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Research Article

Comparative Study of the Fingerprint Pattern among Diabetic (Type 1) & Non-Diabetic Children in Koya City

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Abstract: Dactyloscopy is a branch of Dermatoglyphics (investigate of epidermal ridges) which includes estimation and classification of unique finger impression patterns for detection. The whole unique finger impression patterns are laid down for all time for the third month of the intrauterine living and they continue unchanged throughout life.

This is, in addition, the period after every organ in the body is finalizing their progress. Consequently, a positive link of the dermatoglyphic character through dissimilar diseases like diabetes, mongolism, schizophrenia and leprosy have been correctly reported in the literature.

The aim of the study is to show a relationship among fingertip patterns between type 1 diabetes cases in comparison to controls together with children in Koya City. In this study, 16 type 1 diabetic subjects and 16 controls were selected from the children in the Koya city in Kurdistan region of Iraq and their fingerprints were taken by the ink method.

Overall the results showed that there is a significant difference in fingerprints between type 1 diabetes and controls in children. The print patterns, including whorls, arches, loops and suntypes were analysed for both cases. In conclusion, the findings of this study indicate possible markers for the use of dermatoglyphics in early diagnosis of type 1 diabetes in children.

Keywords: Dactyloscopy, Type 1 Diabetes, Fingerprints, Fingerprint patterns, Ridge.

1. Introduction

Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both (American Diabetes Association). The classical classification of diabetes as proposed by the American Diabetes Association (ADA) in 1997 as type 1, type 2, other types, and gestational diabetes mellitus (GDM) is still the most accepted classification and adopted by ADA [1]. Type 1 diabetes, a multifactorial disease with a strong genetic component, is caused by the autoimmune destruction of pancreatic β cells. The major susceptibility locus maps to the HLA class II genes at 6p21, although more than 40 non-HLA susceptibility gene markers have been confirmed [2].

Type 1 diabetes was formerly known as juvenile diabetes due to its common presentation in children and adolescents and is characterized by the endocrine pancreas ceasing to produce insulin following the immune-mediated destruction of β-islet cells [3]. Type 1 diabetes accounts for 5–10% of the total cases of diabetes worldwide [4].

The study of the epidermal ridge patterns of the skin of the fingers, palms, toes, and soles is known as "Dermatoglyphics" [5]. Fingerprints represent a particular characteristic for each individual. Characteristic patterns are also formed on the palms of the hands and soles of the feet. Their origin and development is still unknown, but it is believed to have a strong genetic component, although it is not the only thing determining its formation. Each fingerprint is a papillary drawing composed by papillae and rete ridges [6].

The study of fingerprints has been useful in the investigation and identification of certain disorders and syndromes based on the variation of fingerprint patterns and total finger ridge count. In recent years, interest in the medical application of dermatoglyphic analysis has increased among the clinicians [7]. There are many

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people who suffer from some of the skin diseases. These diseases have a strong influence on the process of fingerprint recognition. People with fingerprint diseases are unable to use fingerprint scanners, which is discriminating for them since they are not allowed to use their fingerprints for authentication purposes [8].

2. Material and Methods

The following materials were employed in this research: 1- Ink Pad, 2- A4 paper for taking fingerprints. We did our tests in the Shahid Dr. Khalid Hospital, Koya City and also we took some fingerprints from the house visits in a local area and the collection is based on gender and age. We got 16 children of normal health and 16 children with Type 1 Diabetes. Of these 16 children, 7 of both normal and diabetic were girls and 9 were boys aged between 1 to 14 years. We used both right and left hands of selected children for the study of fingerprints. Our procedure was:

a) Cleaned left and right hands to remove dirty substances from the surface of the fingers.
b) Stood to the left of the children while printing the right hand. Stood to the right of the children while printing the left hand.
c) Relaxed and looked some object and assure completely free hands.
d) Hold the finger at the circus tent below the nail and at the root of the finger on third joint.
e) The direction of rolled the finger should be from the most awkward position to the easiest portion.
f) Individually rolled impression was made by placing the side of the stamp pad of the finger upon the inking plate and rolling to the other side until its face the opposite direction.
g) Transferred the ink to the card by rolling the inked finger to the A4 paper sheet.
h) Ink and printed each finger (both odd and right hands) one by one in succession.
i) Plain impression took simultaneously consists of right and left thumb.
j) Recorded results for determining cases of fingerprints from both diabetes and normal children, according to age and gender.

3. Results and Discussion

All the 32 (16 type 1 diabetic and 16 control group), 9 male and 7 female for both groups, respectively, participants were children of consenting age and 1-13 years old and 1-14 years of age for diabetic and control groups respectively (Fig. 1 and Table 1).

Dermatoglyphic features are inherited by polygenic system with individual gene contributing a small additive effect. This has been reflected in a number of diseases and can be used as a diagnostic aid in the screening of genetically transmitted diseases [9].

There are three basic fingerprint patterns 1- Arches 2- Loops 3- Whorls [10]. The types of fingerprints are unique based on the genetic characteristics of each individual. Dermatoglyphics (from an ancient Greek word Derma- means skin, glyph- means carving) is the scientific study of fingerprints. In humans and animals, these dermatoglyphic patterns are present on fingers, palms, soles and give insight into a critical period of embryogenesis between four weeks and five months, when the architecture of a major system is developing [11].

In normal individuals, the most predominant fingerprint patterns are loops (60-65%) followed by, whorls (30-35%) and only 5% percent of the total population have arches. A high prevalence of universal distribution for the 10 fingers is as follows; Right hand (thumb to little finger): whorl - whorl - ulnar loop - whorl - ulnar loop; Left hand (thumb to little finger): whorl - whorl - ulnar loop - whorl - ulnar loop [12].

Fingerprints are permanently configured before the 20th week of the gestation, hence the non-genetic component is determined by the environment of early pregnancy during which tissue differentiation and organogenesis are happening. Fingerprint characteristics are associated with the early parental environment [13].

In the study of the normal male and the diabetes male, we considered that the range of the loops, in normal male is 37.50%, while in the diabetes male the value is zero. At the time of study for the arches type of fingerprints, in the normal male is zero, but for diabetes, male is increased to 25%. For the whorl type, the range in normal male individual is 6.25%, while in other groups of diabetes male is increased to 18.75% (Fig. 2).

The loop pattern consists of one or more free recurving ridges and one delta. The loop pattern is subdivided into two types: a) Ulnar loop composed of ridges that open on the ulnar side and b) Radial loop composed of ridges that open on the radial side [14].

In the study of the normal female and the diabetes female, we described that the value of the loops, in normal female is 31%. 25 while in the diabetes female the range is 18%. 75 at the time of study for the arches type of fingerprints for the normal female are 6%. 25 but for the diabetes female is increased to 25%. For the whorl type the normal female person is 18.75%, but in other groups of diabetes female is decreased to 12.50% (Fig. 3).

Our study showed that the type of loop in normal males is 37.50%, even with the diabetes female group the type of loop is 18.75%. This study showed that the control male arches group is no value which is zero, while in the patient female the arches group value is high to 25%. Limitations of the study, showed us that the control male whorls range is 6.25%, but for the

female patients is 12%. 50 which increased value (Fig. 4).

Our study showed that the type of loop in normal females is 31.25%, but in the diabetes male group, the type of loop is 0%. This study showed that the control female arches group is 6.25%, but in the patients male the arches group value is high to 25%. Another limitation of the study, showed us that the control female whorls range and the diabetes male or equal value which is about 18.75% (Fig. 5).

For the total normal and diabetes males, the loop group in the normal male is higher than diabetes (68.75%>18.75%). For the total normal and diabetes male the arches group in the normal male is lower than diabetes (6.25%<50%). For the total normal and diabetes male the whole group in the normal male is undervaluing than diabetes (25%<31.25%) (Fig. 6).

Arches are found in five percent of fingerprint patterns. The ridges run from one side to another of patterns, making no backward turns. Ordinarily, there is no data in an arch pattern. There are four types of arch patterns A- Plain arches, B- Radial arches, C- Ulnar arches, D- Tented arches [15]. The study showed us that the control total ulnar loops are higher than diabetes total ulnar loop, which is (25.00%>18.75%). Control total radial loop value is very higher than the diabetes total radial loop (0-43.75%). Control total plain arch value is 6.25%, which is lower than the total diabetes plain arch 31.50%. The total of both of the control and diabetes tented type fingerprints is between (0-6.25%), which is total diabetes is in the high value (Fig. 7).

In the total normal plain value is 12.50%, but in total diabetes, plain is 18.75%. In total control, central pocket loop and diabetes are similar about (0). In total control double loop and diabetes is similar about (6.25%). In total normal and diabetes accidental type is similar in both (6.25%) (Fig. 8).

Table 1. Comparison of frequency (%) distribution of fingerprint patterns between sexes of control and type 1 diabetic group.

	Pattern Types %				
	Sex	**Loops**	**Arches**	**Whorls**	**Total**
Control (n=16)	Male	6 (37.5%)	0 (0%)	1 (6.25%)	7 (43.75%)
	female	5 (31.25%)	1 (6.25%)	3 (18.75%)	9 (56.25%)
	Total	11 (68.75%)	1 (6.25%)	4 (25%)	16 (100%)
Diabetic (n=16)	Male	0 (0%)	4 (25%)	3 (18.75%)	7 (43.75%)
	Female	3 (18.75%)	4 (25%)	2 (12.5%)	9 (56.25%)
	Total	3 (18.75%)	8 (50%)	5 (31.25%)	16 (100%)

Table 2. Comparison of frequency (%) distribution of fingerprint specific patterns between sexes of control and type 1 diabetic group.

		Specific Pattern Types %								
	Sex	**Loops**		**Arches**		**Whorls**				**Total**
		Ulnar loop	**Radial loop**	**Plain arch**	**Tented arch**	**Plain Whorl**	**Central pocket loop**	**Double loop**	**Accidental**	
Control (n=16)	Male	2 (12.5%)	4 (25%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (6.25%)	7 (43.75%)
	Female	2 (12.5)	3 (18.75%)	1 (6.25)	0 (0%)	2 (12.5%)	0 (0%)	1 (6.25)	0 (0%)	9 (56.25%)
	Total	4 (25%)	7 (43.75%)	1 (6.25%)	0 (0%)	2 (12.5%)	0 (0%)	1 (6.25%)	1 (6.25%)	16 (100%)
Diabetic (n=16)	Male	0 (0%)	0 (0%)	2 (6.25%)	2 (6.25%)	3 (18.75%)	0 (0%)	0 (0%)	0 (0%)	7 (43.75%)
	Female	3 (18.75%)	0 (0%)	4 (25%)	0 (0%)	0 (0%)	0 (0%)	1 (6.25%)	1 (6.25%)	9 (56.25%)
	Total	3 (18.75%)	0 (0%)	6 (31.5%)	2 (6.25%)	3 (18.75%)	0 (0%)	1 (6.25%)	1 (6.25%)	16 (100%)

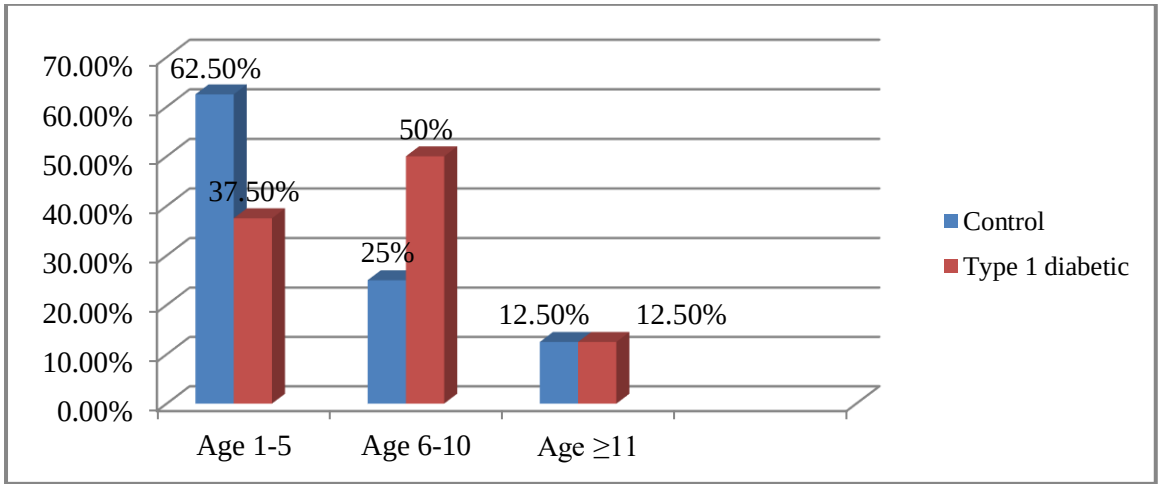

Fig. 1. Age with distribution of both diabetic and non-diabetic subjects.

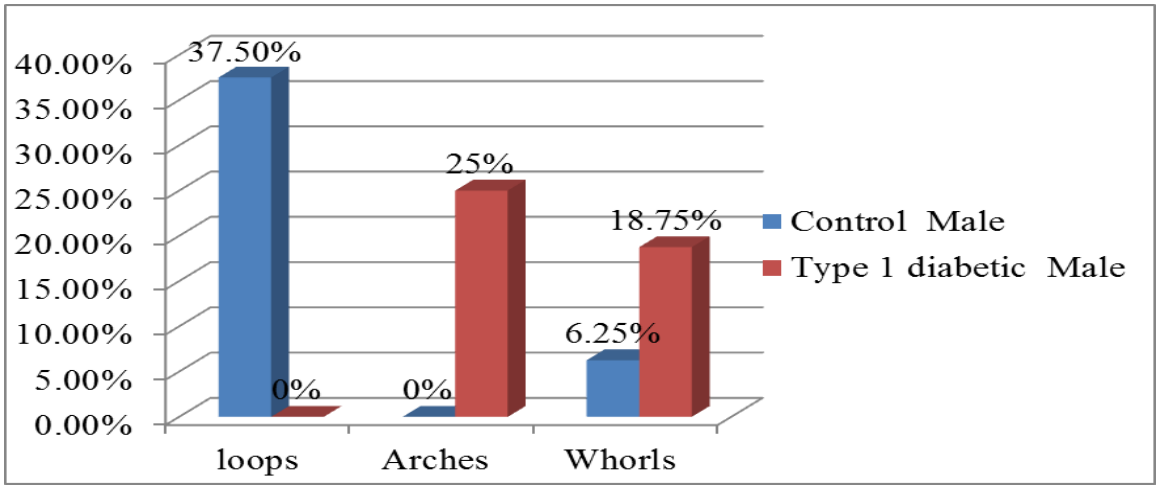

Fig. 2. General frequency distribution of fingerprint patterns of control male and type 1 diabetics males.

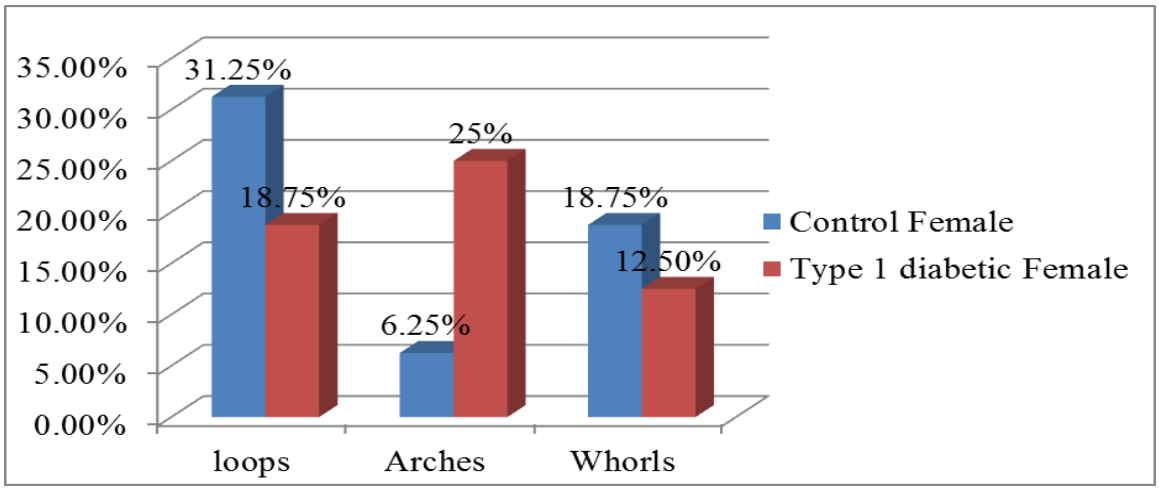

Fig. 3. General frequency distribution of fingerprint patterns of control female and type 1 diabetics females.

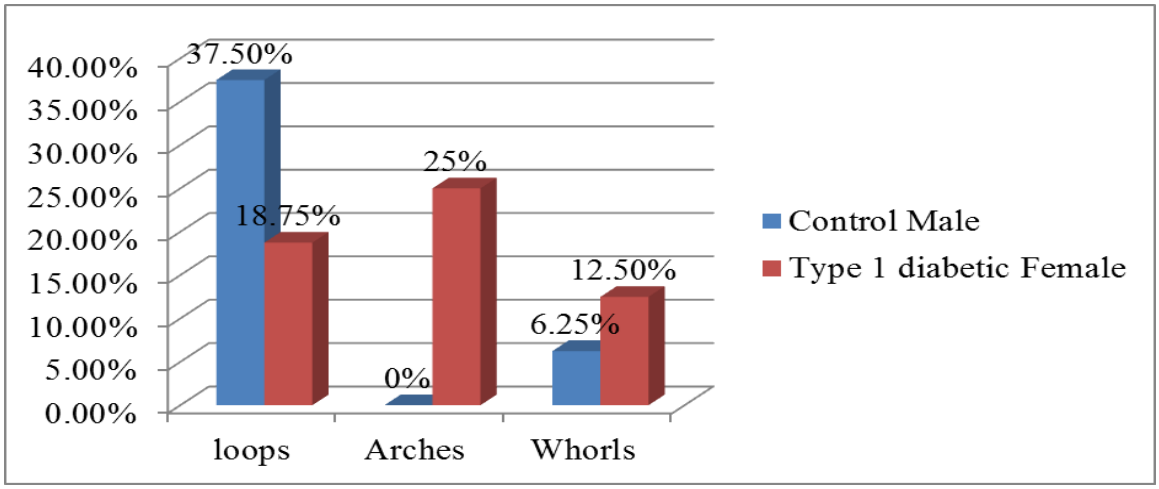

Fig. 4. General frequency distribution of fingerprint patterns of control males and type 1 diabetics females.

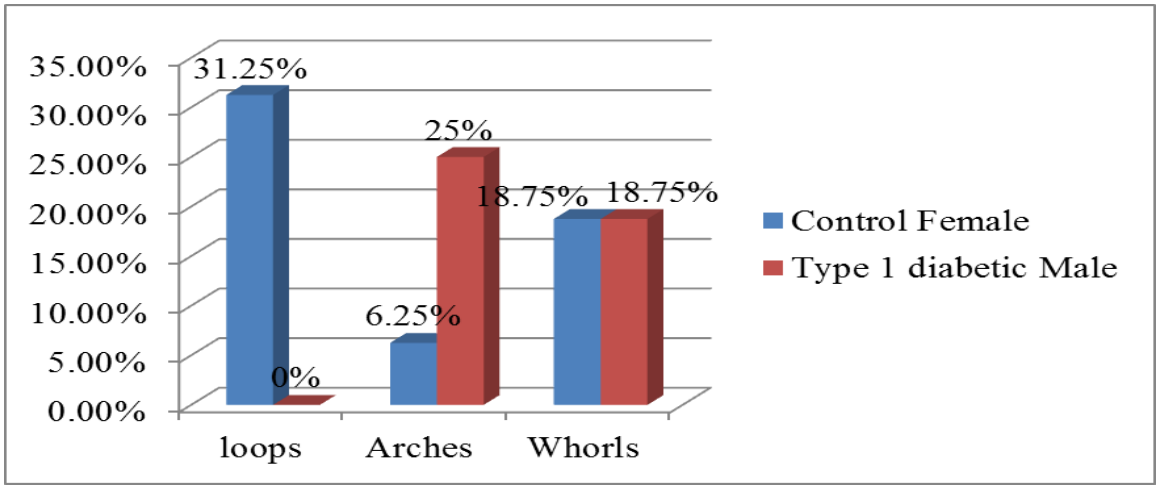

Fig. 5. General frequency distribution of fingerprint patterns of control females and type 1 diabetics males.

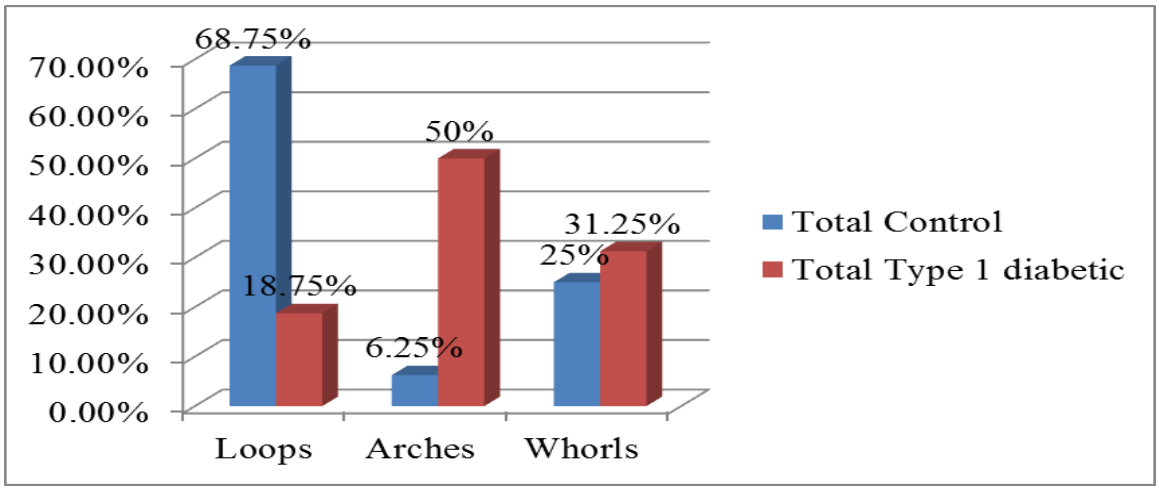

Fig. 6. General frequency distribution of fingerprint patterns of total control and total type 1 diabetics males.

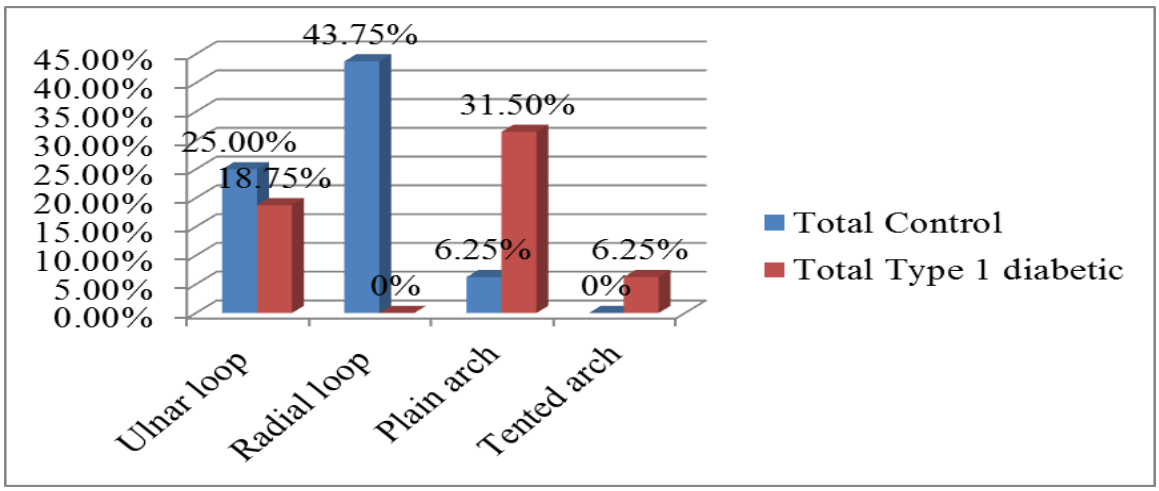

Fig. 7. Specific frequency distribution of loops and arch of total control and total type 1 diabetics.

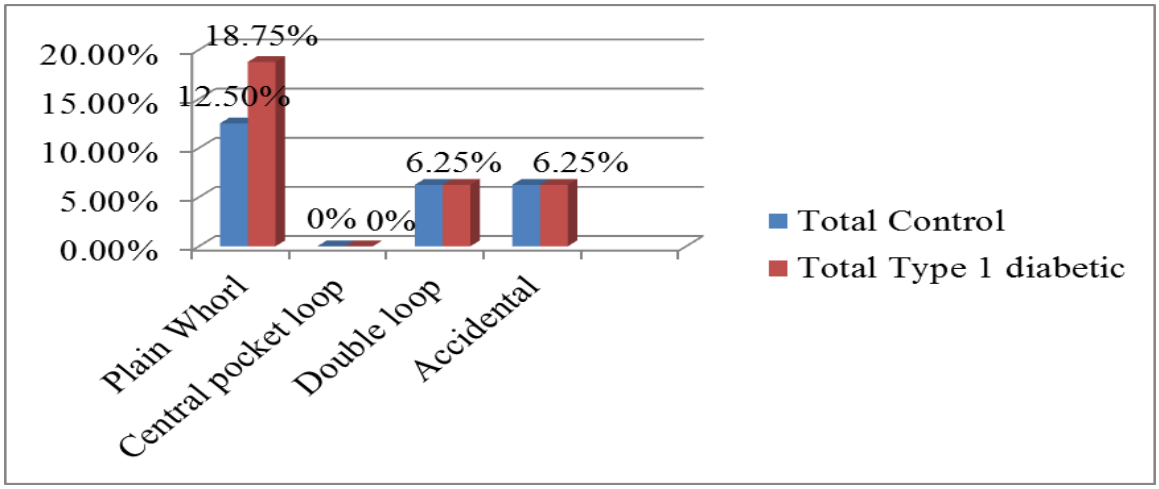

Fig. 8. Specific frequency distribution of whorls of total control and total type 1 diabetics.

Whorls are seen in about 25-35% of fingerprint patterns encountered. Any fingerprint pattern which contains 2 or more deltas will be a whorl pattern. There are four types of whorl patterns viz:

a) Plain whorls consist of one or more ridges which make or tend to make a complete circuit with two deltas.
b) Central pocket loops whorls consist of at least one recurving ridge or obstruction at right angles to the line of flow, with two deltas, between which, when an imaginary line is drawn, no recurving ridge within the pattern area is cut or touched.
c) Double loops whorls consist of two separate and distinct loop formations with two separate and distinct shoulders for each core, two deltas and one or more ridges which make, a complete circuit.
d) Accidental whorl is a pattern which possesses some of the requirements for two or more different types or a pattern which conforms to none of the definitions [16].

Research showed that in type 1 diabetes, there is increased frequency in whorls, and decreased ulnar loop, increased frequency of Sydney line, and increased incidences of arches in females [17].

Chi-square test used to compare between controls and type 1 diabetes all pattern of fingerprints the results showed that statistical differences between normal children and type 1 diabetes, the value was (0.006) between control and patients that indicate significant result (p<0.05).

4. Conclusions and Recommendations

For the study, there is a statistically significant difference fingerprint pattern of diabetic and control with a p value<0.05. It can be concluded that with the help of this finding, in clinical medicine dermatoglyphics can be used to predict the phenotype of possible future illness and hence it allows us to adopt more preventive measures for future generations. Based on the study conducted, our recommendation for future research is as follows:

a) Compare the differences in the fingerprint patterns and finger ridge count (FRC) in patients with type 1 diabetes mellitus with non-diabetic as a control group in Koya City, Kurdistan region, Iraq.
b) Competition between dermatoglyphic features with different diseases like mongolism, schizophrenia among children in Koya City.

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