-43 years (43.3%), which is consistent with findings from a southern Indian study that identified the 20–30-year age group as the most affected [22]. However, a 2019 American study observed the highest incidence in individuals over 70 years of age, making it one of the most extensive epidemiological studies of vitiligo, with a higher incidence and prevalence noted in the elderly [23]. Conversely, research by Mahajan et al. showed that the majority of their 478 patients were 20 years old or younger [20], while a Dutch study reported that 50% of participants saw the onset of the disease before the age of 20 years [24].

The current study showed that the mean age of onset was 20.13 ± 14.19. This finding was comparable to other studies from various nations that included the same case of vitigo. For example, a study carried out in Brazil revealed that the age at onset was 25.25 years. A population in Turkey also showed similar ages, with a mean age at onset of 24.6 years [25, 26]. On the other hand, a study conducted in India reported a later onset of the disease, with a mean age of 55 years [27]. These results confirm that anyone at any age can get vitiligo.

The current study indicated that individuals with clinically diagnosed generalized vitiligo comprised approximately 76.7% of the total patient population, whereas localized vitiligo was less common, representing 23.3%. Conversely, a study by Gopal et al. in India reported a higher prevalence of generalized vitiligo at 58.3%, compared to 41.7% for localized vitiligo [3].

In terms of FBS levels, the current study revealed that most vitiligo patients had normal blood sugar levels (63.3%), with a smaller percentage showing high (33.3%) and low (3.3%) levels. Conversely, a majority of healthy individuals had FBS levels above the normal range (70%). Conversely, a 1999 study from Kerman presented opposing results, showing higher abnormal glucose values in vitiligo patients compared to healthy individuals [9]. Metabolic disorders are commonly observed in patients with systemic vitiligo, and the association between metabolic syndrome and vitiligo has been extensively researched and documented in various studies [28-30]. This research corroborates earlier studies on the association between metabolic disorders and vitiligo. The findings reveal a significant disparity in FBS levels between vitiligo patients and the healthy control group (p-value < 0.001), with 10 (33.3%) of the cases presenting impaired FBS. This suggests a link between FBS levels and the presence of vitiligo.

Numerous studies have indicated that thyroid disorders frequently occur in patients with vitiligo. A recent study revealed that the vast majority of vitiligo cases presented with normal levels of TSH, T3, and T4, at 90%, 66.7%, and 56.7%, respectively. In terms of T4, 43.3% of patients exhibited low hormone levels. These results are consistent with the findings of Khiangte et al., which showed comparable percentages of normal TSH, T3, and T4 levels at 67.7%, 66.6%, and 58.8%, respectively [31]. In terms of elevated TSH levels, this study observed a 10% incidence, in contrast to Khiangte et al.'s study, which found that 27.78% of vitiligo patients had higher serum TSH levels compared to 8.57% in the control group [31].

The current study's findings suggested that thyroid hormones were not significantly associated with vitiligo patterns, as patients with either generalized or localized types displayed similar distributions of normal thyroid hormone levels (Pearson chi-square = 0.186, P value = 0.911, df = 2, n = 30). Nonetheless, hypothyroidism has been observed in vitiligo patients across 54 studies, with the highest incidence reported in South America at 95% [32]. Additionally, the data indicate no significant link between gender and vitiligo patterns. The generalized pattern was predominantly seen in females, whereas the localized pattern was more prevalent in males, with both genders showing similar distribution patterns (P value = 0.84, df = 1, n = 30). This is in line with a study from South Asia, which found a higher occurrence of generalized vitiligo in females and localized vitiligo in males [18].

CONCLUSION

vitiligo appears to impact both genders, albeit with a higher occurrence in females. Generalized vitiligo is more common, and no definitive connection has been found between vitiligo patterns and hypothyroidism. Additionally, our research indicates a consistent pattern of changes in blood sugar and thyroid function tests among vitiligo patients, which supports the link between autoimmunity and vitiligo. Routine screening for thyroid disorders and fasting blood sugar is advised, as these factors could influence the diagnosis and treatment of vitiligo. In addition, further investigation and testing are required to clarify the pathophysiological mechanisms involved.

Acknowledgments

In this section, you can acknowledge any support given which is not covered by the author contribution or funding sections. This may include administrative and technical support, or donations in kind (e.g., materials used for experiments).

Conflicts of Interest

No conflicts of interest.

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دراسة تأثير البهاق على نسبة السكر في الدم الصائم وهرمونات الغدة الدرقية عند المرضى الليبيين

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المستخلص

البهاق هو مرض جلدي شائع يتميز بتطور بقع بيضاء ضيقة من الجلد. يؤثر على 1-2 ٪ من عامة السكان. تلعب المناعة الذاتية دورا مهما في الفيزيولوجيا المرضية للبهاق. تهدف هذه الدراسة إلى تقييم مستوى سكر الدم الصائم واضطرابات وظائف الغدة الدرقية بين مرضى البهاق و الاصحاء. أجريت على حوالي ثلاثين مريضا تم تشخيص إصابتهم بالبهاق (53.3٪ إناث و 46.7٪ ذكور) حضروا إلى مستشفى طرابلس المركزي (TCH) ومستشفى تاجوراء للمتابعة ، وشملت الدراسة عدد مماثل من الأشخاص الاصحاء تم اختيارهم بشكل عشوائي. تم جمع جميع عينات الدم للفحص لاختبار FBS ، ثلاثي يودوثيرونين (T3) ، هرمون الغدة الدرقية (T4) ، والهرمون المحفز للغدة الدرقية (TSH). وفقا للبيانات المتحصل عليها من الدراسة ، كان متوسط عمر المرضى الذين شاركوا في هذه الدراسة 34.4±16.51 سنة ، بينما كان متوسط عمر بداية ظهور المرض 20.13 ±14.19. بالإضافة إلى ذلك ، كشفت البيانات أن هناك اختلافات كبيرة في FBS بين مرضى البهاق والاصحاء بقيمة احتمالية (p value = <0.001). علاوة على ذلك ، كانت هناك فروق ذات دلالة إحصائية بين مرضى البهاق والأشخاص غير المصابين بالبهاق في T4 (p value = 0.042). علاوة على ذلك ، لم يكن هناك ارتباط كبير بين الأنماط الظاهرية للبهاق ومستويات هرمون الغدة الدرقية (P value = 0.911 مربع كاي = 0.186). وفقا لنتائج الدراسة الحالية ، يبدو أن البهاق يؤثر على كلا الجنسين ، وخاصة النساء. وقد لوحظ أيضا أن البهاق المعمم كان أكثر شيوعا ، ولم يكن هناك ارتباط بين أنماط البهاق وقصور الغدة الدرقية.

الكلمات الدالة: مرض البهاق ،تحليل السكر في الدم الصائم ، اضطرابات الغدة الدرقية ، داء السكري