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Comparison of Difference in Blackening obtained from a Country made Pistol of 7.65mm at different Ranges

Shubhi Agarwal[1], Ravinder Chauhan[2], Somesh Verma[3]
[1]*Forensic Professional (Ballistics), Central Forensic Science Laboratory, Barkheda Bondar, P.P. Bairagarh Kalan, Bhopal 462030, Madhya Pradesh, India.*
[2]*Senior Scientific Officer, Central Forensic Science Laboratory/ Central Bureau of Investigation, Block No. 4, CGO Complex, Lodhi Road, New Delhi, India.*
[3]*Lab Assistant, Central Forensic Science Laboratory/ Central Bureau of Investigation, Block No. 4, CGO Complex, Lodhi Road, New Delhi, India.*

Abstract: Background: A variety of country made firearms are manufactured in different parts of India. These firearms are designed to fire shotgun, pistol, and revolver as well as rifle cartridges, which are easily available. But there is great difference in manufacturing of standard firearms and country-made firearms. Country-made firearms are made up of locally available materials with no proper or standard measurement. This causes a great hindrance in the estimation of range of firing from GSR distribution pattern made on the target surface. The main aim of this study is to show that range of firing cannot be determined by observing the blackening present on the target in case of country made firearms. The present study includes firing of 7.65mm ammunition from 50 country made pistols at three different ranges of 10 cm, 20 cm, and 30 cm. The blackening pattern obtained on the target was measured and compared to know whether it is possible to estimate the firing range by studying the pattern of blackening seen on target surface.
Result: After comparing the observation and measurement, it was seen there was significant amount of inconsistency in the values of blackening obtained from different firing ranges.
Conclusion: Thus, it was concluded that range of firing cannot be estimated by measuring the amount of blackening obtained on the cloth target in case of country made firearms.
Keywords: Country-made Firearms; 7.65mm ammunition; Gunshot Residue; Range of Firing; Blackening.

I. INTRODUCTION

A firearm is a device by which a projectile or projectiles can be hurled with a great force. This force is supplied by the expansion of gases, usually produced by the burning of propellants. The expansion of compressed air is utilised by air guns and air rifle. Firearms, in India, are basically of two types: Standard firearms and Country-made Firearms.[1]The country made firearms (also known as locally made firearms) are mostly encountered in criminal cases in India as they are cheaper and easily available to the criminals. These firearms are available in different shapes and sizes and also have varied components such as the hammer, mode of loading, location of extractor, etc. These firearms are designed to fire shotgun, pistol, and revolver as well as rifle cartridges, which are easily available. Moreover, some of the homemade firearms are capable to fire the standard cartridges of two or more close calibres.[2]Due to their non-standard nature these weapons are usually imperfect and are highly dangerous even to those who use them. Various imperfections include defective firing mechanism, rough bore surface, gaping between barrel and breech barrel, imperfect barrel length and diameter.[3-4]Whenever a firearm is discharged, a great volume of gaseous material is produced collectively called GSR (Gunshot Residue) particles.[5] The GSR constitutes primer and propellant residues along with minute particles of the bullet and sometimes scrapings from the inside of barrel. GSR mainly composes of burnt, semi-burnt and unburnt particles from primer mixture, lubricants, grease and metals from cartridge as well as the weapon itself. The organic compounds include nitrites, nitrates and other metallic compounds originating from primer, propellant, cartridge case and projectile, whereas metallic contents include antimony, barium and lead originating from primer.[6] Study of gunshot residue has helped a great deal in forensic ballistics. It helps in determining the range of firing, identification of bullet holes as well as identification of the shooter.[7-8]The various factors which influence the pattern of GSR on the target includes angle of firing, distance of firing, type of ammunition, barrel condition as well as condition of the firearm.[9]The inconsistency and rough making of country made firearms makes it impossible to standardise the

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amount of GSR which can be obtained by firing from a specific range.[10] Cloth is used as a target as GSR is retained on the cloth comparatively longer than the skin or any other material making it more probable for detection or study.[9]

II. MATERIALS & METHODOLOGY

A. *Country-made Firearm*

50 samples of country-made firearms of 7.65 mm caliber were used for firing. These firearms were obtained from Central Forensic Science Laboratory, Central Bureau of Investigation (CBI) (New Delhi). Fig. 1 represents the samples of country made pistols which were used during firing.

Fig. 1 Country-made Pistols used for sampling

B. *Cartridges*

150 cartridges of 7.65mm caliber were used for firing. The cartridges were obtained from case property as well as from the laboratory stock. Each firearm was fired three times at three different ranges of 10 cm, 20 cm and 30 cm from the target.

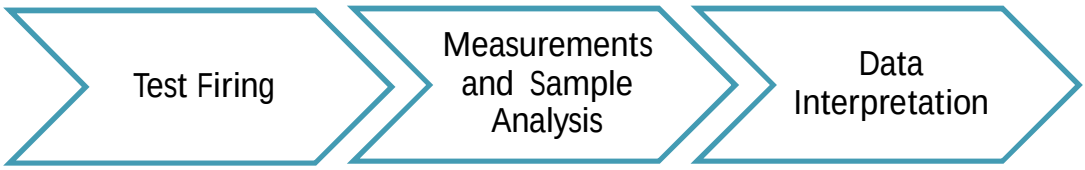
C. *Cloth*

Cotton cloth of white colour was used as target because cloth is the most common type of evidence with bullet holes on it. Also, GSR particles get adhere to the clothes which help in linking the criminal with crime scene. The dimension of cloth sample taken was 32 cm x 35 cm.

D. *Bullet Recovery Box and Firearm Mount*

The cloth sample was stapled on hardboard which was mounted on the bullet recovery box and the firearm was held tightly on firearm mount to negotiate any type of injury or incident.

III. METHODOLOGY



1) *Test Firing:* Test firing was conducted by placing the firearm at three different ranges. Each firearm was fired once and the blackening patterned obtained was carefully photographed and samples were kept within papers to avoid any contamination.
2) *Measurement and Sample Analysis*

After test firing, firstly the measurements of firearm were taken under the following parameters:

a) Barrel length of the firearm (measured using a scale)
b) Bore diameter (measured using Vernier calliper)

Following this, amount of blackening on target sample was calculated by the following formulae:

Length of blackening (cm) x Breadth of blackening (cm)

Data obtained was analysed and documented and graphical representation was drawn to study the consistency and linearity in the data. The intensity of blackening was studied on the basis of its colour that is black, light black and grey.

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3) Data interpretation

The data was analysed and a comparative study was done among:

a) The blackening obtained from same firearm from the three different ranges

b) The blackening obtained from the different firearms from the same range

IV. RESULTS

All the samples obtained were arranged in graphical form to understand the linearity in the values obtained among different ranges. All the values were tabulated according to their respective firing range. After this, the values were compared and studied to obtain the average dimension of blackening pattern along with lowest value and highest value. Table 1 illustrates the average blackening dimension along with highest and lowest values among three different firing ranges that are 10cm, 20cm, and 30cm.

Range of Firing	Average Dimensions of Blackening (L×B)	Lowest value obtained	Highest value obtained
10 cm	5.894 × 5.728	1.5 × 1	13 × 13
20 cm	2.976 × 2.744	0 × 0	8 × 8
30 cm	0.274 × 0.264	0 × 0	6 × 6

Table 1: Values of various dimensions of blackening obtained

After studying the data properly it was observed that there was very much deviation in values when compared within ranges. Average values can be used for estimating firing range but the actual values shows a lot of variation in values when compared with average values. Therefore, such values obtained from test firing cannot be used in range estimation.

A. Comparison Of Blackening Obtained From 10cm Firing Range

Figure 2 exemplify the various trends obtained in blackening pattern from 10cm firing range. The variations obtained can be justified by the facts like barrel length and diameter/ caliber of the firearms. By observing different pictures the difference in the intensity of blackening around the bullet hole was noted. Cause of such difference might be the defects in the make of a firearm as country made firearms were used so this factor might play a role. The graphical representation of amount of blackening from 50 firearms is shown in figure 3. The variations in peaks obtained clearly depicts that blackening cannot be used as a parameter in estimating firing range.

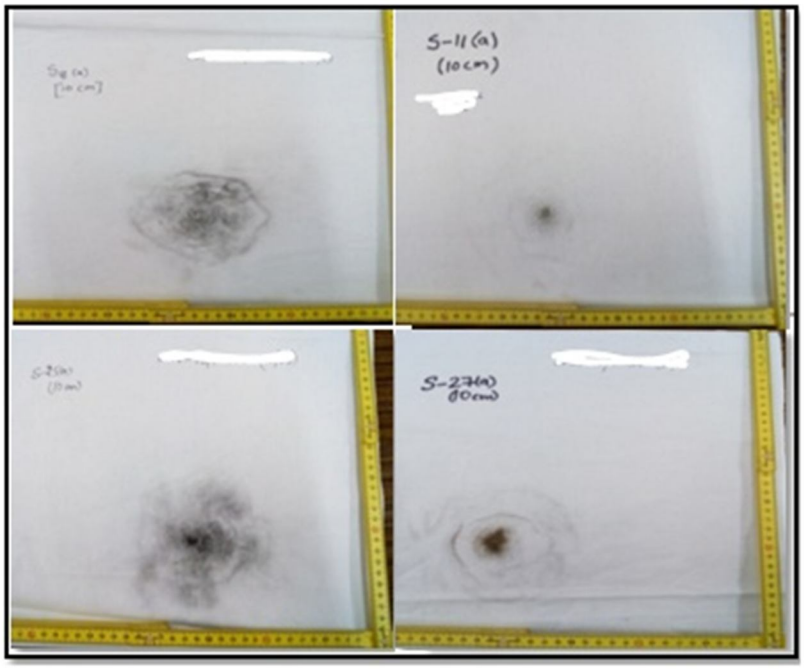

Fig. 2 Trends obtained in blackening pattern from 10 cm

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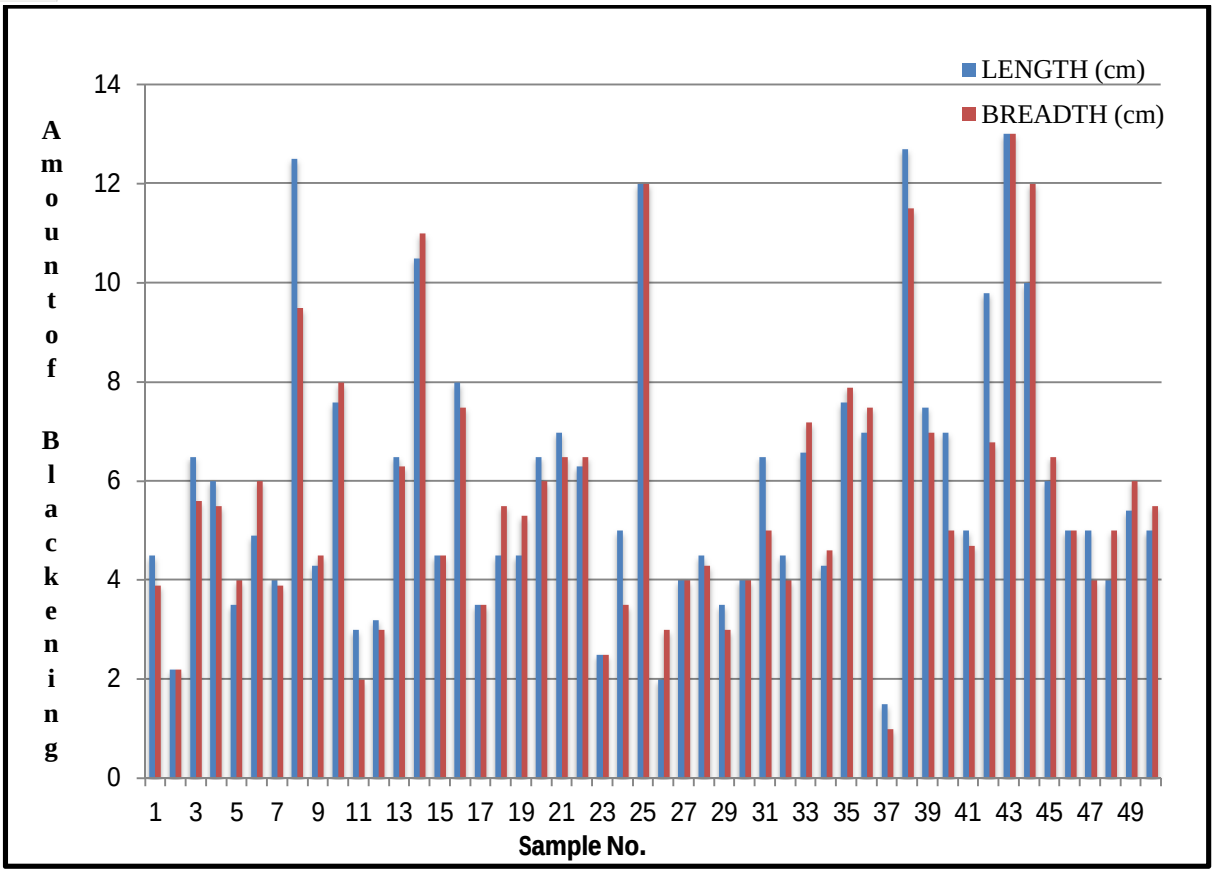

Fig. 3Amount of blackening obtained from 10 cm range

B. Comparison Of Blackening Obtained Obtained From 20cm Firing Range

Amount of Blackening obtained in this range was very light or negligible in most of the cases. In some cases blackening was observed around the bullet hole diameter. Figure 4 shows the various types of blackening pattern obtained from 20 cm range. A lot of variations in amount of blackening were observed irrespective of same range, same caliber and same barrel lengths of the firearm. Figure 5 illustrates the graphical representation of blackening obtained from 50 samples from 20cm range.

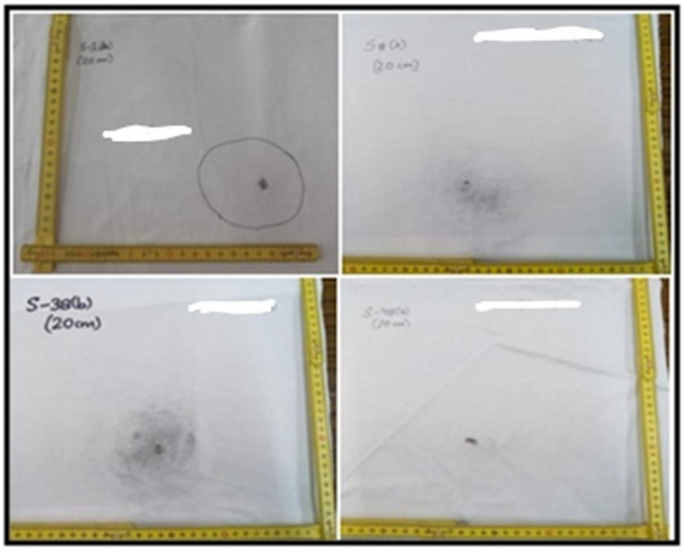

Fig. 4 Trends obtained in blackening pattern from 20 cm

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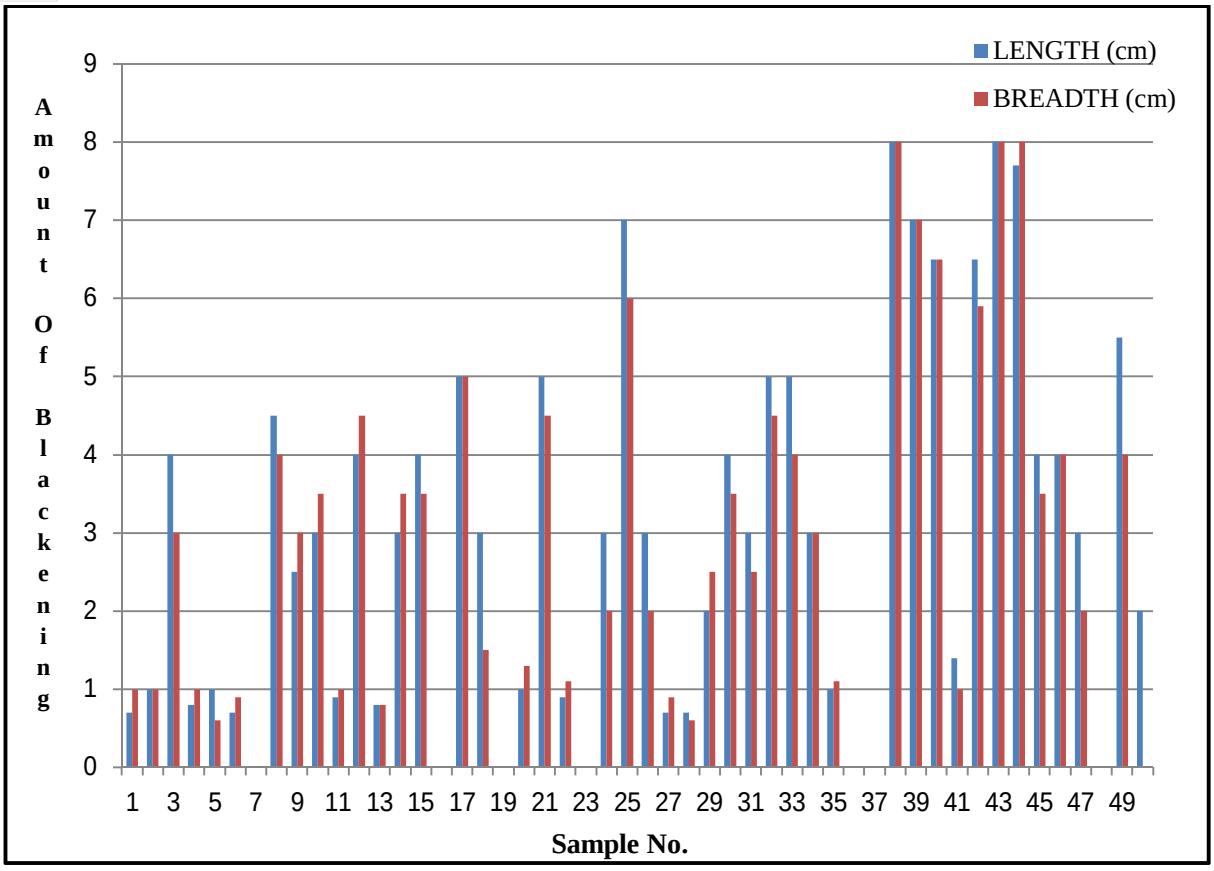

Fig.5 Amount of blackening obtained from 20 cm range

C. Comparison Of Blackening Obtained Obtained From 30cm Firing Range

All the samples lacked blackening pattern except only few. The reason for this can be the range and the quality of firearm which could not facilitate the proper burning of the propellant resulting in improper ballistics. Figure 6 shows the various types of patterns obtained. Figure 7 shows the graphical representation of the values from 30cm range.

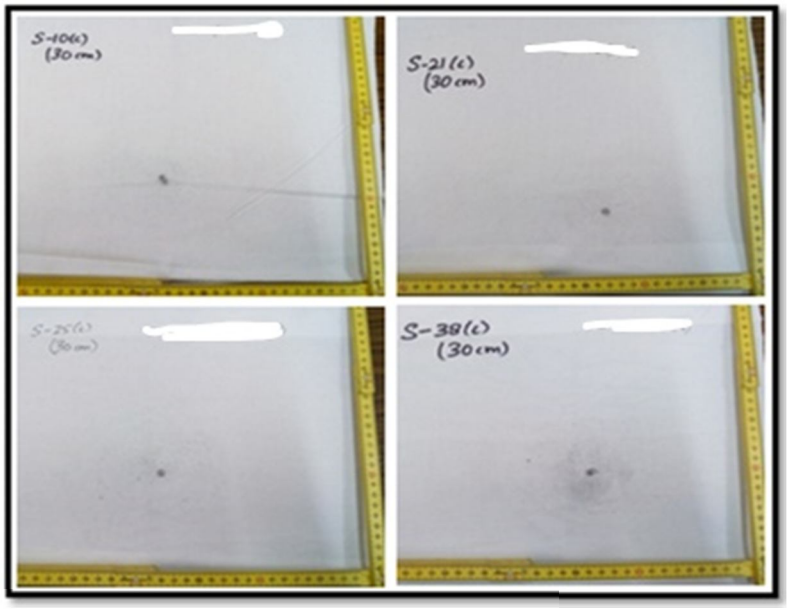

Fig. 6 Trends obtained in blackening pattern from 30 cm

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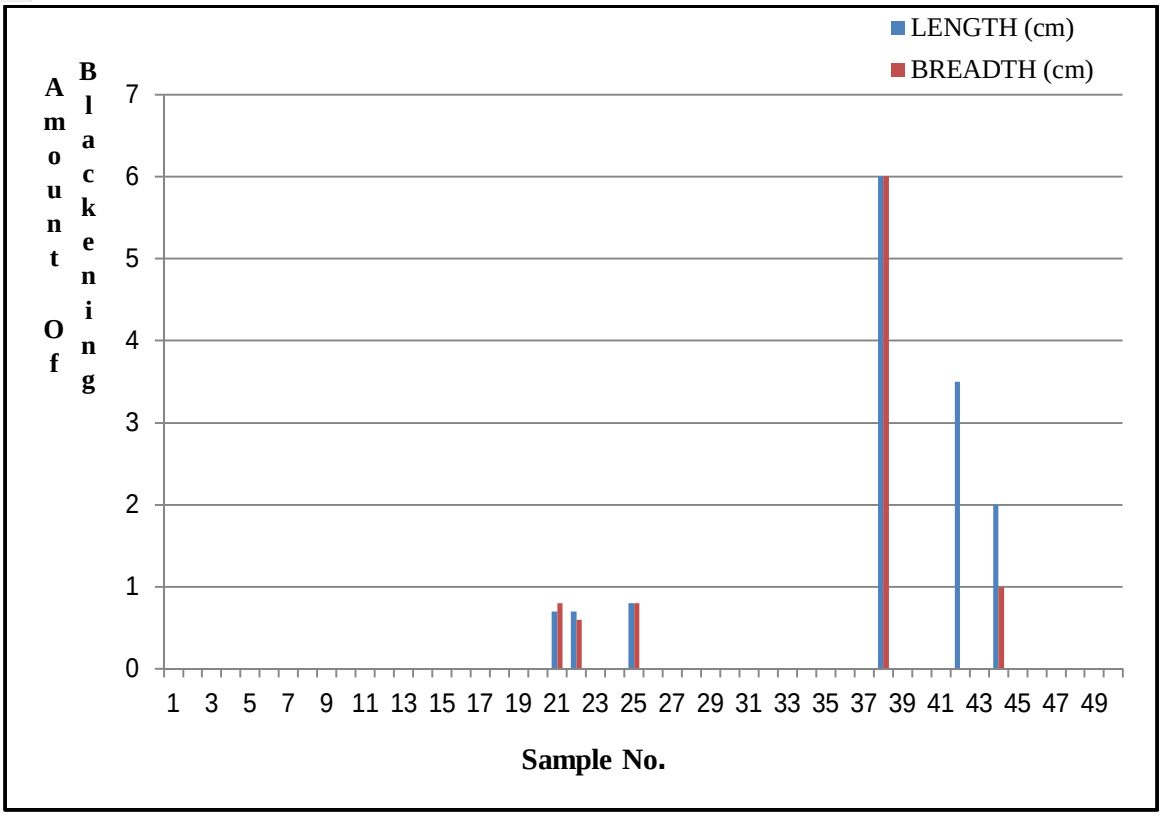

Fig. 7 Amount of blackening obtained from 30 cm range

Variations obtained in values can be clearly seen through the graphical representation. Inconsistence peaks of length and breadth of the blackening patterns in all the three ranges which were used in the study clearly signify that blackening cannot be used as one of the parameter in estimating firing range where country made firearms are involved in shooting incidents.

V. DISCUSSION

The study was performed to estimate the firing range from country made firearms. Consistency and variations were studied through graphical representation of the data. During the whole analysis it was noted that the average values were inconsistent with the values obtained during sampling. On behalf of this, it can be said that range cannot be calculated with accuracy in case of country made firearms. Country made firearms are highly inconsistent in their make and model which gave very inconsistent result. As proper shape and size has a profound effect in the ballistic therefore the results obtained in this study are very inconsistent. The influence of various factors on blackening pattern was studied by.[11]According to his study the cone of GSR ejected from the muzzle is influenced by the barrel length, calibre and jet velocity. Many variations can also be found if firearm/ammunition combination differs. The distance between muzzle and beginning of vortex also influences the GSR pattern on the target. Another feature responsible is the ejection mechanism. Although this does not affect much but still has a little influence.

Jain et al. (2004) and Modi et al. (1984) discussed about the manufacturing of country made firearms. They reported that such firearms are designed to chamber and fire the standard cartridges of two or more close calibres. Finishing of these firearms are so poor that the fired cartridge cases or bullets can be distinct very easily by the characteristic marks present on them. These firearms are not much effective at distant range and are not safe in regular firing because the cheap materials are used in their manufacturing.

VI. CONCLUSION

The barrel length and barrel diameter vary a lot in case of country made firearms, even if manufactured by the same manufacturer. These features are inconsistent with the standard firearms or standard ammunition. The blackening obtained on target hole depends entirely on the condition of firearm. The difference in average values of blackening obtained from different ranges is quite marked. The actual readings of blackening varied a lot from the average values. The main reasons for difference in blackening pattern of different firearms are

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A. Variations in barrel length
B. Variations in barrel diameter
C. Condition of the barrel, as in some firearms there were several holes on muzzle end which effected the deposition of GSR on the target.
D. Space between the breech end of barrel and the breech block face

Hence, blackening cannot be used as a parameter to measure the range of firing in case of country made firearms.

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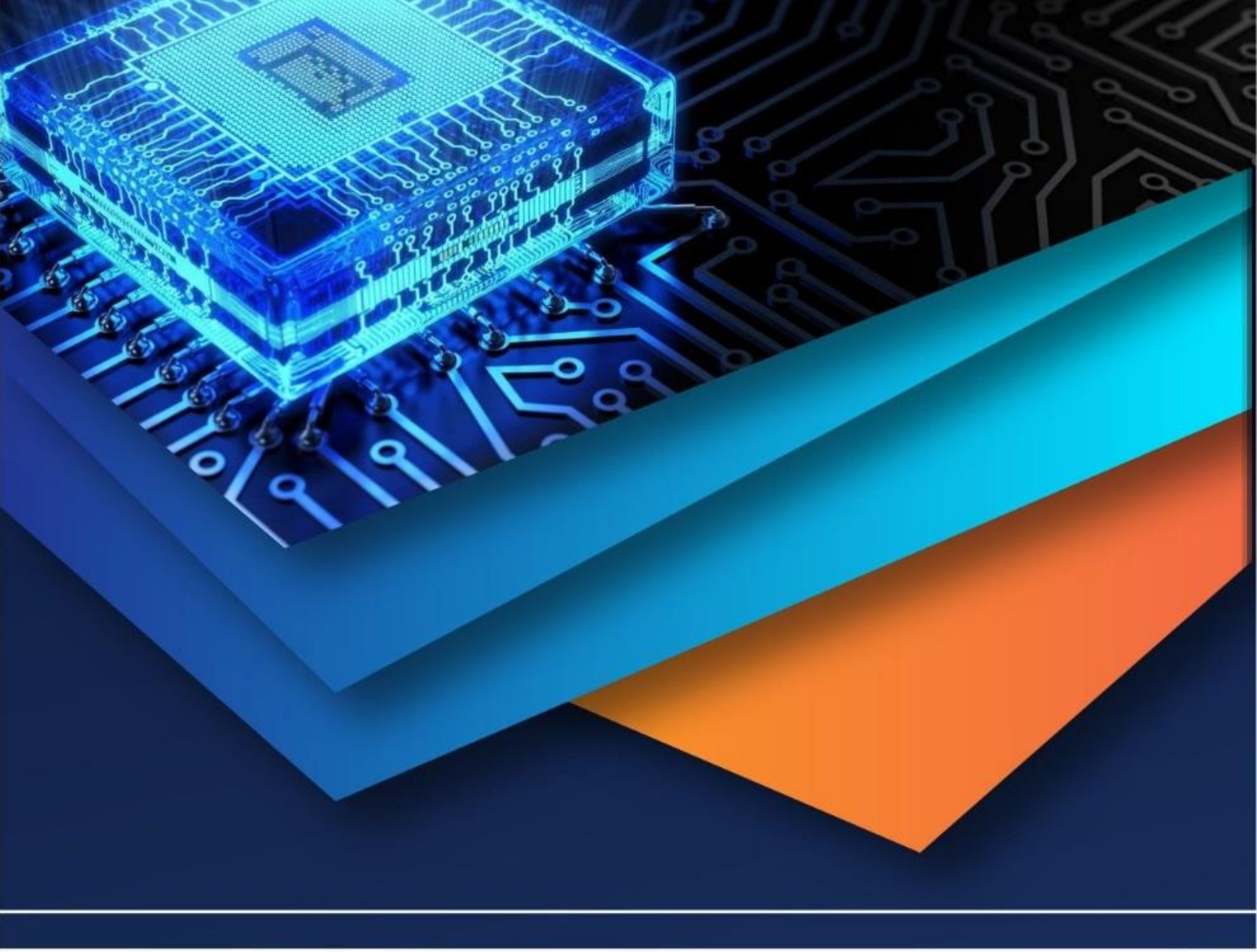

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