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Bullet Accuracy of Canik Tp9sf Elite Pistol and Taurus G3 Pistol: A Comparative Analysis

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Abstract: - Bullet accuracy evaluation is vital for firearm enthusiasts as it directly affects effectiveness and precision. In addition, bullet accuracy is crucial in determining the suitability of firearms for various applications. However, limited studies have been conducted to assess bullet accuracy, particularly of handguns. Thus, this study used Randomized Complete Block Design (RCBD) to compare the bullet accuracy of Canik TP9SF Elite Pistol and Taurus G3 Pistol, two of the most used handguns. Each handgun was used in four experiment setups, each with varying distances (i.e., 40m and 50m) and types of bullets (i.e., reloaded and full metal). The handgun was fired thrice in each setup, and the results were recorded with the help of two ballistics experts. The collected data were analyzed using mean, standard deviation, and t-test. The study results are as follows: First, Canik TP9SF Elite Pistol had varying levels of accuracy depending on bullet type and distance fired. Second, the Taurus G3 Pistol demonstrated low accuracy regardless of bullet type. Third, Canik TP9SF Elite Pistol was generally superior to Taurus G3 Pistol, especially when using full metal jacketed bullets. Nevertheless, both pistols showed limitations in accuracy, particularly at longer distances.

Keywords: Firearm design, groupings, precision, shot placement, shooting experiments statistical analysis, and Type of Ammunition.

I. INTRODUCTION

Accurate firearms are crucial for their effectiveness and suitability for various applications [1]. The CANIK TP9SF Elite Pistol and Taurus G3 Pistol are popular options in the market with a reputation for performance [2]. Evaluating the bullet accuracy of these pistols is essential for firearm enthusiasts, law enforcement professionals, and individuals seeking reliable self-defense weapons [3].

The Canik TP9SF Elite pistol, manufactured by Canik Arms, offers a polymer frame, striker-fired action, and a reputation for reliability [4]. On the other hand, the Taurus G3, produced by Taurus Holdings, has been praised for its affordability, ergonomics, and capacity [5]. Both pistols offer a range of features that cater to different shooting preferences and needs.

This study aims to assess the bullet accuracy of the Canik TP9SF Elite Pistol and Taurus G3 Pistol, examining how they perform with two types of bullets at varying distances. Specifically, this research seeks to determine the level of accuracy for each pistol when fired at certain distances, considering the type of bullet used. Additionally, this study will analyze the difference in bullet accuracy between the two pistols based on the type of bullet used and the distance fired.

This study provides a valuable comparative analysis of the Canik TP9SF Elite Pistol and Taurus G3 Pistol's bullet accuracy by examining these research questions. Through a comprehensive evaluation, we can gain insights into the performance differences between these firearms and assist potential buyers and shooters make informed decisions based on their shooting requirements**.**

II. METHODOLOGY

A. Research Design

This study aimed to compare the bullet accuracy of the Canik TP9SF Elite Pistol and the Taurus G3 Pistol using two types of bullets at different ranges. This experimental research used the Randomized Complete Block Design (RCBD). According to Khan [6], the RCBD is a research design in which the experimental material is divided into blocks of homogeneous experimental units (i.e., having the same characteristics), and each block contains a complete set of treatments assigned randomly to the experimental units. Actually, RCBD is a one-restriction design used to control a variable that influences the response variable. The primary aim of the restriction is to control the variable causing variability in the response. Efforts of blocking are made to create a situation of homogeneity within the block. Blocking is a source of variability. For instance, two different treatments varying different distances for every type of ammunition, with three trials for each sample treatment. RCBD is a mixed model in which one factor

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is fixed, and the other is random. The main assumption of the design is that there is no contact between the treatment and the block effect. In this study, the experimental units are the gun accuracy of the Canik TP9SF Elite Pistol and Taurus G3 Pistol, which are classified according to the bullet type and fired at distances of 50 and 40 meters. Generally, RCBD is more precise than the completely randomized design (CRD) [7].There is no restriction on the number of treatments or replicates. Some treatments may be replicated more times than others. Missing plots are easily estimated [8]. Table 1 and 2 present the experiment setup using Taurus G3 Pistol and Canik TP9SF Elite Pistol, respectively.

Table I. Experiment Setup for Taurus G3 Pistol

	Distance	Type of Bullet	Number of ammunitions	Trials
T1	40m	Reloaded	3 pcs	t1, t2, t3
		Full Metal	3 pcs	t1, t2, t3
T2	50m	Reloaded	3 pcs	t1, t2, t3
		Full Metal	3 pcs	t1, t2, t3

Table II. Experiment Setup for Canik TP9SFPistol

	Distance	Type of Bullet	Number of ammunitions	Trials
T1	40m	Reloaded	3 pcs	t1, t2, t3
		Full Metal	3 pcs	t1, t2, t3
T2	50m	Reloaded	3 pcs	t1, t2, t3
		Full Metal	3 pcs	t1, t2, t3

Figure 1 illustrates the input, process, and output of the study. The input consists of variables of the study, such as the Type of Bullet and Distance of the target. The process presents the bullet accuracy of the Canik TP9SF Elite Pistol and the Taurus G3 Pistol. The output presents the comparative report of the bullet accuracy of the Canik TP9SF Elite Pistol and the Taurus G3 Pistol.

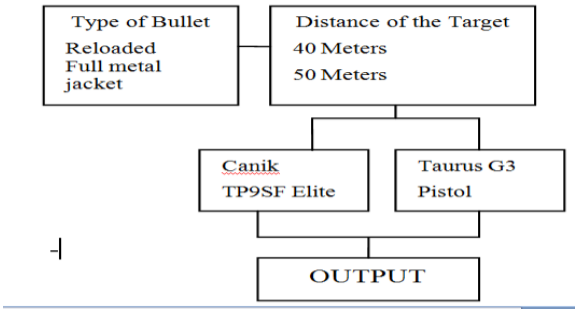

Figure 1. Input, Process, and Output.

Figure 2. ARMSCOR Philippines Firing range

B. Data Gathering Procedure

A permit was obtained through the Graduate School's office from the Dean of Criminal Justice Education at West Visayas State University-Lambunao Campus to carry out a trial investigation into the Precision of Terminal Ballistics for Canik TP9SF Elite Pistol and Taurus G3 Pistols. The experimentation started in the middle of September to November of 2021. A letter of authorization was acquired from ARMSCOR Philippines (Marikina). Following the approval of these permits, letters of invitation will be sent to the range officer and ballistics experts who serve as evaluators and panel members. They were invited to observe and evaluate the results during the

experiment. The necessary materials were readied, and the shooting range was prepared for the commencement of the experiment. An ample quantity of ammunition was procured for the study, and a registered hand loader in Iloilo City reloaded the ammunition. The research employed registered Canik TP9SF Elite Pistol and Taurus G3 Pistols sourced from licensed firearm owners. The range officer ensures that the researcher and expert participants wear hearing and eye protection before entering the range. Only one firearm at a time was used at each shooting station. No other firearm handling behind the firing line. The only place where loaded firearms are allowed is on the firing line. Loading and unloading occur only at the firing line. When all range rules are clear, the test firing commences.

C. c. Data Analysis Procedure

The gathered data after the experimentation were subjected to statistical analysis using the Statistical Package for the Social Sciences (SPSS) software. The results were interpreted using the following statistical tools:

For descriptive analysis, mean and standard deviation were used. Mean was used to determine the extent of bullet accuracy of Canik TP9SF Elite Pistol and Taurus G3 Pistols when fired at 40m and 50m. Standard Deviation was used to determine the homogeneity and heterogeneity of the mean.

To determine the extent of bullet accuracy of Canik TP9SF Elite Pistol and Taurus G3 Pistols when fired at 40m and 50m, the following scale and interpretation were used:

Table III. The scale and interpretation

Scale	Description	Interpretation
8.50-10.00	Very Accurate	The bullet hits the target with a scale of 9 and 10
6.50-8.49	Accurate	The bullet hitting the target with a scale of 7 and 8
4.50-6.49	Moderately Accurate	The bullet hits the target with a scale of 5 and 6
2.50-4.49	Slightly Inaccurate	The bullet hits the target with a scale of 3 and 4
0.00-2.49	Not at all Accurate	The bullet hits the target with a scale 0, 1 and 2

For inferential analysis, a t-test was used to determine whether a significant difference existed in the means of the two groups. The extent of significance was set at 0.05 alpha.

III. RESULTS AND DISCUSSION

A. Descriptive Analysis

The test firing results using the Canik TP9SF pistol indicate a slight decrease in accuracy when Full Metal Jacketed (FMJ) bullets were used at a 50-meter distance, with a mean accuracy of 4.00 and a standard deviation of 3.06. In contrast, the accuracy significantly lowered when Reloaded bullets were used, with a mean accuracy of 1.00 and a standard deviation of 1.15. The bullets hit the target within the 0, 1, and 2 range on the accuracy scale, implying that Reloaded bullets may experience a decline in accuracy when fired at a 50-meter distance. The study's findings match the most effective range for a 9mm bullet, about 50 meters or 55 yards [9].

These findings were supported by ballistic theory, which shows that bullets with a copper-coated lead core travel faster than plain lead bullets. Also, heavier bullets are less affected by wind gusts, and bullets with higher ballistic coefficients resist drag better than those with low BC [10][11].

On the other hand, the Canik TP9SF pistol could be more accurate at 50 meters when using reloaded bullets due to their lower muzzle velocity compared to full metal jacketed bullets. The study's results have practical implications for firearm users, particularly those who reload their ammunition. Indeed, they must consider the limitations of reloaded bullets, such as a decline in accuracy at higher distances, and choose bullets that have higher ballistic coefficients and velocities to improve accuracy and compensate for external factors that affect bullet trajectory. Table 4 shows the data onthe Bullet Accuracy of the Canik TP9SF Pistol Fired at 50 Meters.

Table IV. Level of Bullet Accuracy of Canik TP9SF Pistol Fired at the Distance of 50 Meters.

Category	SD	Mean	Description
Type of Bullets			
Full metal jacketed			Slightly Inaccurate
	3.06	*4.00*	
Reloaded bullet			Not at all Accurate
	1.15	*1.00*	

Table 5 shows the level of bullet accuracy of the Canik TP9SF Pistol fired at 40 meters, classified according to the type of bullets. The table reveals that full metal jacketed bullets have a higher accuracy level than reloaded bullets, with an average score of 6.00 and 4.33, respectively. The standard deviation for full metal jacketed bullets is also lower at 2.00, indicating less variability in accuracy scores than reloaded bullets with a standard deviation of 4.04.

This finding is consistent with a study by Morgan et al. [12], which concluded that full metal jacketed bullets generally have higher accuracy and consistency. Reloaded bullets tend to have more significant variation and lower accuracy. The study by Cho et al. [13] further supports this finding, stating that full metal jacketed bullets tend to fly straighter with lower deviations, leading to a more consistent trajectory and impact on the target.

It is important to note that the level of bullet accuracy for both types of bullets is classified as moderately accurate and slightly accurate, respectively. This result suggests room for improvement in bullet accuracy, regardless of bullet type. Further studies on factors that affect bullet accuracy, such as bullet weight, barrel length, and shooting techniques, should provide more insights intoimproving accuracy scores.

Table V. Level of Bullet Accuracy of Canik TP9SF Pistol Fired at the Distance of 40 Meters.

Category	SD	Mean	Description
Type of Bullets			
Full metal jacketed	*2.00*	*6.00*	Moderately Accurate
Reloaded bullet	*4.04*	*4.33*	Slightly Accurate

Table 6 shows that both types of bullets used in the study (full metal jacketed and reloaded bullets) have a zero mean and zero standard deviation of bullet accuracy when fired at 50 meters. This indicates that neither type of bullet accurately hit the target at the intended distance. Based on the provided scale, the description assigned to this data is "Not at all Accurate.” A possible explanation for this could be the limitation of the Taurus G3 pistol itself and the distance of 50 meters being relatively far for pistols. According to the FBI, the average engagement distance for law enforcement officers is within 7 yards (6.4 meters), and most shooting incidents occur within 21 feet (6.4 meters) or less [14]. Therefore, firing a pistol at 50 meters is beyond its intended purpose and design, resulting in inaccuracy.

Furthermore, the type of bullet used also affects accuracy. For instance, Wolfe and Kopsch [15] found that full metal jacketed bullets tend to have less accuracy than hollow point bullets due to their design, which causes them to be more prone to deflection upon hitting an object. Reloaded bullets, on the other hand, have inconsistent components and tolerances that affect their accuracy.

Table VI. Bullet accuracy of Taurus G3 pistol.

Category	SD	Mean	Description
Type of Bullets			
Full metal jacketed	0.00	0.00	Not at all Accurate
Reloaded bullet	0.00	0.00	Not at all Accurate

The data presented in Table 7 shows the level of bullet accuracy of Taurus G3 pistol fired at 40 meters classified according to the type of bullets. The mean score for full metal jacketed bullets is 1.67, which falls under the "not at all accurate" category. Similarly, the mean score for reloaded bullets is 1.00, which also falls under the "not at all accurate" category. The standard deviation for full metal jacketed bullets is 2.31,indicating a wide range of scores.In contrast, the standard deviation for reloaded bullets is 1.15.

The data suggests that the Taurus G3 pistol may produce inaccurate results with either full metal jacketed or reloaded bullets when fired at 40 meters. This finding is consistent with the study by Spottiswoode et al. [16], which reported that ammunition quality had a more significant impact on accuracy than the choice of firearm.Another study by Johansson et al. [17] found that the bullet's design and quality significantly impacted accuracy when fired from different handguns. The study also found that bullet accuracy decreased with increasing distance, consistent with the data shown in Table 7.

Table VII. Level of bullet accuracy of Taurus G3 pistol fired at a distance of 40 meters.

Category	SD	Mean	Description
Type of Bullet			
Full metal jacketed	*2.31*	*1.67*	Not at all Accurate
Reloaded bullet	*1.15*	*1.00*	Not at all Accurate

B. Inferential Data Analysis

According to the data presented, there is no significant difference in bullet accuracy of the Canik TP9SF pistol when using different types of bullets at both 40 meters and 50 meters. However, it is essential to note that this finding is limited to the specific handgun model and brand used in this study. Also, it does not apply to other models or brands.For instance, Di Maio [18] found that bullet accuracy is influenced by several factors, such as the type of firearm used, type of bullet, and shooter skill level. Furthermore, Musa et al. [19] found that a firearm's accuracy levelis affected by environmental factors such as wind speed and direction. Meanwhile, Kagarise and Bartlett [20] found a significant difference in bullet accuracy between handguns with fixed and adjustable sights. This finding indicates that the type of sight mechanism plays a vital role in handgun accuracy.

Table VIII. Differencesin the Level of Bullet Accuracy of Canik TP9SF Pistol

Category	Mean dif.	t-value	Df	p-value	Decision
40 mFull metal Reloaded	1.33	1.200	4	0.296	Not Significant
50 m Full metal Reloaded	2.67	1.414	4	0.230	Not Significant

Based on the inferential data analysis presented in Table 9, there is no significant difference in the level of bullet accuracy of the Taurus G3 pistol when fired at 50 and 40 meters according to the type of bullets. The mean difference for reloaded and full metal bullets at 40 meters is only 0.67, and the t-value is only 0.447, which is insignificant at the 0.05 level. Similarly, the mean difference for reloaded and full metal bullets at 50 meters is negative (-0.33), indicating that the full metal bullets were more accurate. Still, the t-value is only -0.500, insignificant at the 0.05 level.

According to the National Institute of Justice [21], there was no significant difference in accuracy when comparing different types of ammunition from different manufacturers. However, it is essential to note that other factors affect the accuracy of the Taurus G3 pistol beyond the type of bullets used, such as the shooter's skills and environmental conditions. These factors should be taken into consideration when evaluating the overall accuracy of the pistol in different situations

Table IX. Difference in the level of bullet accuracy of the Taurus G3 pistol

Category	Mean dif	t-value	Df	p-value	Decision
40 m Full metal Reloaded	0.67	0.447	4	0.678	Not Significant
50 m Full metal Reloaded	-0.33	-0.500	4	0.643	Not Significant

IV. CONCLUSIONS

The study reviewed the accuracy of full metal jacketed (FMJ) and reloaded bullets at different distances for the Canik TP9SF and Taurus G3 pistols. Results showed a slight decrease in accuracy for the Canik TP9SF pistol with FMJ bullets at a 50-meter distance, while reloaded bullets had significantly lower accuracy. The lower accuracy of reloaded bullets at higher distances may be due to their lower muzzle velocity compared to FMJ bullets. Choosing bullets with higher ballistic coefficients and velocities may improve accuracy and compensate for external factors affecting bullet trajectory. FMJ bullets generally have higher accuracy and consistency than reloaded bullets. However, both bullet types used in the study for the Canik TP9SF pistol at 40 meters have room for improvement in bullet accuracy. Neither FMJ nor reloaded bullets produced accurate results in hitting the target at 50 meters for the Taurus G3 pistol, likely due to the pistol's limitations. The type of bullet used can also affect accuracy. Due to their design, FMJ bullets tend to have less accuracy than hollow point bullets, and reloaded bullets have inconsistent components and tolerances that affect accuracy. The study emphasized that firearm type, shooter skill level, environmental conditions, and sight mechanism can impact handgun accuracy. Overall, the study highlights the

importance of understanding the multiple factors affecting bullet and handgun accuracy to improve shooting skills, performances, and other factors to consider when evaluating handgun accuracy.

V. VI. RECOMMENDATIONS

When using the Canik TP9SF pistol at distances of 40 and 50 meters, it is recommended to choose full metal jacketed bullets over reloaded bullets for better accuracy scores. Additionally, it is advised to consider bullets with higher ballistic coefficients and velocities to compensate for external factors that can affect bullet trajectory and improve accuracy.

It is important to note that firing a pistol at 50 meters may be beyond its intended purpose and design, resulting in inaccurate shots. As such, shooters should know this limitation when selecting their shooting distance.

When shooting with any handgun, it is essential to choose high-quality ammunition to maximize accuracy scores. Several factors can impact handgun accuracy, including the type of firearm used, the type of bullet, the shooter's skill level, environmental conditions, and the type of sight mechanism.

When evaluating the overall accuracy of the Taurus G3 pistol, it is necessary to consider several factors that could affect accuracy, such as the shooter's skill level and environmental conditions. Further studies will help shed light on factors that affect bullet accuracy, such as bullet weight, barrel length, and shooting techniques, providing insights into improving accuracy scores.

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