

COMPARISON OF OCCUPATIONAL MARKS IN FINGER AND PALMPRINT IMPRESSIONS OF POTTERS, BRICK KILN LABOURERS & MASONS WITH REFERENCE SAMPLES

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Abstract: Fingerprints are unique to individuals and can be used for identification purposes. In the case of occupational marks, the analysis would involve identifying specific features within the prints that are indicative of a particular occupation. These features could include calluses, scars, cuts, or abrasions that are commonly observed in potters, laborers, or masons due to their work-related activities. Palmprints provide a broader surface area for examination and can also reveal occupational marks. Similar to fingerprints, the analysis would involve identifying distinctive features associated with the work of potters, laborers, and masons. These features could include roughness, hardened skin, or specific patterns related to tool handling. To compare the occupational marks found in the finger and palmprint impressions of potters, laborers, and masons, the prints obtained from individuals in these occupations would be compared against the standard samples. This research paper aims to determine if consistent patterns or features are unique to each occupation that distinguish them from others. The research paper entails a comprehensive visual examination of finger and palm prints obtained from individuals working as potters, laborers, and masons, in conjunction with standard samples. This analysis aims to gather relevant data and draw conclusions regarding the potential use of occupational marks found in fingerprints and palm prints during investigative procedures.

Keywords: fingerprints, palm prints, occupational marks, investigation, potters, laborers, masons, forensic evidence, identification.

Introduction

Fingerprints are widely recognized as a unique and reliable form of identification, serving as valuable forensic evidence in various investigations (Jain & Pankanti, 2005). They offer distinctive ridge patterns that are specific to each individual, enabling precise identification and linking individuals to specific activities or locations (Jain & Pankanti, 2009). (Forensic Science and Fingerprints, 2016) (Jasuja & Bindra, 2000) In addition to individualization, fingerprints can also provide valuable information about a person's occupation through the presence of occupational marks and identification marks like tattoo, etc within the prints (Sharma, 2021b) (Byard, 2015; Kulshreshtha & Mondal, 2017a; Rohith et al., 2020). Palmprints, offering a larger surface area for examination, present an opportunity to capture a wider range of occupational marks. By analyzing both finger and palm prints, distinctive features associated with the work of individuals can be identified, such as roughness, hardened skin, or unique patterns related to tool handling. These occupational marks can potentially serve as valuable forensic indicators, aiding in the investigation process by providing insights into an individual's occupation and potential involvement in specific activities (Shetty et al., 2009a) (Akhtar et al., 2017; Sharma, 2021b).

Occupational marks are specific features that manifest on the hands and fingers of individuals engaged in particular occupations (Forbes, n.d.-a). These marks result from the repetitive use of tools, equipment, or tasks associated with a specific line of work. They can

include calluses, scars, cuts, or abrasions, which reflect individuals' physical demands and occupational activities in their respective professions. Various types of occupational marks can be observed in fingerprints and palm prints. These marks are indicative of the specific activities and work-related conditions individuals are exposed to in their occupations (Kanerva, n.d.; Sharma, 2021a; Shetty et al., 2009b). Here are some common types of occupational marks:

1. **Calluses:** Calluses are areas of hardened and thickened skin that develop as a result of repeated friction or pressure. Occupations involving manual labor or the use of tools can lead to the formation of calluses, which can be observed as raised or rough areas on the fingertips or palms.
2. **Scars:** Scars are permanent marks on the skin that result from injuries or wounds. Individuals may frequently encounter sharp objects or tools in some occupations, leading to cuts, lacerations, or surgical scars. These scars can leave distinct patterns or irregularities in fingerprints or palm prints.
3. **Abrasions:** Abrasions are superficial injuries to the skin caused by rubbing or scraping against rough surfaces. Certain occupations, such as construction or manufacturing, may expose individuals to abrasive materials or surfaces, resulting in the presence of abrasions in their fingerprints or palm prints.
4. **Burns:** Burns can occur when the skin is exposed to heat, flames, chemicals, or electrical sources. Occupations involving direct contact with hot objects, working in high-temperature environments, or handling hazardous

materials may lead to burn marks on the skin, which can be visible in fingerprints or palm prints.

5. Stains: Some occupations involve the use of dyes, inks, paints, or other substances that can leave stains on the skin. These stains can manifest as discolorations or pigmentation changes in fingerprints or palm prints.
6. Blisters: Blisters are fluid-filled pockets that form on the skin due to friction, heat, or chemical exposure. Occupations requiring repetitive hand movements or activities involving high friction levels may result in blisters forming, which can be observed in fingerprints or palm prints.

These occupational marks provide unique and identifiable characteristics that can assist in the identification of individuals and potentially link them to specific occupational activities. These are helpful in identifying unknown dead bodies in mass disasters, plane crashes, earthquakes, and fire explosions in any situation where visual identification is not possible so that it is identified with the help of various techniques such as fingerprinting, DNA profiling, anthropometric measurements, forensic radiology, etc.(Bahadur & Modi, n.d.; Kulshreshtha & Mondal, 2017b; Pramod et al., 2012; Sharma & Singh, 2014)(Byard, 2015; Huo et al., 2022; Sweet, 2001) Forensic experts can examine these marks during investigations to establish connections between suspects, victims, and crime scenes, contributing to the overall understanding of the circumstances surrounding a case(Kanerva, n.d.; Kumari et al., 2006; T. L. Diepgen & P. J. Coenraads, 2000; Ubaidullah, 2018).

The primary objective of this research paper is to explore and compare the occupational marks present in finger and palm prints. The study focuses on individuals from various occupations, including potters, laborers, and masons, who commonly exhibit specific occupational marks due to the nature of their work. By comparing the prints of individuals in these occupations against standardized samples, the research aims to identify consistent patterns or features that are unique to each occupation, enabling their differentiation and potential application in forensic investigations(Forbes, n.d.-b; Hazarika & Russell, 2012; Jain & Pankanti, 2005; The Forensic Laboratory Handbook Procedures and Practice, n.d.). Individuals from different occupations were involved in this research, their occupations, working environment, and working practices are explained below(Thygersen et al., 2016):

Potters are individuals who work with clay and other materials to create pottery and ceramic objects. They use various techniques such as molding, shaping, and glazing to craft functional and decorative items like bowls, vases, and plates. Potters often work in pottery studios or workshops, where they operate pottery wheels, kilns, and other specialized tools. Their work involves a combination of artistic skill and technical knowledge to create unique and aesthetically pleasing pieces. Potters may also engage in tasks like preparing

clay, mixing glazes, and finishing the surfaces of their creations. The nature of their work exposes them to prolonged contact with clay, resulting in specific occupational marks and characteristics in their fingerprints and palm prints.

Brick kiln laborers are individuals who work in brick kilns where clay bricks are manufactured. Their work involves various physical tasks, including stacking and arranging bricks, feeding clay into brick-making machines, and operating kilns for firing the bricks. These laborers often work in hot and dusty environments, exposing them to the elements and harsh working conditions. The repetitive motions and handling of bricks can lead to specific occupational marks on their hands, such as calluses, blisters, and burn marks. These marks are a result of the physical demands and hazards associated with brick manufacturing.

Masons are skilled craftsmen who work with stone, concrete, and other construction materials to build structures like buildings, walls, and bridges. They interpret architectural plans and use tools such as trowels, hammers, and chisels to lay bricks or stones, apply mortar, and create sturdy and visually appealing structures. Masonry work requires precision, attention to detail, and knowledge of various techniques to ensure structural integrity. Masons often work outdoors and may be exposed to challenging weather conditions. The nature of their work involves manual dexterity and physical exertion, resulting in occupational marks that can be observed in their fingerprints and palm prints.

Normal corporate job professionals (standard samples) refer to individuals working in typical office or corporate settings. These professionals are usually employed in administrative, managerial, or professional roles that do not involve manual labor or specialized vocational skills. Their work is primarily desk-based and involves tasks such as administrative duties, meetings, data analysis, and project management. Additionally, normal corporate job professionals typically display a lower occurrence of occupational marks such as blisters, cut marks, and burn marks. This is because their work environment is relatively safer and less physically demanding compared to occupations that involve manual labor or exposure to hazards(Thygersen et al., 2016).

Through a comprehensive visual examination of finger and palm prints obtained from individuals in these occupations, in conjunction with standard samples, this research aims to gather relevant data and draw conclusions regarding the significance and potential use of occupational marks found in fingerprints and palm prints during investigative procedures(Jain & Pankanti, 2005; The Forensic Laboratory Handbook Procedures and Practice, n.d.). The findings of this study have the potential to enhance forensic identification techniques and assist law enforcement agencies in narrowing down suspects based on their occupational characteristics,

ultimately contributing to more effective and accurate criminal investigations.

Methodology:

A comprehensive visual examination of finger and palm prints will be conducted to achieve the research objective. The collected prints will be visually examined by using a hand lens. Occupational marks, including calluses, scars, cuts, or abrasions, will be identified and documented for each participant. The specific regions of the prints where these marks are present will also be recorded. The prints obtained from the participants will be compared against standardized samples of individuals working in standard corporate jobs. This comparison will help determine if the identified occupational marks are unique to the target occupations or if they are also present in individuals from other professions.

Materials:

- ❖ Ink
- ❖ roller

- ❖ fiberglass plates
- ❖ A4 sheet of 200 pieces
- ❖ Magnifying glasses
- ❖ highlighting markers
- ❖ pencil
- ❖ pen

Sample collection:

The study will involve a total sample size of 200 individuals, consisting of participants from different occupational groups. The sample size for each occupation, including potters, brick kiln laborers, and masons, will be 60 individuals. A comparison group of 20 individuals working in standard corporate jobs will also be included. The age range for the participants will vary based on their occupation, as outlined in the table below (Table 1). Fingerprint and palmprint samples will be collected from each participant using standard fingerprinting techniques. The prints will be obtained using fingerprint ink and fingerprinting cards. Care will be taken to ensure clear and high-quality prints for analysis.

Table1: Sample Size and Age Groups

Occupation	Sample Size	Age Group
Potters	60	21 to 90 yrs.
Brick kiln laborers	60	20 to 42 yrs.
Masons	60	20 to 40 yrs.
Standard Professionals	20	21 to 42 yrs.
Total	200	20 to 90 yrs.

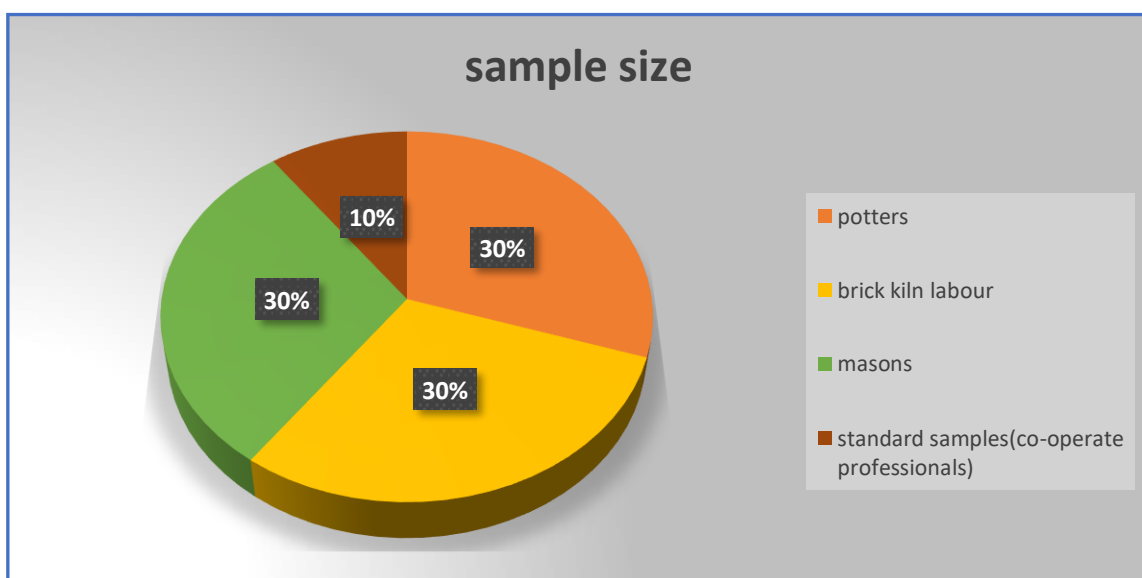


Fig.1 pie chart showing the relationship between the occupational group and their sample size

Ethical Considerations and Informed Consent: This research will adhere to ethical guidelines and ensure the privacy and confidentiality of the participants. All participants will be provided with detailed information

about the research objectives and procedures. Informed consent will be obtained from each participant before their involvement in the study.

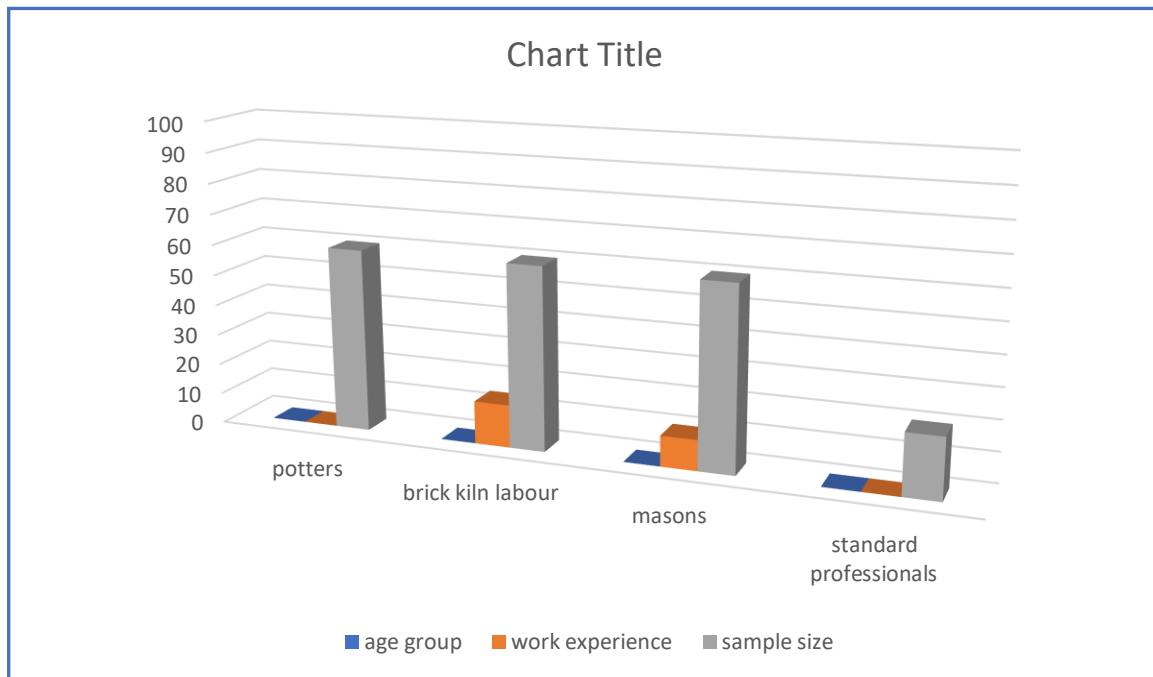


Figure 2 shows the relationship between occupational groups, their age, work experience, and sample size.

Observations and Result:

Occupational marks observed in various occupations provide valuable insights into an individual's line of work. When it comes to potters, several distinct occupational marks can be identified. The interdigital part of the palm just below the index finger may exhibit diminished ridges and creases, a consequence of the continuous handling of clay and pottery tools. Additionally, potters who have been working for an extended period tend to develop calluses in the interdigital region, reflecting the repetitive nature of their tasks. Another notable mark is the presence of specific cut marks in the middle of the thumb, likely resulting from the use of a thread to cut raw pots from

the rotor. Moreover, with increasing work experience, the ridges on the fingertips may become more prominent or depleted, indicative of the physical demands placed on the hands. Interestingly, female potters with years of experience tend to display more prominent calluses in their palms compared to their male counterparts. Furthermore, a higher number of creases can be observed in the thenar region of the palm, adding to the distinctive features found in the fingerprints and palm prints of potters. The figure shows Blisters, Cuts, and Scars and Unusual creases in the fingerprints and palm prints of potters.



Figure 3(a)



Figure 3(b)



Figure 3(c)



Figure 3(d)

Figures 3(a-d) shows the fingerprints and palmprints of potters.

Brick kiln laborers exhibit specific characteristics in their fingerprints and palm prints due to the nature of their work. One notable observation is the presence of specific burn marks in the middle palm region. These burn marks are a direct result of the intense heat exposure they encounter while working in the brick kilns. The hot surfaces and materials involved in the kiln operations can cause burns on their palms, leaving distinct marks. Another observation is the depletion or diminishment of ridges in the interdigital and thenar regions of their palms. This can be attributed to the

repetitive manual tasks performed by brick kiln laborers, such as handling bricks and other materials. Over time, the continuous friction and pressure on these areas can lead to the wear and tear of ridges, resulting in their depletion or diminishment. Additionally, the interdigital region of their palmprints shows the development of metacarpophalangeal pads with increasing work experience. These pads serve as a physiological adaptation to the physical demands of their work, providing extra cushioning and support. The figure shows Blisters, Cuts, and Scars and Unusual creases in the fingerprints and palm prints of brick kiln laborers.



Figure 4(a)



Figure 4(b)



Figure 4(c)



Figure 4(d)

Figures 4(a-d) shows fingerprints and palmprints of brick kiln labor.

Masons also demonstrate unique characteristics in their fingerprints and palm prints that reflect their occupation. One prominent observation is the depletion of ridges from the central region of the palm print. This depletion is a consequence of the manual handling of tools and materials involved in masonry work. The continuous friction and pressure exerted on the central part of the palm during tasks like bricklaying can cause the ridges to wear down over time. Additionally, specific cut marks are often found in the thenar region of the

palmprint among masons. These cut marks are a result of using sharp tools and equipment, such as trowels or chisels, in their work. The precision cutting and shaping of bricks or stones can leave distinct marks on their palms. Alongside, there are broad longitudinal creases below the interdigital part of the palm, which can be attributed to the repetitive motions and physical strain associated with masonry tasks. These creases form as a response to the continuous gripping and manipulation of tools and materials. Furthermore, the presence of

occupational marks like cuts, blisters, and scars in the palmer region of masons serves as a testament to the potential hazards they encounter while working in their

trade. The figure shows Blisters, Cuts, and Scars and Unusual creases in the fingerprints and palm prints of masons.



Figure 5(a)



Figure 5(b)



5(c)



Figure 5(d)

Figure

Figures 5(a-d) show the fingerprints and palmprints of masons.

On the other hand, when comparing these occupational marks to standard professionals, certain characteristics stand out. Standard individuals tend to exhibit a lesser number of creases in the interdigital part of the palm, indicating a contrast with occupations that involve more physically demanding or repetitive tasks. Additionally, the ridges in the palm region are more prominent in standard professionals, potentially influenced by factors

such as hand usage and the nature of their work. Moreover, compared to occupational groups, the occurrence of blisters, cut marks, and burn marks is lower in standard professionals, reflecting the differences in the physical demands and work environment of their respective occupations. The figure shows the fingerprints and palm prints of standard professionals.



Figure 6 (a)



Figure 6 (b)



Figure 6(c)

Figures 6(a-c) shows the fingerprints and palm prints of standard professional people.

Overall, the study of occupational marks in fingerprints and palm prints plays a crucial role in forensic identification. These marks can assist investigators in

narrowing down suspects, establishing a connection between individuals and specific occupations, and providing valuable insights into an individual's work history and activities.

Table 2: shows the Critical observations in palm prints and fingerprints

s. no.	Occupational class	Age range	Average work experience	Critical observations
1	Potters	21 to 90 yrs.	25-30	<ul style="list-style-type: none"> - Diminished ridges and creases in the interdigital part - Formation of calluses in the interdigital part - Specific cut marks in the middle of the thumb - Prominence and depletion of ridges with work experience

				<ul style="list-style-type: none"> - More prominent calluses in female potters with years of experience - Higher number of creases in the thenar region of the palm - Lesser number of creases in males aged 30-50 compared to older males
2	Brick kiln labors	20 to 42 yrs.	10-25	<ul style="list-style-type: none"> - Specific burn marks in the middle palm region - Depletion or diminishment of ridges in the interdigital and thenar regions -Development of metacarpophalangeal pads in the interdigital region - Broad longitudinal creases below the interdigital part in palm prints
3	Masons	20 to 40 yrs.	10-14	<p>Ridges are depleted from the central region of the palm print.</p> <ul style="list-style-type: none"> • Specific cut marks are present in the thenar region of the palmprint in the individual. • Broad longitudinal creases below the interdigital part in the palm of masons. • Specific occupational marks like cuts, blisters, and scars are present in the palmer region of masons.
4	Normal corporate job professionals (standard samples)	21 to 42 yrs.	N/A	<ul style="list-style-type: none"> - Lesser number of creases in the interdigital part - More prominent ridges in the palm region - Lower occurrence of blisters, cut marks, and burn marks

Table 3: shows the observations and their explanation in palm prints and fingerprints

Occupation	Observation	Explanation
Potters	Diminished ridges and creases in the interdigital part	Due to working as a potter
	Formation of calluses in the interdigital part	Potters working for more than 10 years
	Specific cut marks in the middle of the thumb	Possibly from cutting raw pots with a thread
	Prominence and depletion of ridges with work experience	Ridges become more prominent and depleted with increasing work experience
	More prominent calluses in female potters with years of experience	Females show more prominent calluses compared to males with the same experience
	A higher number of creases in the thenar region of the palm	Found in all individuals
	Lesser number of creases in males aged 30-50 compared to older males	Age-related differences in crease formation
Brick Kiln Labours	- Specific burn marks in the middle palm region	The intense heat exposure in brick kilns can cause burn marks on the palms.
	- Depletion or diminishment of ridges in the interdigital and thenar regions	Repetitive manual tasks performed by brick kiln laborers can lead to the wear and tear of ridges in those areas.
	- Development of metacarpophalangeal pads in the interdigital region with increasing work experience	The gripping and handling techniques used in brick kiln work can lead to the development of pads in that region.
	- Broad longitudinal creases below the interdigital part in the palmprint	Physical stress on the hands during brick kiln activities can result in the formation of broad creases in that area.

Occupation	Observation	Explanation
Masons	- Depletion of ridges from the central region of the palm print	The manual handling of tools and materials in masonry work can cause the depletion of ridges in that area.
	- Presence of specific cut marks in the thenar region of the palmprint	The use of sharp tools or equipment in masonry activities can leave distinct cut marks on the palm print.
	- Broad longitudinal creases below the interdigital part in the palm	The physical strain exerted on the hands during repetitive masonry tasks can result in the formation of broad creases.
	- Presence of occupational marks such as cuts, blisters, and scars in the palmer region	The nature of masonry work can lead to the occurrence of various occupational marks in the palm region.
Standard professionals	Lesser number of creases in the interdigital part	Found in all standard individuals
	More prominent ridges in the palm region	Ridges in the palm are more distinct
	Lower occurrence of blisters, cut marks, and burn marks	Compared to occupational groups, standards show fewer marks

Table 4: shows the observations in palm prints and fingerprints of different occupational samples

Occupation	Observation
Potters	- Diminished ridges and creases in the interdigital part
	- Formation of calluses in the interdigital part
	- Specific cut marks in the middle of the thumb
	- Prominence and depletion of ridges with work experience
	- More prominent calluses in female potters with years of experience
	- Higher number of creases in the thenar region of the palm
	- Lesser number of creases in males aged 30-50 compared to older males
Brick kiln labors	- Specific burn marks in the middle palm region - Depletion or diminishment of ridges in the interdigital and thenar regions - Development of metacarpophalangeal pads in the interdigital region - Broad longitudinal creases below the interdigital part in palm prints
Masons	- Depletion of ridges from the central region of the palm print - Presence of specific cut marks in the thenar region of the palm print - Broad longitudinal creases below the interdigital part in palm prints - Presence of occupational marks such as cuts, blisters, and scars in the palmar region.
Standard professionals	- Lesser number of creases in the interdigital part
	- More prominent ridges in the palm region
	- Lower occurrence of blisters, cut marks, and burn marks

The results of this research will provide insights into the presence and characteristics of occupational marks in the fingerprints and palm prints of individuals working in various occupations. The analysis will reveal the specific features that are commonly observed in potters, laborers, and masons due to their work-related activities. These features may include distinct patterns of calluses, scars, cuts, or abrasions in particular regions of the prints. Furthermore, the examination of palm prints will uncover additional occupational marks that contribute to the overall profile of individuals in these occupations. Features such as roughness, hardened skin, or unique

patterns related to tool handling may be prominent in the palm prints of individuals engaged in manual work.

Discussion:

It is important to acknowledge the potential limitations of this study. The sample size, although representative, may not encompass the entire population of individuals working in the target occupations. Additionally, factors such as the variability of work environments and individual variations within each occupation may influence the presence and characteristics of occupational marks. Nonetheless, this research will provide valuable insights into the potential use of

occupational marks in forensic investigations and contribute to the existing body of knowledge in the field.

Conclusion:

This research contributes to the understanding of occupational marks as potential forensic evidence. By recognizing the distinct patterns and features associated with different occupations, law enforcement agencies can leverage these marks to aid in the investigation process. The findings of this study emphasize the significance of occupational marks in fingerprints and palm prints, highlighting their potential as additional tools for identification and narrowing down the list of suspects based on their work environments.

Future Prospect

In terms of future perspectives, the research on occupational marks in fingerprints and palm prints presents several promising avenues for further exploration and practical application in the field of forensic science. Expanding the scope of the study to include a wider range of occupations would provide a more comprehensive understanding of occupational marks and their variations. Investigating occupations across different industries and professions would enable the establishment of a broader database of occupational patterns and features, enhancing the accuracy and reliability of the forensic analysis. Furthermore, incorporating advanced technologies and methodologies into the analysis of occupational marks could yield more precise and detailed results. The integration of high-resolution imaging techniques, such as advanced fingerprint scanners and palm print recognition systems, could enhance the detection and analysis of occupational marks. By leveraging machine learning and artificial intelligence algorithms, it may be possible to automate the identification and comparison processes, leading to more efficient and accurate forensic investigations.

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