Original Article

Two Point Discrimination Threshold Among Different Aged Populations of People with Diabetes

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ABSTRACT

Two-point discrimination is the distinction of two points put to skin at the same time (TPD). **Objective:** The main objective of this study is to determine the variation in two-point discrimination sense with increasing age among diabetic population. **Methods:** Cross Sectional conducted among 309 Diabetic Participants from age 21-60 years. Data Collected from University of South Asia, Lahore. Study completed within 6 months (from 5th September 2019 to 28th February 2020) by Non-Probability Convenient Sampling. The ability to distinguish the two-point was estimated in millimeters by using TPD tool. Results were analyzed by SPSS-25. **Result:** Average TPD value is 2.4888±.75428 (male 2.57±.73124 and female 2.40±.76946). There is a significant difference between the mean value of TPD for Gender (male and female [P=0.04]) and Different Age Group (20-30 age (m=1.6462±.300), 31-40 age (m=2.1609±.341), 41-50 age (m=2.7224±.342) and 51-60 age (m=3.4678±.346), [P = 0.000]. **Conclusion:** There was a significant difference in Two Point Discrimination (TPD) values among different age groups and gender. Females have more sensitivity than males. TPD value increase with increase of age.

INTRODUCTION

Two-point discrimination is the distinction of two points put to skin at the same time (TPD)[1]. The minimal distance between two equal pressure and simultaneous stimuli delivered to the skin is the measure of TPD [2]. Weber initially defined two-point discrimination in 1853. [3,4]. TPD can be classed as static, blunt-tipped (the most common), or sharp-tipped (the most uncommon). An Aesthesiometer with a sharp tip is used to measure static TPD in the first two categories [5]. The nervous system is composed of the peripheral nervous system as well as the central nervous system. Through the network of peripheral nerves, the central nervous system is supplied with sensory and motor input from the body's periphery (CNS). Somatosensory modalities can include things like pressure, light touch, pain, temperature, and proprioception, amongst other things [6]. These sensations play a crucial part in consciousness, the initiation and regulation of movement, and the information received from the surrounding environment [7]. The examination of these senses reveals information regarding the CNS and PNS's ability to function [8]. According to Moberg (1990), accurate and reliable TPD findings are feasible with the correct approach and

instrument. TPD is the simplest and most often used test for determining peripheral nerve damage and the result or return of feeling following nerve injury [9]. This test assesses the distance between two locations felt by a person under the same pressure. It is a tactile discriminating approach that provides precise data on space and is frequently used as a reliable tool to examine such aesthetic sensibility [10]. The test spacing varies from one millimeter on the tongue to two to six millimeters on the fingers to 400-600 millimeters on the lower back, depending on the predicted body part [9]. TPD tends to the affectability of covering sensitive areas of the body surface by producing regularising values. It is important to record these regulating values (in millimetres) in each limit since the patient may be able to sense these jolts [12]. TPD is commonly used in neurological examinations to evaluate and assess hand injuries. To determine how much damage has occurred to the peripheral nerve of the hand, previously present DPT data are employed. informed that utilising an Aestesiometer to assess TPD in the upper extremities is the most appropriate and useful approach [10]. TPD levels change according on the area of the body. Various previous TPD studies examined the sense of stress for fixed and movable segregation, TPD observation methodologies of ordinary people, and TPD evaluation models based on ages [11]. There has been several research on TPD, however the data is insufficient. Many studies on TPD have been conducted in the West, but nothing has been discovered in Pakistan. Normal values are extremely useful in sensory testing for evaluating results, diagnosing nerve damage in the hand, and in post-surgical patients. A sensory exam is used to determine the loss of sensory patterns. Any somatic condition is indicated by a change in discriminative capacity [12]. The current study examined TPD values in healthy people ranging in age from 21 to 60 years old in order to get baseline statistics for sensory system goal evaluation. In most local circumstances, typical TPD values in relation to age and gender are scarce. The findings of this study will assist others in comparing aberrant TPD readings to normal values. The findings will also aid in understanding the influence of ageing on sensory functions in male and female populations, which is an important aspect of neuro physiotherapy [13].

METHODS

Rao software was used to perform a cross-sectional study among participants. The ratio of males and females in each of the four-age group (21-30 years old, 31-40 years old, 41-50 years old, and 51-60 years old) was equal. All the data was obtained through interviews with people who were either readily available or consented to offer accurate or enough information, such as the Lahore Railway Headquarter and University of South Asia. A self-designed questionnaire based on demographic information was completed. Static two-point discrimination test using an Aesthesiometer and the Two Point Discriminator tool. Hand intra-rater reliability is 0.82. Two PD values on the right index finger of the right hand were assessed with shut eyes after a cotton wisp was used to examine touch sensation. Results were provided in millimetres when participants couldn't tell the difference between two places (mm). Nonprobability Data were collected using the Convenient Sampling Technique. After the summary was authorised by the University South Asia's ethical committee and the authorization of all involved departments, subjects were questioned to ensure that they met the criteria for participation in the research. Participants were explained thoroughly about the testing procedure. All individuals agreed to participate, were willing to be studied further, and completed the survey form. The independent variables were age and gender, while the dependent variable was two-point discrimination. The survey questionnaire was named after the study's inclusion criteria. This research included participants who were otherwise healthy. Both sexes are included, 21-60 years old. Neurological impairment, peripheral neuropathy, upper limb injuries within the previous six months; burns, scars and dermal hypersensitivity; skin illnesses; stroke, multiple sclerosis; and cognitive issues were all excluded from the study. After the summary was accepted, the study was completed in 6 months (from September 5th, 2019, to February 28th, 2020). Responses from participants were collected, and all data were recorded into an SPSS file. The frequency table, graph, and charts were used to quantify descriptive data (e.g., gender, socioeconomic status, dominant hand). The mean and standard deviation were used to calculate quantitative data (including age and two-point discrimination values). In an independent sample t-test, the Two Point Discrimination values of male and female participants were compared. The P-value cutoff was set at 0.05 or below to ensure statistical significance. ANOVA was used to compare the average 2PD values between age groups.

RESULTS

There are nearly equal numbers of male and female (50 percent in each group) among 309 diabetic participants ranging in age from 21 to 60 years (21-30, 31-40, 41-50, and 51-60). (25 percent in each group). Sixty-four percent are employed, while 35.9 percent are jobless. 97.7% are right-handed, whereas 2.3 percent are left-handed. 8.1 percent (n=25) are upper class, 83.5 percent (n=258) are middle class, and 8.4 percent (n=26) are lower class. At the right index fingertip, the average TPD was 2.488.75428 across

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309 subjects. The smallest and largest values are 1.15mm and 3.95mm, respectively. Males average 2.57.73124, while females average 2.40.76946.

Age Group	N	TPD Mean±SD	Minimum	Minimum
21-30	79	1.646±.3004	1.15	2.60
31-40	78	2.160±.3413	1.45	3.05
41-50	76	2.722±.3422	1.85	3.65
51-60	76	3.467±.3460	2.45	3.95
Total	309	2.488±.7542	1.15	3.95

Table 1: Descriptive Statistics of Value of Two Point Discrimination according to Age Groups

The mean TPD for the 21-30 age group across 309 participants is 1.6462.30040. TPD for the 31-40 age group is 2.1609.34137, for the 41-50 age group is 2.7224.34229, and for the 51-60 age group is 3.4678.34600. Table 2: One Way ANOVA For difference between Age Groups and Within Age Groups

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	141.45	3	47.15	425.76	.001
Within Groups	33.77	305	0.112		
Total	175.23	308			

Table 2: Sum of squares

Age Group	(J) Age	Mean Difference (I-J)	Sig.
21-30	31-40	-0.514*	.001
	41-50	-1.076*	.001
	51-60	-1.821*	.001
31-40	21-30	0.514*	.001
	41-50	-0.561*	.001
	51-60	-1.306*	.001
41-50	21-30	1.076*	.001
	31-40	0.561*	.001
	51-60	-0.745*	.001
51-60	21-30	1.821*	.001
	31-40	1.306*	.001
	41-50	0.745*	.001

Table 3: Post Hoc Test

There were four age groups (21-60 years) compared using One-way ANOVA for the average TPD value. Age groupings 21-30, 31-40, 41-50, and 51-60 are very different from one other. (P = 0.00) Groups 31-40 and groups 21-30, 41-50, and 51-60 are very different from each other. This study has no significance (P Value 0.00). Comparing groups 41-50 to 21-30, 31-40, and 51-60 reveals significant differences. (P = 0.00). It is clear that group 51-60 is distinct from the other three groups. (P = 0.00) A statistical significance level of 0.05 has been found across all age groups. Two-Point Discrimination ratings were significantly different among age groups [F (3, 305)= 425.767 p = 0.000].

	Gender	Mean±SD	Independent Samples Test
Value of Two Point Discrimination at Right Index Finger Tip (mm)	Male	2.574±.73	t(307)=1.996, P =0.047
	Female	2.404±.77	

Table 4: Independent Sample t test Two Point Discrimination

Difference among Gender

The male TPD is 2.57.73124 and the female TPD is 2.40.76946, according to the table. Compared to females, males have a greater TPD average. The TPD result was p0.05, t (307)=1.996, p =.047 for the independent sample t-test, which shows a significant difference between men and women.

DISCUSSION

Among 309 participants, there are nearly equal numbers of male and female (50 percent in each group) in four age groups ranging from 21 to 60 years old (21-30, 31-40, 41-50, and 51-60)."(25 percent in each group). In contrast, just 35.9 percent of the population is out of work. Most people are right-handed, with only 2.3 percent being left-handed. 97.7 percent More than 83% are in the middle class, whereas less than 8% are in the top class. At the right index fingertip, the mean TPD value is 2.4888.75428 across 309 people. The minimum and maximum values are 1.15mm and 3.95mm, respectively. 2.57.73124 for men and 2.40.76946 for women [14,15]. According to a 2014 study conducted by Asir and Kannathu, finger tips contain more free endings of nerves than the rest of the body, which explains why fingertips are more sensitive to TPD than the rest of the body. This study also discovered that the human body's fingertips are extremely fragile [16]. The interosseous muscle has a TPD value of 21.0 mm, as found by Michael F.'s investigation of two-point separation affectability in the hand. The hand was chosen to get TPD values in our study because it is an exceptionally remarkable organ with specific capabilities and flexibility in the human body. Skin around the tip-off pointers' volar surface on the right hand measured 2.4 mm, according to this study. When compared to older persons, younger people had greater TPD values [17]. The disk-discriminator, aesthesiometer, and drawing compass have all been used in previous studies for two-point discrimination. Because it requires the least amount of attention in use, aesthesiometer's key benefit is its ability to break even with weight transfer. The device is designed such that the pointer has a regular sharp tip. It is one of the simplest ways to accurately measure TPD [18]. It was revealed in a 2017 study by Cashin et al. that age had a significant impact on two-point segregation esteems. Changes in the senses occur as we age, according to this study. Our research shows that as people become older, their TPD sensitivity declines. It has been revealed that the 2-point segregation capacity of an individual is affected by their age [19]. Ja-Pung Koo, Soon-Hee Kim, and colleagues conducted a research. In 2016. They measured TPD in the upper limb and found that females had lower TPD distance values than men, while females have higher TPD. According to current studies, males are less sensitive than females, while females have greater 2PD levels [20].

CONCLUSION

There was a substantial variation in Two Point Discrimination (TPD) scores across age and gender categories. Males are less sensitive than females. The TPD value increases with age.

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