

## Comparison of Palm Prints in Relation to Gender and Age Among Native Lucknow Population: A Correlation Study

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### KEYWORDS

Palm, Prints,  
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### ABSTRACT

*Background:* Palm is the inner surface of hand between wrist and fingers, Palm print is composed of principal lines, wrinkles and ridges, it is unique to each individual and does not change throughout life. The present study was done to determine the distribution of different category of palm prints and to determine the correlation between palm print patterns among both the genders and different age groups.

*Methodology:* The study was comprised of 100 study subjects from different age groups ranging from 20 to 60 years from both males and females, samples were randomly collected out of which were 46 males and 54 females. Palm prints were recorded using low resolution image technique and further evaluated by Wu et al, classification system.

*Result:* In the present study population female predominance was 1:1.2 male to female ratio where frequency of males were highest in 31-40 years of age (34.5%) whereas in females it was 20-30 years of age (46.3%). In both right and left palm of male and female Category 6 palm print was highest and it did not differ significantly. On correlation with age right palm print of female found to be associated with age.

*Conclusion:* The present study was done among Lucknow population to analyse predominant patterns of palm print in both the gender and different age group and correlate them among both the genders and different age groups. The predominant palm print pattern in males and females with respect to right and left palm did not differ significantly. On correlation between age and palm print right palm print of females found to be associated with age. Further research with larger sample size may add more findings to the study.

### 1. Introduction:

Human identification has become an important factor in today's era and the most challenging subjects that man has combat to it. Forensic Odontology has played a major role in identification of persons in mass disasters, criminal investigations, ethnic studies, identification of unknown bodies [1]. Gender Determination is an important factor in the process of identification of a person in case of natural calamities, crime investigations and cases of mishaps. They are various methods deployed for identification of gender either by morphological analysis or molecular analysis [2]. No two individuals in world look alike and are unique in themselves this concept of uniqueness is utilized in the human identification procedures [3]. Various distinguishing traits have been used for personal identification like iris, fingerprint, palmprint, voice and hand geometry as they are unique and define each and every member of the population which further helps is making identify subjects of large scale population [4]. Palm is defined as inner surface of hand between wrist and fingers, It is composed of principle lines also known as flexion creases, wrinkles also called as secondary creases and ridges. There are three principal lines made by flexing the hand and wrist namely heart line, head line and life line [5]. The principle lines and the wrinkles are formed between third and fifth month of pregnancy. These patterns are useful in personal identification as identical twins and right and left palm of same individuals also have different palm prints [6]. There are many literature available which focuses

research of palm prints on low resolution images of 150 dip or less which can extract features like principle lines, wrinkles and ridges and high resolution images of 400dpi or less where features like ridges, singular points and minutia points are observed [7]. Based on the feasibility and considering the most stable features of palm i.e palm prints Wu et al 8 Classified palm prints based on principle lines into different categories [8]. The present study was undertaken to determine the distribution of different categories of palm prints and to determine the correlation between palm print patterns among both the genders and different age groups.

## 2. Materials And Method

### Study Design

The study was comprised of 100 study subjects from different age groups ranging from 20 to 60 years from both males and females, samples were randomly collected only from individuals belonging to Native Lucknow Population out of which were 46 males and 54 females. Ethical clearance from the Institute and prior consent from the subjects after thorough explanation of the procedure and promise to keep the confidentiality of the subjects data were taken.

### Recording of Palm Prints

Firstly, both right and left Palms were washed with soap water and cleaned free of sweat and dry with the help of tissue paper or towel. For neat and clean photograph subjects were asked to sit on a chair rest the hand on the table by stretching and opening the fingers of the palm so that folding do not appear on the photographs, Digital photograph of right and left palms were taken by Sony Cyber-shot DSC-W570, 16.1 Megapixels, 5x Optical zoom, 25mm wide angle lens, 2.7 inch LCD screen megapixel camera after collection of photographs data was transferred in the laptop, the pictures were labelled as per the study number and stored for further analysis[Fig1-4]. Principal lines was analysed by Wu et al classification system [8].

Category	Classification
Category 1	Palm prints composed of no more than one principal line
Category 2	Palm prints composed of two principal lines and no intersection
Category 3	Palm prints composed of two principal lines and one intersection
Category 4	Palm prints composed of three principal lines and no intersection
Category 5	Palm prints composed of three principal lines and one intersection
Category 6	Palm prints composed of three principal lines and more than one intersection



Figure.1 Category 3- Left palm of female



Figure.2 Category 4- Left palm of male



Figure.3 Category 5- Right palm of male



Figure.4 Category 6- Right palm of female

### Inclusion Criteria

- Both genders (Males and Females)
- Study subjects were from age group between 20-60 years
- Individuals of Lucknow origin
- Study subjects free of any physical abnormalities and systemic illness
- Study subjects free of any skin abnormality on palms
- Study subjects free of any trauma to palms

### Exclusion criteria

- Transgender/ Third gender individuals
- Study subjects below 20 years of age and above 60 years of age
- Individuals from different city, state or foreigners residing in Lucknow
- Study subjects with any skin abnormality on palms
- Study subjects with any systemic diseases and immune-compromised patient

### 3. Statistical Analysis

Discrete (categorical) data were summarised in number (n) and percentage (%) and compared by chi-square ( $\chi^2$ ) test. A two-tailed ( $\alpha=2$ )  $P < 0.05$  was considered statistically significant. Analysis was performed on SPSS software (Windows version 22.0).

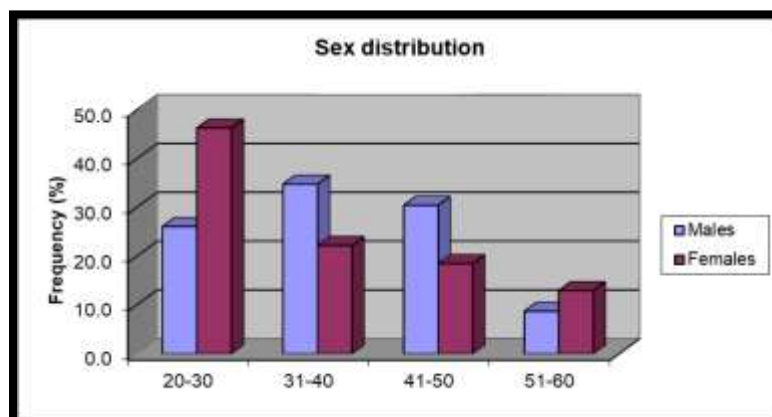
### 4. Results

#### Basic characteristics

The present study assesses palm prints of Lucknow population and correlates it with their age and gender. Total 100 subjects, 46 males and 54 females, age between 20-60 yrs were recruited (Table 1). Study population was female predominance with 1:1.2 male to female ratio. The frequency of males was highest in 31-40 yrs (34.8%) whereas in females it was in 20-30 yrs (46.3%) (Fig.5). In both right (53.8%) and left (40.0%) sides of males, the palm print frequency of category 6 was the maximum (Table 2) whereas in females it also showed similar trend at right i.e. maximum frequency of category 6 at right (54.5%) and left (42.9%) was found to be the maximum. (Fig.6)

**Table 1: Distribution of age and gender of study population**

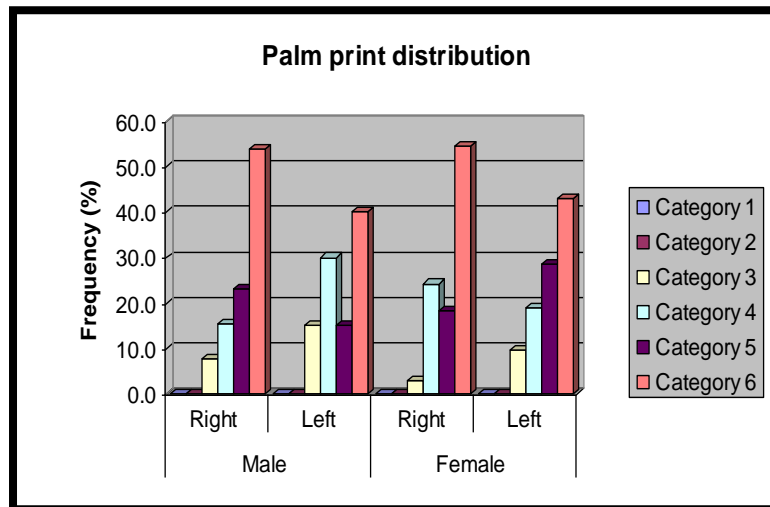
Age (yrs)	Males (n=46) (%)	Females (n=54) (%)
20-30	12 (26.1)	25 (46.3)
31-40	16 (34.8)	12 (22.2)
41-50	14 (30.4)	10 (18.5)
51-60	4 (8.7)	7 (13.0)



**Figure 5. Frequency Distribution of age and gender**

**Table 2: Distribution of palm prints of two genders**

Palm print	Male (n=46)		Female (n=54)	
	Right (n=26) (%)	Left (n=20) (%)	Right (n=33) (%)	Left (n=21) (%)
1	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
2	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
3	2 (7.7)	3 (15.0)	1 (3.0)	2 (9.5)
4	4 (15.4)	6 (30.0)	8 (24.2)	4 (19.0)
5	6 (23.1)	3 (15.0)	6 (18.2)	6 (28.6)
6	14 (53.8)	8 (40.0)	18 (54.5)	9 (42.8)



**Figure 6. Frequency Distribution between male and female**

## Correlation

### I. Gender wise

The correlation between gender and palm prints of studied population is summarised in Table 3 and 4. For each gender, comparing the frequency of palm prints between right and left sides (i.e. intra group),  $\chi^2$  test showed similar ( $P > 0.05$ ) distribution of palm prints between two sides in both males ( $\chi^2=2.50$ ,  $P = 0.476$ ) and females ( $\chi^2=2.10$ ,  $P = 0.551$ ) i.e. did not differed significantly (Table 3) (Fig.7&8).

**Table 3: Distribution and comparison of right and left palm prints in males and females**

Palm print category	Male (n=46)		$\chi^2$ value	P value	Female (n=54)		$\chi^2$ value)	P value
	Right (n=26) (%)	Left (n=20) (%)			Right (n=33) (%)	Left (n=21) (%)		
1	0 (0.0)	0 (0.0)	2.50	0.476	0 (0.0)	0 (0.0)	2.10	0.551
2	0 (0.0)	0 (0.0)			0 (0.0)	0 (0.0)		
3	2 (7.7)	3 (15.0)			1 (3.0)	2 (9.5)		
4	4 (15.4)	6 (30.0)			8 (24.2)	4 (19.0)		
5	6 (23.1)	3 (15.0)			6 (18.2)	6 (28.6)		
6	14 (53.8)	8 (40.0)			18 (54.5)	9 (42.9)		

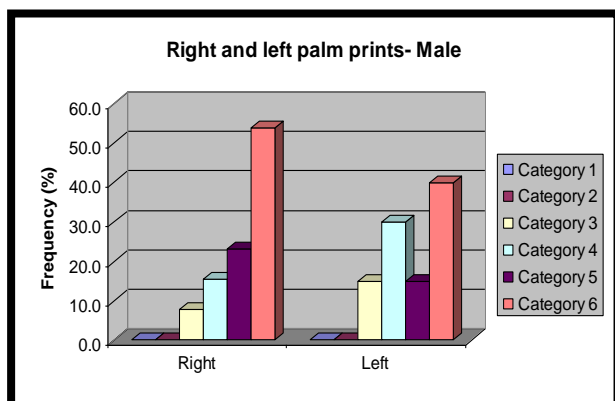


Figure 7. Distribution of Right and Left Palmprints in Male

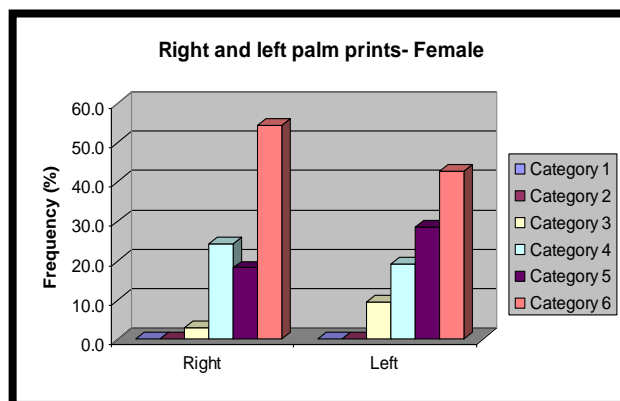


Figure 8. Distribution of Right and Left Palmprints in Females

Similarly, for each side, comparing the frequency of palm prints between males and females (i.e. inter group),  $\chi^2$  test further showed similar ( $P > 0.05$ ) distribution of palm prints between two genders at both right ( $\chi^2=1.36, P = 0.761$ ) and left ( $\chi^2=1.64, P = 0.651$ ) sides i.e. also not differed significantly (Table 4) (Fig.9&10).

Table 4: Distribution and comparison of right and left palm prints between two genders

Palm print category	Right (n=59)		$\chi^2$ value	P value	Left (n=41)		$\chi^2$ value)	P value
	Male (n=26) (%)	Female (n=33) (%)			Male (n=20) (%)	Female (n=21) (%)		
1	0 (0.0)	0 (0.0)	1.36	0.761	0 (0.0)	0 (0.0)	1.64	0.651
2	0 (0.0)	0 (0.0)			0 (0.0)	0 (0.0)		
3	2 (7.7)	1 (3.0)			3 (15.0)	2 (9.5)		
4	4 (15.4)	8 (24.2)			6 (30.0)	4 (19.0)		
5	6 (23.1)	6 (18.2)			3 (15.0)	6 (28.6)		
6	14 (53.8)	18 (54.5)			8 (40.0)	9 (42.9)		

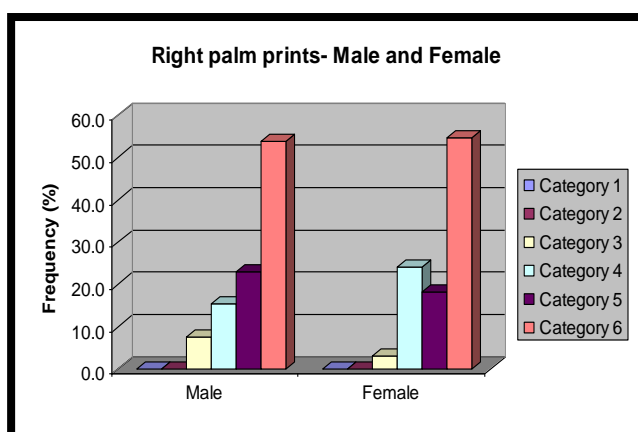


Figure 9. Distribution of Right Palmprints in Male and Female

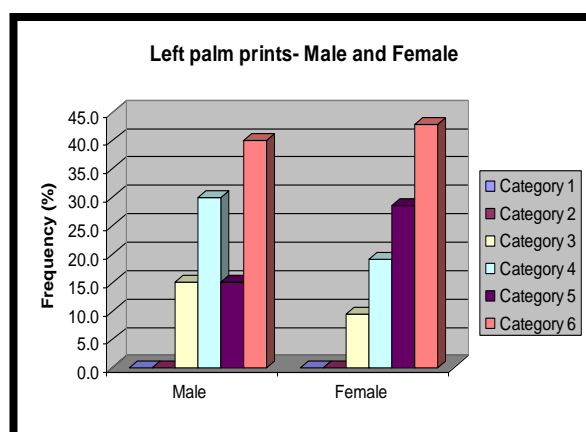


Figure 10. Distribution of Left Palmprints in Male and Females

## II. Age wise

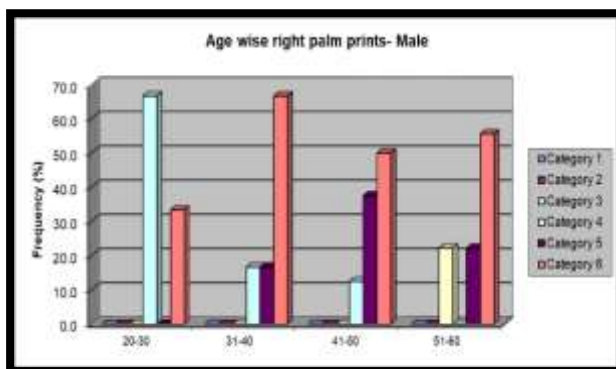
The correlation between age and palm prints of studied population is summarised in Table 5 and 6. Comparing the frequency of each right and left palm prints of male with their age,  $\chi^2$  test showed similar ( $P > 0.05$ ) distribution of both right ( $\chi^2=12.31, P = 0.197$ ) and left ( $\chi^2=2.30, P = 0.986$ ) palm prints with age in males i.e. did not differed significantly (Table 5) (Fig.11&12). In contrast, in



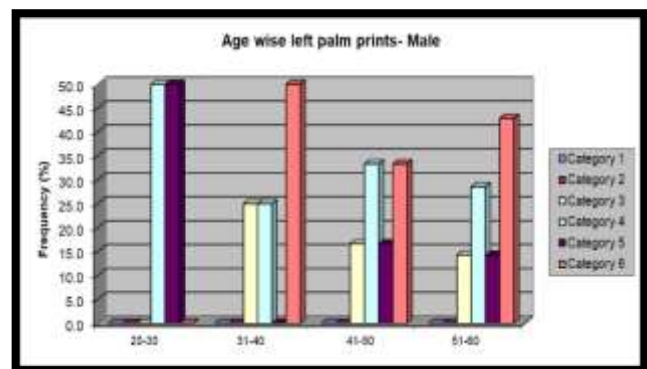
females, it varied significantly ( $P > 0.05$ ) at right ( $\chi^2=20.30$ ,  $P = 0.016$ ) but found similar ( $P > 0.05$ ) at left ( $\chi^2=7.20$ ,  $P = 0.616$ ) (Table 6) (Fig 13&14). In conclusion, the right palm prints of females found to be associated with age.

**Table 5: Distribution and comparison of right and left palm prints of males with their age**

Palm Print Category	Right (n=26)					Left (n=20)							
	20-30 (n=3) (%)	31-40 (n=6) (%)	41-50 (n=8) (%)	51-60 (n=9) (%)	$\chi^2$ value	$P$ value	20-30 (n=3) (%)	31-40 (n=4) (%)	41-50 (n=6) (%)	51-60 (n=7) (%)	$\chi^2$ value	$P$ value	
1	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	12.31	0.197	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2.30	0.986	
2	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)			0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)			0 (0.0)
3	0 (0.0)	0 (0.0)	0 (0.0)	2 (22.2)			0 (0.0)	1 (25.0)	1 (16.7)	1 (14.3)			
4	2 (66.7)	1 (16.7)	1 (12.5)	0 (0.0)			1 (33.3)	1 (25.0)	2 (33.3)	2 (28.6)			
5	0 (0.0)	1 (16.7)	3 (37.5)	2 (22.2)			1 (33.3)	0 (0.0)	1 (16.7)	1 (14.3)			
6	1 (33.3)	4 (66.7)	4 (50.0)	5 (55.6)			1 (33.3)	2 (50.0)	2 (33.3)	3 (42.9)			



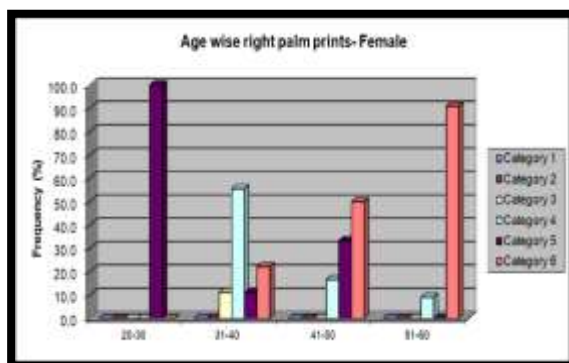
**Figure 11. Age Distribution of Right Palm Prints in Male**



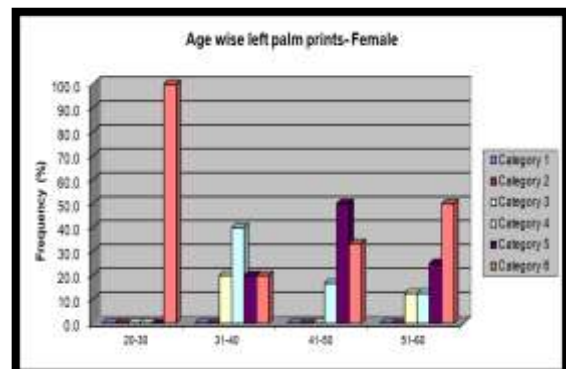
**Figure 12. Age Distribution of Left Palm Prints in Male**

**Table 6: Distribution and comparison of right and left palm prints of females with their age**

Palm print category	Right (n=33)					Left (n=21)						
	20-30 (n=1) (%)	31-40 (n=9) (%)	41-50 (n=12) (%)	51-60 (n=11) (%)	$\chi^2$ value	$P$ value	20-30 (n=2) (%)	31-40 (n=5) (%)	41-50 (n=6) (%)	51-60 (n=8) (%)	$\chi^2$ value	$P$ value
1	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	20.30	0.016	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	7.20	0.616
2	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)			0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		
3	0 (0.0)	1 (11.1)	0 (0.0)	0 (0.0)			0 (0.0)	1 (20.0)	0 (0.0)	1 (12.5)		
4	0 (0.0)	5 (55.6)	2 (16.7)	1 (9.1)			0 (0.0)	2 (40.0)	1 (16.7)	1 (12.5)		
5	1 (100.0)	1 (11.1)	4 (33.3)	0 (0.0)			0 (0.0)	1 (20.0)	3 (50.0)	2 (25.0)		
6	0 (0.0)	2 (22.2)	6 (50.0)	10 (90.9)			2 (100.0)	1 (20.0)	2 (33.3)	4 (50.0)		



**Figure 13. Age Distribution of Right Palmprints in Female**



**Figure 14. Age Distribution of Left Palmprints in Female**

## **5. Discussion**

Individual identification plays a vital role in forensic investigation. Nowadays they are different means of personal identification methods but the problem arises when they are not always available in rural and urban areas and are also bound to cost effectiveness [9]. Along with the previous methods deployed they are also upcoming methods like palm print which is also gaining lot more attention of the researchers. The use of palm print is predominant in personal identification. Thus our study is aimed to determine the distribution of different categories of palm print and to determine the correlation between palm print patterns among both the genders and different age groups which could also provide a baseline for further studies. Palmprint is a physiological characteristic which is reliable throughout life and is also unique for each individual [10]. Personal identification of a deceased person in mass disaster, accidents, missing individuals is done by comparison of antemortem records with post-mortem record. Palm print method is preferred over other methods because of easily captured low resolution images which can easily extract main features like principal lines, it is non-invasive and does not disclose personal identity of a person [11-14].

In the present study the study population was of female predominance in compared to males. In Male Category 6(53.8%) of right palm was maximum followed by Category 5(23.1%), Category 4(15.4%) and Category 3(7.7%) whereas in left palm category 6(40.0%) was found maximum followed by category 4(30.0%), Category 5 and Category 3 (15.0%) were equal. Category 1 and category 2 were not observed. In Female Category 6(54.5%) of right palm was observed more followed by Category 4 (24.2%), Category 5(18.2%), Category 3 (3.0%) whereas in left palm Category 6(4.9%) followed by Category 5(28.6%), Category 4 (19.0%), Category 3(9.5%) were observed, Category 1 and Category 2 were not observed in either of the palm. A study done by Biswas et al [15] states that Category 1 and Category 2 were not seen and Category 4 was more found in female. Another study done among South Kerala Population by Rekha et al observed Category 5(62.3%) followed by Category 4(27.2%), Category 2 (6.1%) and Category 3 (4.4%) [11]. There are only very few studies done based on capturing low resolution images and evaluating them manually, mainly studies are done on palm print based on different algorithms, palm print scanners, devices and then evaluating them on their data base based on different softwares [16]. Similar study is done by Duta et al,[4] who extracted some feature points on palm lines from offline palm print images for verification another study by Han et al, used Sobel and morphological operations to extract line like features from palm prints [17]. Kumar et al, evaluated hand geometric features and integrated line like features for personal verification all these methods develop computational complexity and are very time consuming [18].

In the present study on correlation between gender and palm print, the frequency of palm prints between right and left sides showed similar distribution of palm prints between two sides in both males and females which did not differed significantly, similarly for each side comparing the frequency of palm prints between males and females also showed similar distribution of palm prints between two genders at both right and left sides that is also not differed significantly. A study done by Fakir et al, among twin population where 84% similarity was seen in left palm and 80% in right palm [9]. Identification of gender using palm print does not have much literature.

In the present study on correlation between age and palm print, frequency of each right and left palm prints of male with their age showed similar distribution of both right and left palm prints with age in males that did not differed significantly. In contrast, in females it varied significantly in right but shown similar in left, In conclusion right palm prints of females found to be associated with age.

## **6. Conclusion**

The present study was done to analyse predominant patterns of palm print in both the gender and age group and correlate them among both the genders and different age groups. The predominant palm print pattern in males and females with respect to right and left palm Category 6 is found the most which did not differed significantly. On correlation between age and palm print right palm print of

females found to be associated with age. To the best of our knowledge there is no literature available on comparing the frequency between right and left palm print between gender and age, The present study was done on a limited sample size further study with larger sample size may add more findings in the field of research.

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