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RESEARCH ARTICLE

A Study of Dermatoglyphics Patterns in Relation to the Levels of Perceived Stress

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Abstract:

Background:

Dermatoglyphics is the study of dermal ridge configuration on the skin of the fingers and palms, which can be used to diagnose chromosomal disorders and individual identification. Stress is characterized by feeling overwhelmed with mental or emotional pressure and evokes a biological response when any intrinsic or extrinsic stimulus is applied. Stress can cause acute effects and disorders that can trigger structural changes like atrophy and decrement in weight in different brain parts with long-term effects on the nervous system.

Materials and Methods:

In this cross-sectional study, fingerprints of 150 participants of Gulf Medical University with an equal number of students and faculty/ staff were obtained by fingerprint scanner. Participants were classified into low, moderate, and high-stress levels by questionnaire. Collected data were statistically analyzed to find any association between dermatoglyphics and perceived stress levels.

Results:

Radial Loop was found to have the highest frequency as a percentage in all three groups. Plain whorl was the pattern with the second-highest percentage of occurrences. A notable observation was the lack of plain arch and low frequency of accidental whorl in the high-stress group.

Conclusion:

The findings contribute to our understanding of the potential of dermatoglyphics as an indicator of perceived stress, opening up avenues for further research in utilizing these patterns as a non-invasive tool for assessing stress levels.

Keywords: Dermatoglyphics, Perceived stress, Fingerprints, Loops, Whorls, Arches, Radial loop.

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1. INTRODUCTION

Dermatoglyphics is the study of dermal ridge configurations on fingers and palms and has been extensively researched [1]. Galton (1892) was the first to examine fingerprint uniqueness based on ridge patterns. The term “dermatoglyphics” was later coined by Cummins and Midlo (1926) [2]. These ridges develop concurrently with fetal neural development during the intrauterine stage (around the 13th to 21st week) and are influenced by the neocortex region of the brain [3, 4]. Dermatoglyphics is valuable for diagnosing chromosomal disorders and individual identification and has associations with various medical aspects. Fingerprint patterns, primarily determined by genetics, are unique to each individual worldwide and remain stable throughout life, except for dermal trauma [5]. They are a diagnostic tool for genetic-based illnesses and can detect intrauterine abnormalities. Further research is required to establish the full potential of dermatoglyphics in medicine [6]. Factors like prenatal nutrition, umbilical cord length, blood flow/pressure, fetal position, and finger growth rate influence fingerprint development during pregnancy [7].

1.1. Arches

The arch is a basic fingerprint pattern characterized by one or more ridges entering from one side and exiting from the other; It does not consist of a triradius [8]. (Fig. **1A - B**).

It is further divided into two subtypes: The plain arch, which has a slight rise towards the center and forms a smooth curve, and the second is Tented arch, with a central elevation

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resembling a tent and has ridges in the center that create a peak-like structure. Roughly 5% of fingerprints display the arch pattern [8].

1.2. Loops

This pattern comprises core and delta and is divided into radial and ulnar. The fingerprint pattern in the radial loops recurves and exits towards the thumb. On the contrary, the fingerprint pattern in the ulnar loop recurves and exits towards the little finger. About 60 to 70% of fingerprint patterns contain loops [9]. (Fig. **2A - B**).

1.3. Whorls

This form is composed of two deltas and a core and is further divided into four patterns: a loop is placed in concentric rings around a central core to make the plain pattern; the central pocket is where a small loop of two delta loops creates this finger pattern, double loop comprises two loops, and two delta loops and composite whorl are made up of two deltas that surround a central core. About 25 to 35 percent of fingerprint patterns comprise whorls [10].Fig. (**3A - D**).

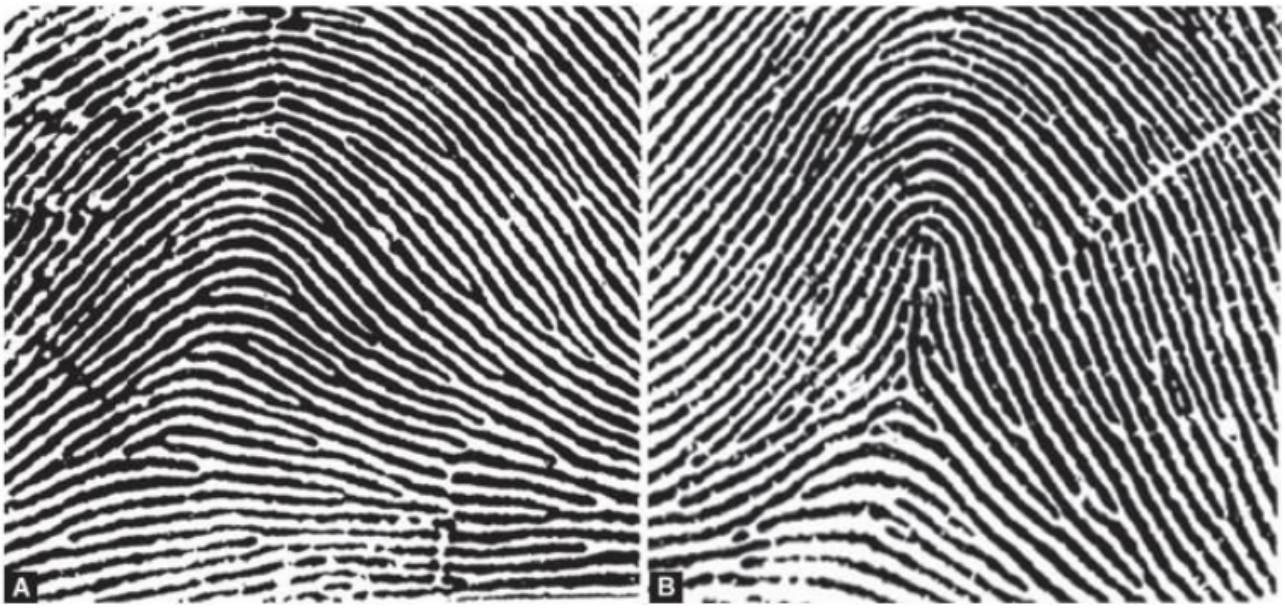

Fig. (1). Illustrated different arch types. (**A**) Plain arch; (**B**) Tented arch [8].

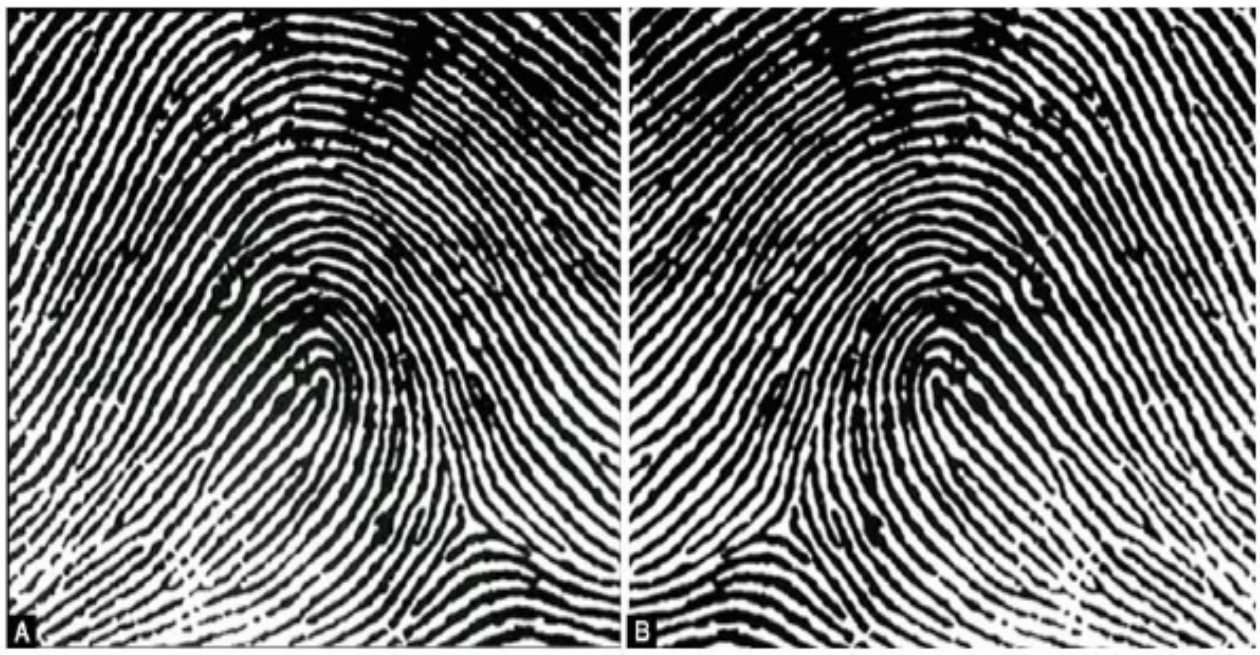

Fig. (2). Illustrated different types of loops. (**A**) Radial loop; (**B**) Ulnar loop [8].

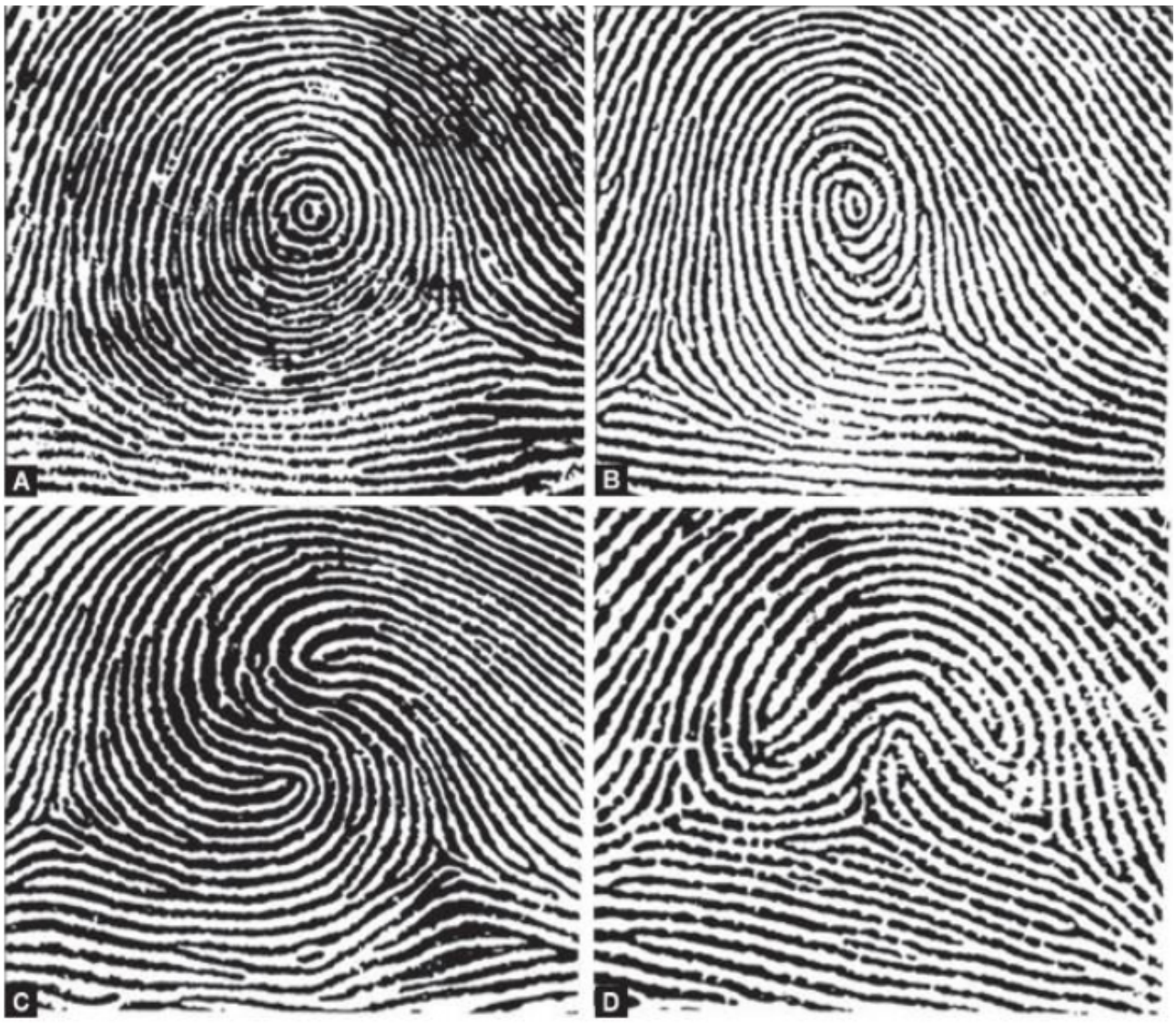

Fig. (3). Illustrated different types of whorls. (**A**) Plain; (**B**) Central pocket; (**C**) Double loop; (**D**) Composite [8].

As Richard Lazarus defines, stress is a phenomenon characterized by social imbalances and disruptions in the social system. It arises when there is an imbalance in the biological, psychological, or social system of an individual [11]. It has been extensively linked to poor mental health, often associated with emotions such as anger, anxiety, and sadness, and varies from person to person due to subjective perceptions of threat [12]. This perception influences one's ability to cope with resulting pressures or demands [13]. Stress greatly threatens homeostasis, leading to alterations that can cause pathophysiological complications and acute bodily effects [14]. Study and work-related stress are highly prevalent in medical and health-related university students. Evidence-based studies have shown elevated stress levels across different cultures and regions among medical, dental, nursing, and mental health students [15].

Dermatoglyphics has proven to be highly significant in assisting the diagnosis of a wide range of diseases [16]. Our stress response plays a crucial role in the development of illnesses, influenced by factors, such as our personality type and our relationship with the environment. Given the lack of existing studies in the literature, it is reasonable to explore the correlation between dermatoglyphic patterns and the perceived stress experienced by individuals. Such research could provide valuable insights into this unexplored area.

The study aimed to analyze the relationship between Dermatoglyphics and Levels of Perceived stress and compare the Dermatoglyphic patterns in different stress levels in both males and females.

2. MATERIALS AND METHODS

A cross-sectional study was conducted at Gulf Medical University, Ajman, with a population of students and faculties/ staff from the university. Burn victims and participants with scarred or inflamed fingers were excluded from the study. A sample size of 150 participants (75 Students and 75 Faculties/ Staff) was determined for the study. The research proposal was submitted to the Institutional Review Board for approval, and confidentiality of patient data was ensured throughout the study.

A validated stress questionnaire called "The Perceived Stress Scale" was utilized in the study to assess the levels of stress of the participants and divide them into:

- Group of low level of stress: (Scores ranging from 0-13)
- Group of moderate level of stress:(Scores ranging from 14-26)
- Group of the high level of stress: (Scores ranging from 27-40)

Fig. (4). Suprema realscan G10 [17].

Subsequently, fingerprints of each participant's left and right hands were obtained from all three groups using the fingerprint scanner/ reader. This study chose the Suprema RealScan G10, equipped with Advanced Rolled Image Construction technology, to scan fingerprints [17] (Fig. **4**).

The fingerprints were registered, stored, examined, studied with scrutiny, and further analyzed for patterns, such as arches, loops, and whorls. From the data observed, it was checked whether specific patterns were repeated among the participants within each group. Once the data was collected from each stress group, it was entered into the IBM Statistical Package for Social Sciences (SPSS) software version 27. Furthermore, the frequent occurrence of these specific patterns was compared between genders (Male and female). Descriptive statistics was used to summarize the relationship between Dermatoglyphics and Levels of Perceived stress in the study population.

3. RESULTS

Out of 150 participants with equal participation, the groupings were classified as - 28 low-stress, 109 moderate-stress, and 13 high-stress participants.

The percentage of the highest frequency was noted for radial loop in all three groups (Table **1**). The second-highest percentage of patterns was the plain whorl observed in all three groups. It is to be noted that central pocket loop whorl was present with higher frequency in the moderate-stress group rather than the two other groups.

The absence of Plain Arch in the high-stress group and the low frequency of accidental whorl in all stress levels was a noteworthy finding.

Table 1. Dermatoglyphic patterns among the total participants with different levels of perceived stress.

Finger Pattern	Low-stress		Moderate-stress		High-stress		Total	
	%	n	%	n	%	n	%	n
Ulnar loop	0.7%	2	3.2%	35	1.5%	2	2.6%	39
Radial loop	60.7%	170	56.7%	619	45.3%	59	56.5%	848
Plain arch	2.5%	7	1.5%	17	0.0%	0	1.6%	24
Tented arch	3.5%	10	3.8%	41	3.0%	4	3.6%	55
Plain whorl	22.1%	62	17.4%	190	30.7%	40	19.4%	292
Accidental whorl	0.3%	1	0.1%	2	0.7%	1	0.2%	4
Double loop	5.3%	15	5.5%	60	6.1%	8	5.5%	83
Central pocket whorl	4.6%	13	11.5%	126	12.3%	16	10.3%	155
Total	100.0%	280	100.0%	1090	100.0%	130	100.0%	1500

Table 2. Dermatoglyphic patterns in different levels of perceived stress in Males and females.

Finger Pattern	Male						Female					
	Low-stress		Moderate-stress		High-stress		Low-stress		Moderate-stress		High-stress	
	%	n	%	n	%	n	%	n	%	n	%	n
Ulnar loop	7.7%	1	92.3%	12	0%	0	3.8%	1	88.5%	23	7.7%	2
Radial loop	33.7%	89	64%	169	2.3%	6	11.9%	81	80.3%	547	7.8%	53
Plain arch	8.3%	1	91.7%	11	0%	0	50%	6	50%	6	0%	0
Tented arch	29.4%	5	70.6%	12	0%	0	13.2%	5	76.3%	29	10.6%	4
Plain whorl	36.6%	37	51.5%	52	11.9%	12	13.1%	25	72.3%	138	14.7%	28
Double loop	35.5%	11	58%	18	6.5%	2	7.7%	4	80.8%	42	11.5%	6

(Table 2) contd.....

Finger Pattern	Male						Female					
	Low-stress		Moderate-stress		High-stress		Low-stress		Moderate-stress		High-stress	
	%	n	%	n	%	n	%	n	%	n	%	n
Accidental whorl	50%	1	0%	0	50%	1	0%	0	100%	2	0%	0
Central pocket	10%	5	72%	36	18%	9	7.6%	8	85.7%	90	6.7%	7
Total of fingers	30.6%	150	63.3%	310	6.1%	30	12.9%	130	77.2%	780	9.9%	100

The analysis of patterns of both genders indicated that among female participants, accidental whorl was exclusively observed in individuals with a moderate level of perceived stress (n=2). Conversely, no occurrences of accidental whorl were noted in participants with low or high levels of perceived stress. Plain arch, on the other hand, was equally observed in low and moderate-stress levels with a percentage of 50% but completely absent in high levels of perceived stress. (Table **2**).

Whereas among the male participants, accidental whorl was exclusively observed in individuals with low and high levels of perceived stress, both occurring with equal frequency (n=1). In contrast, no accidental whorl was noted in individuals with a moderate level of perceived stress. In the high-level perceived stress group, several noteworthy results emerged. Specifically, the absence of an ulnar loop, plain arch, and tented arch was observed, with no instances recorded for each pattern.

4. DISCUSSION

The data analysis of the current study determined that the Radial Loop was the most prominent fingerprint pattern, with the highest frequency noted in all three levels of perceived stress. This is concordant with prior studies that have been carried out. For instance, in a study conducted in 2018 by Nayak *et al*., it was found that the most frequent pattern among Sri Lankan students was the radial loop, although concerning the whole study population, it was the second most prevalent [18].

Several earlier studies have also presented contradicting findings compared to the current research. A study conducted in 2021 by Adriano *et al*. analyzed the association between gestational period and obesity in children using dermatoglyphics, and the results demonstrated the ulnar loop pattern to have the highest frequency in all the groups studied, *i.e*., the low weight, normal weight, and pre-obese groups [19]. In another study in 2022 conducted by Venurkar *et al*., the connection between Dermatoglyphics and Myers-Briggs Personality types was investigated, and the results indicated that the radial loop was the least prevalent pattern and was confined to only one personality type in the study population [20].

A remarkable finding in the present study revealed that the Plain Arch was absent in participants who perceived a high stress level. This is similar to the study conducted in 2021 by Norovsambuu *et al*., which examined the link between dermatoglyphics and Schizophrenia; it was worth noting that the presence of the arch pattern on the right ring finger was observed exclusively in individuals with a moderate stress level, accounting for 0.9%, while it was not detected among those with low or high levels of stress [21].

5. LIMITATIONS

One limitation of this study is its reliance solely on a questionnaire for data collection, suggesting that future investigations should consider alternative methods like interviews or observations to support the questionnaire results. Additionally, using a fingerprint scanner may have limitations, particularly with certain populations, such as individuals with skin conditions or disabilities, affecting their ability to utilize the scanner effectively. To obtain more accurate and representative insights from different groups within the population of interest, future research endeavors could aim for a larger and more diverse sample size.

CONCLUSION

The study provides valuable insights into the relationship between individual characteristics and psychological well-being. This research suggests that dermatoglyphic patterns may reflect the vulnerability of an individual to stress. It is important to note that the relevance of dermatoglyphics lies not in diagnosing existing diseases but rather in preventing diseases by predicting their potential development. By identifying individuals with genetic predispositions through dermatoglyphic analysis, proactive measures can be taken to mitigate the risk and promote early intervention. This research holds promise in informing personalized stress management strategies and facilitating targeted interventions to improve overall well-being and prevent the onset of certain conditions. Further exploration in this field is warranted to advance our understanding of the complex interplay between dermatoglyphics, stress, and disease susceptibility.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Legal and Ethical approvals were obtained by The Institutional Review Board of Gulf Medical University before the initiation of the research work carried out. Ref. no. IRB/COM/STD/43/JULY-2022

HUMAN AND ANIMAL RIGHTS:

Helsinki Declaration was followed to involve human subjects in the study.

CONSENT FOR PUBLICATION

Informed consent was obtained from the patients.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

All collected data will be stored securely and confidentially

in the College of Medicine with the supervisor at Gulf Medical University for three years.

FUNDING

This work was financially supported by the Department of Biomedical Science, College of Medicine at Gulf Medical University.

CONFLICT OF INTEREST

The author declares no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

We would like to thank all our participants for their invaluable support and encouragement.

APPENDIX A: CONSENT FORM

GULF MEDICAL UNIVERSITY, AJMAN, UAE

CONSENT FORM

TITLE: A Study of Dermatoglyphics in Relation to the Levels of Perceived Stress

PRINCIPAL INVESTIGATOR(S): Dr. Ramya Rathan

INVESTIGATOR(S): Isra Ishtiaq Shakir, Naba Khan, Marwa Mahmood, Sadaf Sheikhi

SITE(S): Gulf Medical University, Ajman, UAE

This consent form will enlighten you with the basic idea of the research that we will conduct and help you make an informed decision about whether you would like to participate. It will mention some benefits that you may receive if you agree to participate in the study and how the data that we will gather will be helpful for the research.

You are free to not participate or withdraw yourself from the study at any time. Either way, you will suffer no loss to any benefits to which you are otherwise entitled.

What is the purpose of this study?

To determine if there is an association between dermatoglyphic patterns and the level of perceived stress

Why am I being asked to participate in this study?

We intend to conduct this study within the population of the Gulf Medical University of Ajman, as it is more convenient for us to get a large sample size easily. Students and faculty undergo varying levels of stress, and we find it interesting enough to see if there is an association between their perceived stress levels and their dermatoglyphic patterns (fingerprint patterns).

How long will I be in this study?

Your participation is required for only 20 minutes, which includes answering a short questionnaire and letting us scan for your fingerprints.

How many other subjects will be participating in this study?

A total of 200 participants will be participating in this study.

What will I be asked to do?

You need to answer a short questionnaire that will assess the level of your perceived stress and allow us to scan your fingers for your fingerprints.

What benefit can I expect from participating in the study?

This study will contribute further information to the already existing literature on dermatoglyphics.

On a larger scale, with a much larger sample size this research can be used as a prophylactic/preventive tool in various workplaces, some of which are university settings and in healthcare settings.

Assurance of Confidentiality:

We give complete surety to keep the data you have provided confidential and never to disclose it to anyone except the researchers, faculties, and members of the Institutional Review Board who will have access to the research data, with appropriate regulatory sight.

Can I participate in this study if I do not sign this consent form?

No, your signature on this consent form is a compulsory step for your valuable participation.

Consent

I have read this Consent Form. All my questions have been answered. I volunteer to take part in this study. I authorize the use and disclosure of my questionnaire's responses to the parties listed in the authorization section of this consent for the purposes described above.

Signature of Subject:_____Date: _____

Signature of the Principal Investigator:_____Date:_____

Appendix B: Questionnaire:"The Perceived Stress Scale"

Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

Name_____Date_____

Age_____ Gender (Circle): M F Other_____

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?.....

2. In the last month, how often have you felt that you were unable to control the important things in your life?…….

3. In the last month, how often have you felt nervous and "stressed"?…..

In the last month, how often have you felt confident about your ability to handle your personal problems?…..

5. In the last month, how often have you felt that things were going your way?....

6. In the last month, how often have you found that you could not cope with all the things that you had to do?…..

7. In the last month, how often have you been able to control irritations in your life?.....

8. In the last month, how often have you felt that you were on top of things?……

9. In the last month, how often have you been angered because of things that were outside of your control?…..

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?….

Please feel free to use the Perceived Stress Scale for your research.

Mind Garden, Inc.

info@mindgarden.com

www.mindgarden.com

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