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UTILIZATION OF COMMONLY USED POWDERS FOR ENHANCEMENT OF LATENT FINGERPRINT ON VARIOUS SURFACES

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Abstract

The most valuable form of physical evidence in forensic investigation are latent fingerprints (LFP). They are known as blueprints because they are unique, permanent and most often left at crime scenes on a wide variety of surfaces. These impressions are commonly invisible to naked eyes and can only be seen under UV light after some chemical treatment. To make them visible for investigation procedure it is needed to use proper development techniques for further analysis. There are different methods which are used for fingerprint enhancement like powder dusting, sparkling, spraying etc but in my research work I have used powder dusting technique. It is widely used in developing countries because it is cost effective and its application of usage is so easy to understand. However, commercially available fingerprint powders are expensive and are imported because they are not manufactured locally in Pakistan, thus further straining the country's import bill and the budget of our investigative agencies. That is why we decided to find cheap, locally produced, readily available common household powders as an alternative to expensive imported commercial fingerprint powders. This study focuses on the use of commonly used powders that are mentioned below talcum powder (T.P), compact powder (C.P), blush powder (B.P) and last but not the least Surma also known as kohl powder (S.P). These powders are used for the enhancement of latent fingerprints on different non-porous surfaces. Those nonporous surfaces which are used in this research work are Ceramic, Glass, Plastic and Metal. This research helps us to know which powder gives effective result about development, ridge clarity for analysis. This study shows that findings of different powder performance vary depending on the type of powder used and the nature of surface used. Fine textured powders give better ridge clarity on smooth surfaces. The improved contrast is mostly shown by coloured powders. A crucial role is played by surface in deciding the visibility and quality of developed print. This research aim is to select proper powder and surface combination to achieve optimal fingerprint development.

CHAPTER 1
INTRODUCTION
1.1 Background of the Study

In forensic science the most dependable & widely used method for personal identification is fingerprint. In criminal investigation the uniqueness & permanence of fingerprint ridge patterns plays crucial form of physical evidence. During study it is noticed that fingerprints are often left unintentionally at the crime scene on different surfaces. However, most of those impressions are latent in nature, which means they are not visible to naked eye it requires specific techniques for their visualization and development. Over the years, different methods have been developed to enhance latent fingerprints, which includes chemical treatments, fuming techniques and powder dusting. Among all powder dusting remain one of the simplest, easiest, fastest and most cost-effective method. Especially for nonporous surfaces like glass, metal, plastic & ceramic. Powder dusting technique involves the adherence of fine powders with the sweat and oily residue which is left behind by friction ridge skin and that's how it makes fingerprint pattern visible for examination, comparison and analysis. A diverse range of powders are available for fingerprint development extending from commercially manufactured fingerprint powders to commonly used household & cosmetic powders including talcum powder, compact powder, blush & Surma powder. These powders vary in their particle size, colour, texture and adhesive properties which can greatly impact the quality and visibility of developed fingerprints. An essential role in determining the effectiveness of powder application depends on type and condition of the surface. Therefore, this study mainly focuses on evaluating the effectiveness of commonly used powders in enhancement of latent fingerprint on various surfaces. The interaction between powder type and surface characteristics are specifically examined. The aim of the study is to identify suitable combination of powder and surface that produce clear and high-quality ridge characteristics which can ultimately contributes to improve evidence collection and forensic investigation practices.

1.2 History of Fingerprint Development Techniques

Thousand of years ago, the use of fingerprint for identification originates with early civilizations which are China & Babylon. They used fingerprint impressions for document authentication and personal identification. The scientific foundation of fingerprint identification in forensic science was established in Late 19th & Early 20th centuries with the work of pioneers that includes Sir Francis Galton and Sir Edward Henry. They developed systematic classification methods that made fingerprint identification dependable and acceptable in legal proceedings. In the beginning, fingerprint detection solely depended on patent fingerprints. A patent fingerprints are those fingerprints that are left on surface due to transfer of foreign material-like blood, dirt, and ink that already shows ridge patterns clearly. With advancement in forensic science, attention shifted towards latent fingerprint which are imperceptible and requires development techniques for visualization. Powder dusting came out as one of the earliest & most diversely used methods where fine powders adhere to sweat and oily residues on friction ridge skin which makes hidden prints visible. Gradually, various powders were developed to visualize latent fingerprints, powders include black powder, aluminium powder, and fluorescent powders and enhance contrast on various surfaces. The effectiveness of fingerprint visualization depending on surface type, texture, & environmental conditions increased with these improvements. In addition to powder techniques, chemical methods such as iodine fuming, ninhydrin and silver nitrate were introduced for porous surfaces. while Cyanoacrylate (superglue) fuming became widely applied for nonporous materials. A Highly important case in the history of fingerprint development is the Jennings case (1911). In this case Thomas Jenning was under accusation of murder in Chicago, USA. Fingerprints from a painted railing at the crime scene were recovered by investigators. Those prints were later developed & compared with Jenning's fingerprint by using newly accepted fingerprint comparison techniques. The match provided strong forensic evidence that leads to his conviction. This case became the first court decisions in the United States to accept latent fingerprint evidence as a reliable proof that marks a major milestone in the field of forensic science. Recent developments in forensic advancement have further improved fingerprint detection through technologies includes laser imaging, alternate light sources, and digital enhancement

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system. Despite these development powder dusting remains widely used due to its simple using process, low cost and provides effective result in field investigation. The evolution of fingerprint development techniques reflects continuous scientific progress aimed at improving visibility, reliability and forensic importance of latent fingerprints in criminal investigation.

1.3 Significance of the Study

This study is considerable as it evaluates the effectiveness of commonly available powders for enhancing latent fingerprint on different nonporous surfaces. The findings can help forensic experts to identify low cost & practical alternatives that includes talcum powder, compact powder, blush powder, and Surma powder for fingerprint development, particularly in resource limited settings. It helps us to provide useful insight into best powder surface combinations for obtaining clear ridge details. Thus, improving the accuracy and efficiency of forensic investigation.

1.4 Aim of the Study

The Aim of study is to evaluate the effectiveness of commonly used powders such as talcum powder, compact powder, blush powder, and Surma (kohl) powder in enhancing latent fingerprints on various nonporous surfaces such as ceramic, glass, plastic & metal to identify most suitable powder surface combinations for clear fingerprint development.

1.5 Objectives of the Study

The objectives of this study are mentioned below:

1. To identify & evaluate the effectiveness of commonly used powders such as talcum powder, compact powder, blush powder and Surma (Kohl) powder for the development of latent fingerprints.
2. To Compare the quality and clarity of latent fingerprint ridge details obtained using different powders.

1.6 Research Questions

The research questions are listed below:

1. How effective are commonly used powders talcum powder, compact powder, blush powder and Surma (kohl) in enhancing latent fingerprint?
2. Which powder produces the clearest and most detailed ridge characteristics in latent fingerprint development?

1.7 Hypothesis

Null Hypothesis (H_0):

There are no considerable differences in the effectiveness of commonly used powders (talcum, compact, blush, & Surma powders) in refining latent fingerprint prints on assorted nonporous surfaces.

Alternative Hypothesis (H_1):

There are considerable differences in the effectiveness of commonly used powders (talcum, compact, blush, & Surma powders) in refining latent fingerprint prints on assorted nonporous surfaces and certain powder surface combinations produce better ridge detail and clarity than others.

1.8 Rationale and Justification of the Study

This study is justified due to the essential role of latent fingerprints in forensic investigations. It has continuous need for credible & cost-effective methods for their development. In resource limited settings especially in many forensic & field-based situation access to specialized commercial fingerprint powders may not always available.

Therefore, commonly available powders such as talcum powder, compact powder, blush powder, and Surma powder are explored as alternative options for latent fingerprints enhancement. However, there is limited comparative research from their effectiveness across the different nonporous surfaces.

The aim of this study is to fulfill the gap by evaluating and comparing the powders on different surfaces to determine the most effective powders according to non-porous surface combination. It will support the forensic practitioner in selecting suitable materials or powders for fingerprint development which ultimately improves the quality of forensic evidence recovery in criminal investigation.

Frontier in Medical & Health Research
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1.9 Operational Definitions

Latent Fingerprints:
Those Fingerprints that are not seen with naked eyes, are formed by deposition of natural secretions such as sweat, oil, other residue such as amino acids etc. from friction ridges skin on to the surface.

Fingerprint Enhancement:
The process of using physical and chemical techniques for the development of latent fingerprints to make them visible clear and suitable for examination or analysis.

Powder Dusting Technique:
A physical fingerprint development method technique in which fine powder particles are applied on the brush and that brush is moved upon the latent fingerprint so it can adhere to latent residue and reveal ridge pattens.

Talcum Powder (TP):
A white cosmetic fine fragrance powder commonly used in this study as a low cost & easily available in the market. It is used as an alternative for latent fingerprint development.

Compact Powder (CP):
A pressed cosmetic powder failed in this study to evaluate its effectiveness in enhancing latent fingerprint due to its fine particle structure and easy availability.

Blush Powder (BP):
A coloured cosmetic powder (peach, baby pink, dark pink) used to assess the role of colour contrast in improving fingerprint visibility.

Surma (SP):
A fine powdered black cosmetic used in this study due to its strong contrast property for latent fingerprint development.

Non-Porous Surfaces:
Those surfaces do not absorb moisture from surrounding.

Cyanoacrylate Fuming (Superglue Fuming):
A forensic technique in which super glue vapors react with fingerprint residues such as sweat oil to produce a physical and durable white impression on non-porous surface.

Ridge Details:
The fine and distant patterns of ridges and furrows present in fingerprints that are used for individual identification

Lifting:
The forensic process of transferring developed fingerprints from a surface on a suitable medium such as lifting tape or contrasting paper for preservation and analysis.

CHAPTER 2 LITERATURE REVIEW

2.1 Overview of Latent Fingerprints

Latent fingerprint is one of the most important forms of physical evidence in the field of forensic science due to their unique & permanence quality. Fingerprints are impressions of friction ridges during crime that are unintentionally deposited on touched surfaces through natural secretions that includes sweat, oils, and other contaminants. Unlike patent (visible) fingerprints, latent fingerprints are not readily visible to naked eye. It requires development techniques for visualization and analysis. The formation of latent fingerprints depends on multiple factors which includes the condition of skin, pressure applied during contact and nature of the surface. The latent fingerprints are commonly found on non-Poros surfaces such as glass, plastic, ceramic, metal and other smooth materials which are frequently confronted at crime scene. Detection and enhancement of latent fingerprints play a leading role in criminal investigation because they link a suspect to a crime scene object or victim. Different techniques have been developed for this purpose including physical methods like powder dusting and chemical methods such as super glue fuming. Among all techniques powder testing remains one of the most widely and commonly used as a practical technique due to its simplicity cost effectiveness and its best result or nonporous surfaces. In the context of this study commonly used powder such

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as talcum powder, compact powder, blush powder and Surma powder are evaluated for their ability to stick to latent fingerprint residue to produce clear and distinguishable ridge detail. As it is known that the effectiveness of these powders may very depending on factors such as particle size, colour contrast and surface characteristics. Hence, latent fingerprints serve as a most reliable and valuable source of forensic evidence, and their proper development and analysis are also crucial for accurate identification and successful criminal investigation.

2.2 Surface Influence in Fingerprint Development

The nature and characteristics of surface play a vital role in the development and visualisation of latent fingerprints. The quality, clarity, and persistence of fingerprint usually depend on whether the surface is porous, semi-porous, or non-porous as well as on its texture, smoothness, and cleanness. Nonporous surfaces that include glass, plastic, metal, ceramic and shiny surfaces materials are highly suitable for fingerprint development using powder testing techniques. On the surfaces latent residue of fingerprint remain on the surface rather than being absorbed allowing powder to stick with it effectively and produce clear ridge detail fingerprint quality as compared to rough or contaminated surfaces. On the other hand, rough or uneven surface may result in distorted or incomplete fingerprint due to its irregular surface quality. Similarly, dirt or greasy surface can interfere with the powder adhesion property reducing the visibility and clarity of ridge patterns. Surface colour also plays crucial role in it because it affects fingerprint development white colour powders such as Talcum powder are more effective on dark surfaces while dark powders like Surma powder provide better contrast on light coloured surfaces thus the selection of an appropriate powder does not only depend on its composition but also the colour and texture of the surface. Environmental factors such as humidity, temperature, and times since deposition also affect the quality of fingerprint. These can further influence the quality of latent fingerprints on different surfaces and overtime residues may also degrade making fingerprint identification more challenging. In this study various non-porous surfaces are examined to evaluate how surface properties influence the effectiveness of commonly used powders in enhancing latent fingerprint. Understanding these interactions is necessary for selecting suitable methods and achieving optimal fingerprint development in forensic investigation.

2.3 Conventional Powder Method

The conventional powder method is one of the most actually used physical techniques for the development of latent fingerprints, especially on non-porous surfaces. This method involves the application of fine powder particles onto a surface using a soft fingerprint brush which allows the powder to adhere to the moisture oils and other residue left behind by friction ridge skin. The main principle behind this method is based on physical attraction between the powder particle and fingerprint residue then applied carefully the powder sticks to the grid pattern while the background surfaces remain relatively clean making the latent fingerprint visible. The developed print can then be lifted using adhesive tape and preserved on contrasting backgrounds for further examination and comparison. It can also be preserved by taking photographs. As I mentioned earlier, the waviest powders are used in forensic science that includes black powders, aluminum powders, and fluorescent powders. The selection of powder depends on factors such as color texture of the surface as well as the need for contrast to clearly visualize Ridge detail. The effectiveness of powder method depends on proper application technique. Excessive brushing leads to damage or smear print while insufficient powder application may result in incomplete development of latent fingerprints thus controlled and gentle brushing is essential for obtaining clear and detailed prints. In the context of this study, the conventional powder method is applied using commonly available powders such as talcum powder, compact powder, blush powder, and surma powder which allows for the evaluation of their effectiveness as low-cost alternative for latent

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fingerprint enhancement on various nonporous surfaces.

2.4 Previous Studies on Powder Techniques

This is the one of the earliest studies that shows powder dusting is a productive and highly used method for latent fingerprint development, especially on non-porous surfaces. Research indicates that both commercial and commonly available powders such as talcum powder can produce satisfactory result depending on surface, size and environmental condition. Studies have also highlighted that fingerprint quality varies with powder characteristics and surface properties. Thus, limited comparative research exists on commonly used powders like compact powder, blush and Surma powders which testifies the need for the present study.

CHAPTER 03 MATERIAL AND METHOD

3.1 Study Design

This study was designed as an experimental research study to examine and compare the efficiency of commonly used powders in the optimization of latent fingerprints on various non porous surfaces.

A group of non porous surfaces such as glass, plastic, ceramic, metal & shiny surface materials, were selected as test substrates. Latent fingerprint were deposited on each surface under controlled conditions to ensure consistency in pressure and contact with surface.

In this study commonly available powders used are talcum powder (T.P), compact powder (C.P), blush powder (B.P) Surma powder(S.P) as independent variables. Each powder was applied separately on various surfaces to refine fingerprint samples using appropriate fingerprint brush to develop the latent prints.

The developed Latent fingerprints were then photographed and lifted using lifting tape and transferred on contrasting paper. All lifted samples were scanned at Standardized resolution that is 700dpi for detailed analysis.

The Quality of fingerprints were assessed based on clarity, visibility and ridge detail. The results obtained were systematically compared to determine the most impactful powder for nonporous surfaces.

This Experimental Research Study Setup ensures a well structured and reliable approach for obtaining the performance of commonly used powders in Latent fingerprint development.

3.2 Materials Used (Powders & Brushes)

Those materials which were used in this study for the development of latent fingerprints using powder dusting techniques are given below:

A. Powders Used

These following mentioned powders are selected for this research study because they are commonly available and are of low cost.

1. **Talcum Powder (T.P):** A fine, white cosmetic powder used for its smooth texture. It has ability to adhere to fingerprint residues.
2. **Compact Powder (C.P)**: A pressed facial cosmetic powder evaluated for is efficacy in development of fingerprint.
3. **Blush Powder (B.P)**: A coloured cosmetic powder (dark pink) which is used to access the role of colour contrast in enhancing fingerprint visibility.
4. **Surma Powder (S.P)**: A traditional black kohl powder used because of its strong coverage on light coloured surfaces.

B. Brushes Used

The following brush was used for the application of powders.

1.**Fiberglass Brush**

A specialized fingerprint brush, consisting of fine fibre filaments, was used because of its gentleness and controlled application of powder. It is suitable for smooth surfaces without damaging the latent fingerprint.

C. Supporting Materials

- **Lifting Tape:** It is used for transferring developed fingerprints from surface on contrast sheets. It is one of the preservation methods.
- **Contrasting Paper/White Sheets:** It is used to refine the visibility of lifted print for further analysis.

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- **Digital Scanner (700–1000 dpi):** It is used for high resolution scanning and analysis of developed print. In this study Epson scanner was used.
- **Digital Camera:** It is used for documentation by taking photographs of developed fingerprints at various stages of experiment. By ensuring accurate visual recording and comparison.

3.3 Surface Selection

A critical component of this study is selection of surface. As we know, the effectiveness of latent fingerprint development largely depends on the nature and characteristics of the surface. If the surface is rough then perfect fingerprint will not be developed. On the other hand, if the surface is smooth and it does not have any texture, it will provide perfect fingerprint for further analysis which leads to forensic investigation. Taking this point in the view, I have decided to use non-porous surface in this research study.

The surfaces which are included in his study are listed below:

- Ceramic
- Glass
- Metal
- Plastic

These surfaces were chosen due to their smooth and non-absorbent nature, which allows latent fingerprint residues to remain on the surface, making them suitable for development using the powder dusting technique. Additionally, the selective surfaces vary in terms of texture color and reflectivity which are the most important factors influencing powder adhesion and fingerprint visibility. Both light colored and dark colored surfaces were included in this study to evaluate the role of contrast in fingerprint enhancement using various powders. Experiments were performed under controlled environment which means all surfaces were cleaned there were no contaminants such as dust, grease etc. present on the surfaces which can affect the result. Proper care was taken to ensure uniform conditions for fingerprint deposition and development.

3.4 Experimental Procedure

The experimental procedures were carried out under the controlled laboratory conditions to evaluate the effectiveness of commonly used powder in the development of latent fingerprints on selected nonporous surfaces which are mentioned above.

Step 1: Preparation of Surfaces

All selected surfaces including ceramic, glass, plastic, and metal were all cleaned using a dry cloth & cleansing agent to remove the dust particles. After that the surfaces were allowed to dry before use.

Step 2: Deposition of Fingerprints

Latent fingerprints were deposited on each surface by gently pressing clean fingertips under pressure. Care was taken to maintain the consistency in pressure and contact duration for all the sample

Step 3: Application of Powders

Each surface which contained fingerprints was treated separately with different powders according to their contrast. These powders were applied by using fiberglass brush. By using powder testing method with gentle movement, we ensured proper adherence without disturbing the Ridge details.

Step 4: Development of Fingerprints

The applied powder sticks to the latent residues which were oil, sweat etc. making the Ridge pattern more visible, excess powder was carefully removed by light brushing to enhance clarity and contrast of the developed fingerprints.

Step 5: Lifting of Fingerprints

The developed latent fingerprints were then lifted using transparent lifting tape and transferred on to the contrasting white sheet or black papers for preservation and further analysis.

Step 6: Documentation and Recording

All developed and lifted fingerprints were documented using a digital camera. Additionally, the prints were scanned at standardized resolution which is 700 DPI to ensure high quality digital

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records for further detailed analysis of Ridge patterns.

Step 7: Observation and Comparison
The developed latent fingerprints were examined further based on clarity visibility and ridge detail. The performance of each powder on different surfaces was systematically compared to determine the most effective powder.

3.5 Data Collection Method
For this research data were collected using a structured proforma, all the observations related to fingerprint development including the effectiveness of each powder, clarity, visibility, ridge detail, quality, product used, were systematically recorded. Each sample was examined after powder application and the result obtained from different powders and surface combinations were carefully noted which ensured organized, consistent, and accurate documentation of all experimental findings for further analysis.

3.6 FINGERPRINT POWDER UTILIZATION FORM
Title of Study:
Utilization of Commonly used Powders for enhancement of latent fingerprint on various surfaces.
Researcher Name: Asna Talpur
Institution / Organization: Liaquat University of Medical & Health sciences, Jamshoro, Sindh
Date: 00 -Month -year
Supervisor: __________________
SECTION A: SAMPLE / SURFACE INFORMATION
Sample No.: __________________
Surface Type: ☐ Glass ☐ Rubber ☐ Plastic ☐ Ceramic ☐ Metal
Other: ____________
Surface Condition: Clean ☐ Dusty ☐ Oily / Greasy ☐ Wet / Moist
☐ Textured / Rough ☐ Smooth
Date Collected: 00-Month-year
Location / Source: ____________
SECTION B: POWDER / MATERIAL DETAILS
Powder / Material Used:
☐ Talcum Powder ☐ Compact Powder
☐ Blush Powder (Matte) ☐ Surma Powder
Brand / Manufacturer: __________________
Color / Shade: ☐ White ☐ Pink ☐ Grey ☐ Black ☐ other: __________
Shade Intensity: ☐ Light ☐Medium ☐ Dark
Source: ☐Commercial ☐ Local / Homemade ☐ Imported
Batch / Expiry Date: ______________

SECTION C: APPLICATION / DEVELOPMENT TECHNIQUE
Technique Used: ☐ Brushing / Dusting ☐ Sprinkling / Spraying ☐ Super Glue Fuming (Cyanoacrylate) ☐ Other: ________
Tools / Brushes Used: ☐Fingerprint Brush ☐ Soft Brush ☐ Feather Brush ☐ Cotton Swab / Ball ☐ Other: ________
Duration of Application: ☐ <1 min ☐ 1–3 min ☐ >3 min

Frontier in Medical & Health Research
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SECTION D: FINGERPRINT DEVELOPMENT & QUALITY
Powder Used: ____________________
Surface Description: _____________________
Number of Latent Fingerprints Developed: 00
Number of Useable / Analyzable Prints: 00
Lighting Condition During Development: ☐ UV ☐ Natural ☐ Artificial
Developed Print Condition: ☐ Excellent ☐ Good ☐ Fair ☐ Poor
Ridge Clarity: ☐High ☐ Medium ☐ Low

1. **Background Contrast:**

☐ High ☐ Medium ☐ Low

2. **Recording Method**

☐ Photographed ☐ Lifted ☐ scanned ☐ all of them

3. **Confidentiality:**

☐ Personal identifiers removed
☐ Record stored securely
☐ Record / Prints destroyed

4. **Additional Remarks / Observations:**

____

SECTION E: SAFETY & HANDLING
Powder Used: ____________________

1. Safety Precautions
2. ☐ Avoid Inhalation ☐ Avoid Contact with Skin ☐ Avoid Contact with Eyes
3. ☐ Other: ____________________________

Protective Equipment Used: ☐ Gloves ☐ Mask ☐ Goggles ☐
Other: ____________________________

Disposal Method: ☐ Normal Waste ☐ Hazardous Waste ☐
Other: ____________________________

2. **Additional Notes / Remarks:**

____

3.7 Variables of the Study

In this experimental research study, variables were clearly defined to ensure systematic evaluation of effectiveness of commonly used powder and latent fingerprint development.

Independent Variables

Those variables which are intentionally manipulated or changed during the experiment are known as independent variables.

- Like type of powder used talcum powder compact powder blush powder and sulma powder.
- On the other hand, type of surface which includes glass, ceramic, plastic, and metal.

Dependent Variables

Those variables which provide measurable outcomes observed in response to change in independent variables are known as dependent variables and it includes:

- Clarity of developed latent fingerprints
- Visibility of ridge characteristics
- Quality of ridge

- Overall effectiveness of fingerprint enhancement

Controlled Variables
Those factors which are capped constantly throughout the experiment to ensure reliability and minimize bias are known as controlled variables which includes:

- Pressure applied during fingerprint deposition
- Method and duration of powder application
- Type of brush used
- Environmental conditions such as temperature and humidity
- Scanning resolution for documentation 700 DPI

CHAPTER 4: RESULTS

4.1 Observations on Different Surfaces

Latent fingerprints were successfully developed on multiple non porous surfaces including glass, plastic, ceramic and metallic objects using different powders. On glass surface, 1 to 3 latent fingerprints were developed out of which at least one print was consistently usable and analyzable. Ridge clarity was generally high with excellent quality across powders. On plastic surface, similar results were obtained with one to three fingerprints developed and at least one analyzable print was recorded. Ridge details were clearly visible under proper lightning conditions. On ceramic surface such as white and black cup fingerprints were successfully developed with all powders. The number of developed prints range from one to three with one print consistently suitable for analysis. ridge clarity varied slightly depending on surface colour. On metallic surfaces like disinfectant bottle or metallic surface fingerprint development was achieved through a slight variation and clarity and contrast were observed. Nevertheless at least one analysable print was obtained in each case.

4.2 Effectiveness of Different Powders

All the powders used in this research study such as talcum powder, compact powder, blush powder, and surma powder successfully developed latent fingerprints on selected surfaces.

Surma powder (S.P)
Surma powder produced fingerprints with high contrast and clear visibility in all samples with high Ridge clarity and good overall development.

Talcum powder (T.P)
Talcum powder produced high Ridge clarity, but background contrast was comparatively low due to the light color of the powder.

Compact powder (C.P)
Compact powder showed similar results to talcum powder. It shows higher clarity but contrast varied depending on surface.

Blush powder (B.P)
Blush powder also produces acceptable ridge clarity with contrast varied based on surface color**.** Hence the effectiveness of selective powders varies depending on their physical properties such as particle size, color contrast, and adhesion to latent residues as well as the nature of surface being examined.

4.3 Comparative Analysis

The comparable evaluation of all powders across different surfaces indicates that each powder could produce clear and analyzable latent fingerprints. Surma powder provides relatively higher contrast and enhances visibility due to its dark pigmentation in contrast to talcum and compact powder. These, despite producing high quality ridge details exhibited lower contrast because of their lighter shades, particularly during post observation. According to my knowledge, I think that Talcum powder and compact powder do not have preservatives which preserves fingerprint for long time. Blush Powder shows moderate performance with effectiveness including influenced by color and nature of the surface and it doesn't fade, preserving the latent fingerprint. While differences in contrast and visual appearance were observed but the quality of ridge details obtained from all powders was sufficiently clear and suitable for forensic analysis. The results

Frontier in Medical & Health Research
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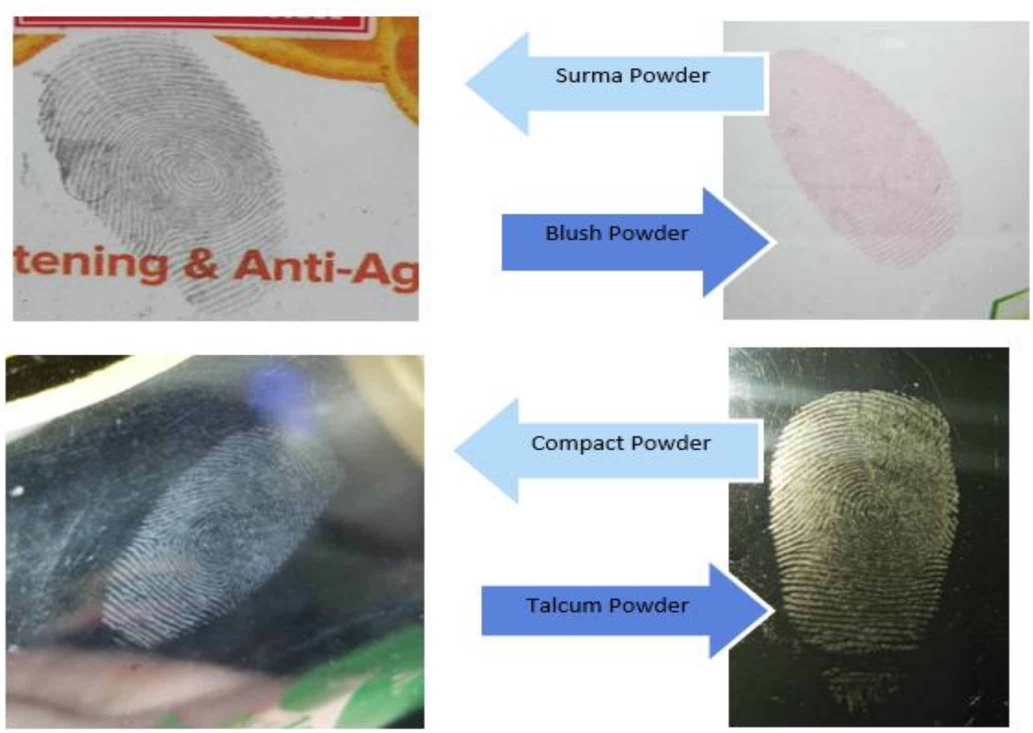
highlight that powder selection affects visibility and contrast but does not compromise the fundamental development of identifiable fingerprint patterns.

CHAPTER 5: DISCUSSION

5.1 Interpretation of Results

Results of the present study show that commonly used powders such as talcum powder, compact powder, blush powder and Surma powder are effective for the development of latent fingerprints on a variety of non-porous surfaces. The interpretation of findings is based on the clarity of ridge details, visibility, and overall quality of developed prints recorded through structured proforma documentation. A vital role was played by the characteristics of surfaces in fingerprint development, smooth and non-porous surface such as glass, plastic facilitated better adhesion of powder particles to latent residues resulting in clear and more continuous ridges patterns. Ceramic and metallic surfaces also supported fingerprint development however, slight variations in visibility were observed due to differences in surface color and reflectivity. With respect to powder performance all tested powders demonstrated the ability to produce clear and analyzable ridge details. Surma powder showed comparatively high visibility due to its dark color which improved contrast against lighter backgrounds. Talcum powder and compact powder although produced well defined ridge structures exhibited comparatively lower visual contrasts particularly after lifting and recording due to their lighter shades. Blush powder showed moderate performance, effectiveness was influenced by the color of the surface. Additional finding of this study is that the visibility and contrast do not necessarily determine analyzability. Despite differences in visual appearance all developed fingerprints retained sufficient ridge details for forensic examination. This suggests that commonly available powders can be effectively used for fingerprint development even if optimal contrast is not achieved. The findings confirmed that latent fingerprint development is influenced by both surface type and powder characteristics, and appropriate selection of powder based on situational requirements can enhance the quality and interpretability of fingerprint evidence.



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Summary Table of Results

SURFACE TYPE	POWDER USED	RIDGE CLARITY	BACKGROUND CONSTRAST	OVERALL QUALITY
Glass (Transparent)	Surma powder	High	High	Excellent
Glass (Transparent)	Talcum powder	High	Low	Good
Glass (Transparent)	Compact powder	High	Medium	Good
Glass (Transparent)	Blush powder	Medium-High	Medium	Good
Plastic Surface	Surma powder	High	High	Excellent
Plastic Surface	Talcum powder	High	Low	Good
Plastic Surface	Compact powder	High	Medium	Good
Plastic Surface	Blush powder	Medium	Medium	Good
Ceramic (White/Black)	Surma powder	High	High	Excellent
Ceramic (White/Black)	Talcum powder	High	Low	Good
Ceramic (White/Black)	Compact powder	High	Medium	Good
Ceramic (White/Black)	Blush powder	Medium	Medium	Good
Metallic Surface	Surma powder	High	High	Excellent
Metallic Surface	Talcum powder	High	Low	Good
Metallic Surface	Compact powder	High	Medium	Good
Metallic Surface	Blush powder	Medium	Medium	Good

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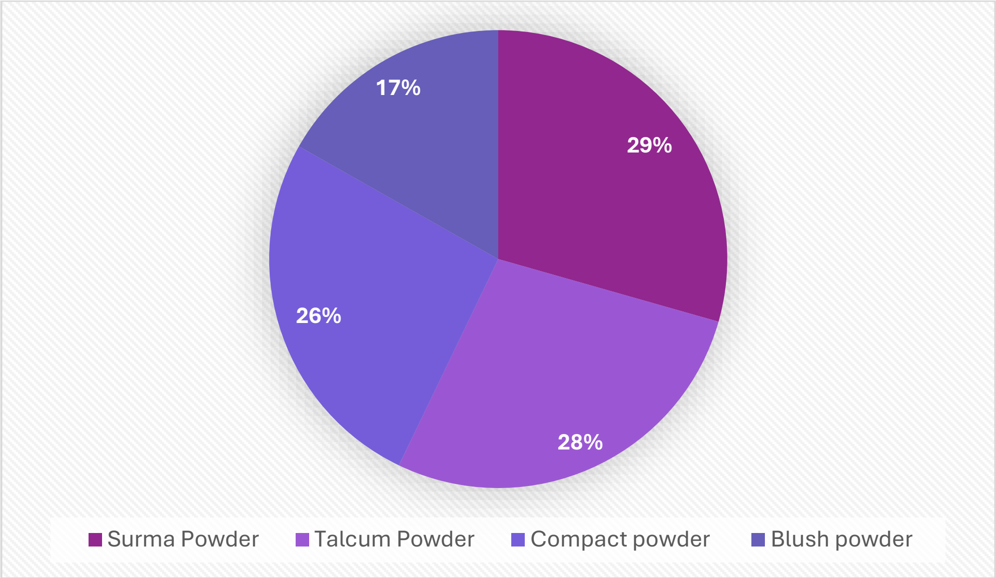
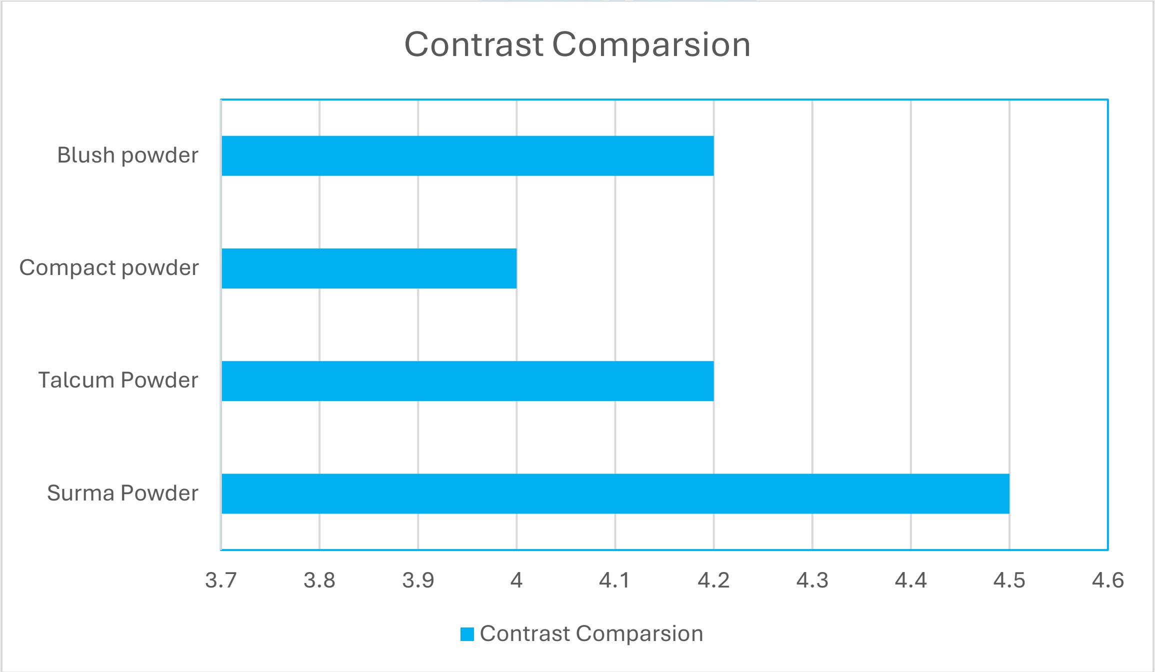
Graphical Representation of Results

1. Effectiveness of Powders



2. Contrast Comparison

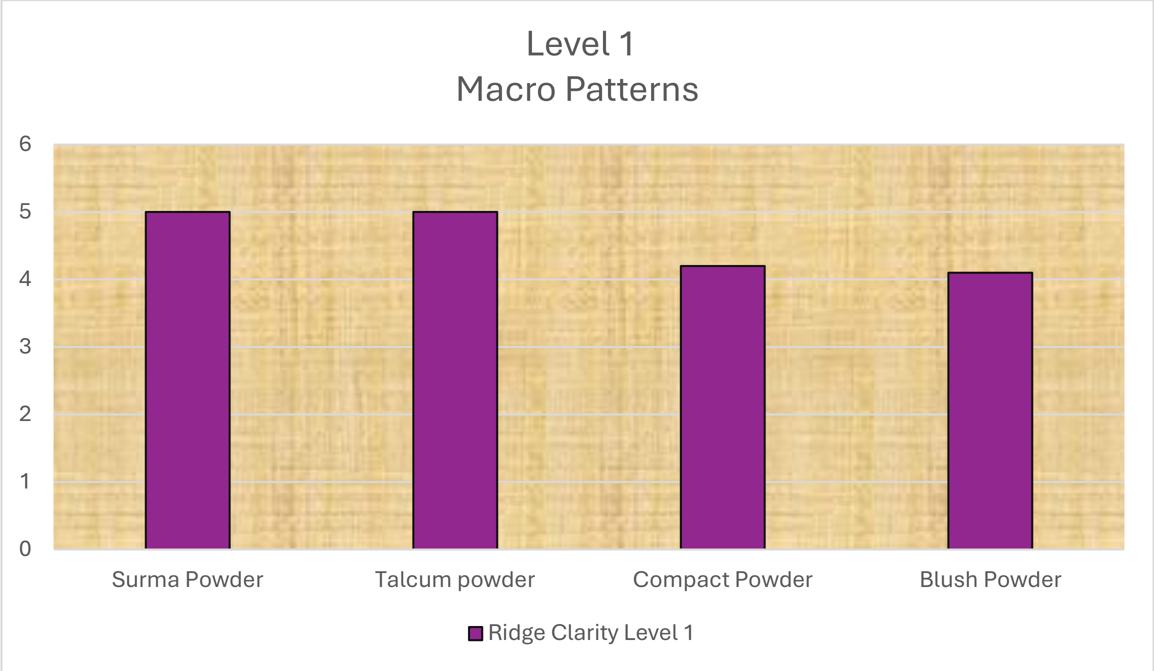


Volume 4, Issue 5, 2026

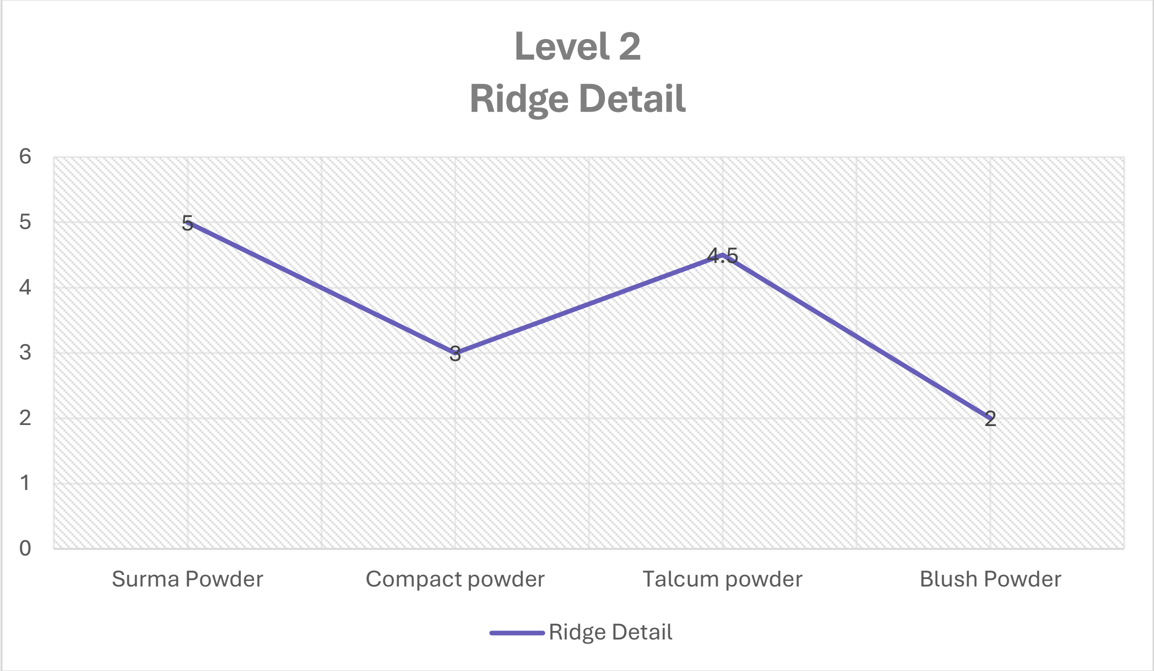
Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

3. Ridge Clarity Comparison

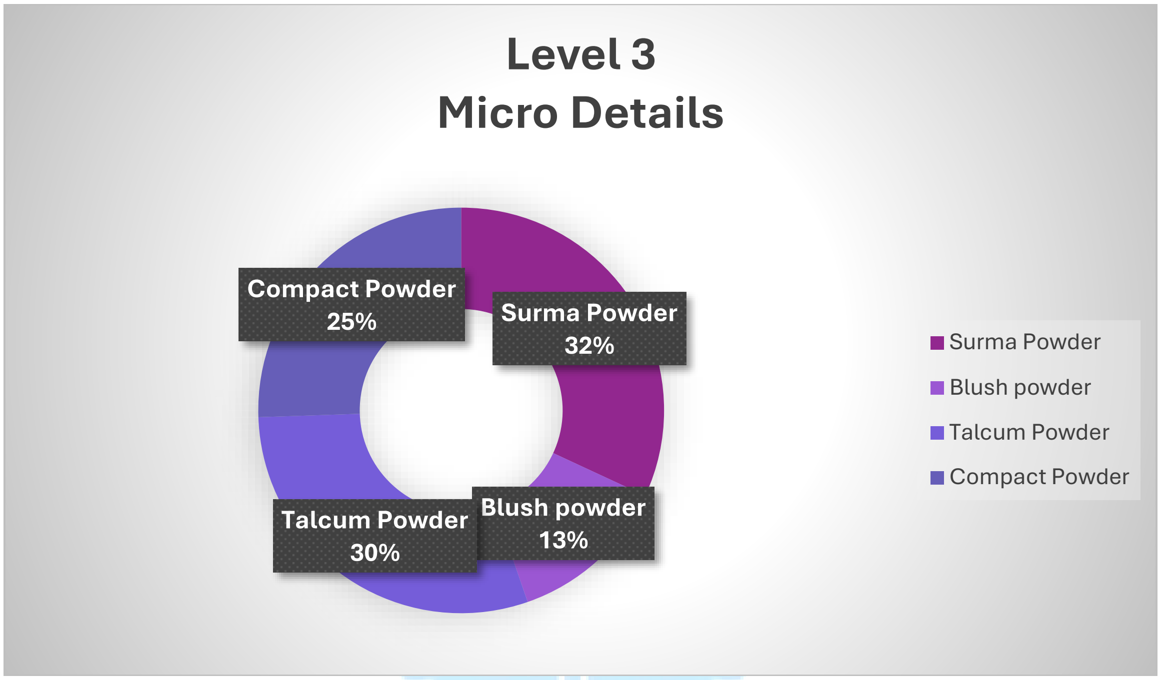


4. Fingerprint Characteristics



Frontier in Medical & Health Research
Volume 4, Issue 5, 2026
ISSN: (e) 3007-1607 (p) 3007-1593

4.Micro Details



CONCLUSION:

Talcum, Compact, Surma and blush powder showed capable development of latent fingerprints & visible ridge patterns on tested surfaces as shown above in graphical results. However, differences were observed in terms of print quality, clarity, & absence of preservatives in some powders. Compact & Talcum powder produced clear, visible fingerprint development initially; however, due to the absence of preservative properties, the developed prints could not be maintained permanently for long term storage and gradually fades with respect to time. Surma powder comparatively gives superior performance because it not only developed clear ridge details but also showed long lasting preservation compared to other powders. Its developed fingerprints remained unchanged, making Surma powder more effective for prolonged examination and documentation. Blush powder also developed fingerprints successfully because of its strong pigmentation. However, with time it tends to spread around fingerprint area, resulting in smudging and reduced clarity of ridge characteristics. This affects in fingerprint analysis and interpretation of result. Overall, the findings suggest that although all tested cosmetic powders can be used for enhancing latent fingerprint, Surma powder showed the most reliable and durable performance for fingerprint visualization and preservation making it a comparatively better option for forensic fingerprint analysis under the conditions of this study.

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