

# GUNPOWDER MODIFIED AIR GUN PELLET PROJECTILES IN FORENSIC MEDICINE AND CRIMINALISTIC

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## ABSTRACT

**Background:** Pellet air guns are typically used for sports or hobby purposes, and their bullets are usually made of plastic or lead-coated steel. However, there have been cases where individuals have modified these bullets by adding gunpowder. Because of this modification, the air guns have more kinetic energy and could be fatal if their modified pellets strike a human target. **Objective:** This research was conducted to examine the risks and dangers that may occur as a result of filling pellet air gun bullets with gunpowder. Air gun bullets, that is, pellets and other types that can be modified, were evaluated in terms of ballistics and criminalistics. **Data sources and Methods:** For the research and analysis, academic databases, books, articles, and internet databases were carefully examined. Scientific data is given throughout the research by observing the literature review data findings and many experimental studies. **Results:** Research has revealed that filling air rifle pellets with gunpowder can pose serious hazards. The high kinetic energy of these modified pellets increases the risk of more serious injury or even death if they hit a person. There have been reports of deaths resulting from firing such projectiles attributable to modification or misuse of the air rifle weapon beyond its intended design. These events pose a serious threat to public health and safety. **Conclusion:** It is imperative to stress the significance of legal regulations and inspections given the risks involved in filling pellet air gun pellets with gunpowder and the consequent judicial deaths. Laws should include measures to prevent such modifications and abuses. Additionally, raising public awareness through information campaigns is essential to help people avoid engaging in these dangerous practices and to promote the safe use of pellet air guns. By taking these essential safety measures, you can protect the public's health and safety and lessen the risks involved in loading pellet air gun projectiles with gunpowder. Furthermore, this practice is important in distinguishing pellet air guns from firearms in forensic and criminalistic examinations.

**Keywords:** Air Gun, Firearm, Gunpowder, Pellet, Bullet.

## INTRODUCTION

Air guns and rifles with compressed air systems are weapons that can send appropriate bullet types using the carbon dioxide pressure force. It is generally used in what are known as external ball type projectiles, known as lead pellet, parachute or mushroom type bullets. Non-fire weapons, such as air guns, unlike firearms, provide energy without gunpowder by compressing carbon dioxide instead of using gunpowder. A number of studies show that air guns cause deaths and serious injuries. Although it is argued that air guns have less capabilities than firearms, it is obvious that they are not innocent, as proven by examinations. It is understood that air guns cause criminal cases as a result of the mutations, i.e. modifications that have been made or can be made in their bullets, in terms of their type and characteristics, penetration power, speed and bullets. When the National Electronic Injury Surveillance System (NEISS) data about air guns, known as non-

firearms, is observed, the rates of fatal and near-fatal injuries have been determined in previous studies (Apelt et al., 2020).

While air guns operate with mechanisms characterized by low speeds, they are recognized as potentially lethal weapons in various forensic scenarios. The minimum energy threshold speed for air gun pellets, categorized as non-firearms in this context, to penetrate human skin is established at 70 m/s. These projectiles can inflict diverse critical injuries on the skin and body. The lack of comprehensive documentation often hinders the accessibility of exact incidences of internal trauma or injuries, as revealed by forensic experts in their examinations of the internal ballistics of air weapons. Notably, users of such weapons are frequently observed within the age brackets of children and young individuals. The primary reason for the incomplete data stems from the fact that emergency physicians typically handle the initial response to these injuries

(Mahadhipta et al., 2021).

In different investigations, it is observed that pellet guns or air guns are an important cause of eye injuries. The chest region is typically the target of such weapons, especially when taking into account the age groups that lack weapons training. When not examined, injuries often have a poor prognosis and are penetrating in nature. In various cases, pellet and ball-type bullets hitting the eye or its surroundings are known to cause loss of vision or complete blindness. In addition to being used for sports, education, and recreational purposes, pellet guns are also used socially and politically to harm people, and in the case of the Kashmir protests, it is known that there are potential risks with different incidents. Ocular injuries have been observed with the use of pellet and air weapons. Of course, distance, bullet weights, the size and criteria of the air weapon used, the air temperature, and the modification of the gunpowder in different weapons or bullets affect the violence to harm or kill **people (Shah et al., 2022)**.

Although air gun injuries are rare, adding gunpowder to their bullets increases their destructiveness and leads to fatal consequences. By disseminating additional information regarding the criminal activity linked to the injuries and fatalities brought on by these precision bullets, it is also crucial to help prevent similar crime cases and increase public awareness (**Milroy et al., 1998**).

Studies highlight the potential for grave repercussions should these weapons be deployed. Although air system weapons generally have lower-speed mechanisms than firearm systems, it is understood that they have different features and may lead to forensic consequences due to modifications.

Detailed examination of air weapons with different projectile types and modified versions is important to assess the serious consequences resulting from forensically and criminalistically relevant events. Because modifications that are not yet known may pose serious dangers in the future. Therefore, this research offers a different perspectives

#### **AIM OF THE STUDY**

Mostly used for sports and recreation, pellet guns are a sort of air-pressurized weapon. However, modifications are occasionally feasible, such as putting gunpowder in these weapons' ammunition. The need for a forensic and criminal assessment is made clear by the

injuries and fatalities brought on by air weapons as well as their possible hazards. The study specifically aims to investigate the impact of the energy threshold speed on the body and the ensuing harm.

#### **MATERIAL AND METHODS**

This study employed a narrative review methodology, reviewing existing empirical research conducted in various nations on gunpowder-modified air weapon pellet projectiles used in forensic cases. Recommendations in these literature studies were taken into consideration and different situations were evaluated. Conclusions were drawn by comparing similar studies. This is because, for better generalization, studies should have a larger sample size. The focus is to demonstrate the seriousness of research findings from a forensic and criminal perspective regarding the possible dangers of loading modified airgun bullets with gunpowder.

Considering the investigations, it is observed that it is possible to make modifications to the bullets as well as the weapons. The kinetic energy of bullets, which can cause more deaths or serious injuries, can be increased with such modifications. For this reason, new data will be presented by obtaining data from the findings in the literature to address the scarcity of research material and the scarcity of cases. The procedures and methods used to fill pellets with gunpowder will also be methodologically assessed in terms of ballistics and criminalistics. Analyzing parachute bullets that have been found to contain extra gunpowder in the literature will draw attention to the dangers that come with these kinds of discoveries during forensic analyses of study findings.

Forensic deaths and injuries resulting from air gun bullets will be examined through autopsy reports and forensic medical examinations, and it will be seen that they are different from firearms. For this reason, it is especially important to examine cases of death caused by gunpowder-containing bullets. Because appropriate measures need to be taken to prevent such modifications and misuses.

#### **FINDINGS**

##### **Air Weapon Ballistics**

Pneumatic guns are gunpowder-free weapons and use compressed air or springs to propel the projectile, often with low kinetic energy, resulting in skull injuries. Because airguns can be altered for illegal use, they have the potential to be fatal. Air guns, which are

known to be used for sports and recreational purposes, are increasingly recognized as a potential cause of serious injury and death (Wan et al., 2019). This situation has spread not only in countries where individual armament is high, but also throughout the world (Rhee et al., 2016).

The research also summarizes the literature on the etiology of injuries and fatalities with this type of weapon. Unlike firearms, air weapons are more vulnerable to modifications. In addition, it is observed that the alloys of the pellets, which are the bullets of these weapons, can be hardened and even have the properties of firearm bullets, including their fabricated production (Wan et al., 2019).

The working principle of air guns is to use pressurized carbon dioxide or air to propel parachute or ball-type projectiles as a result of kinetic energy. Today, different alloys such as steel, aluminum, plastic, or brass can be used in the construction of ball and parachute projectiles in the modern sense (Herrera-Ramirez and Zuñiga-Aviles, 2022).

In general, the bullet types and criteria of common air weapons are as follows:

**Caliber (Diameter):** Generally, diameters are measured in millimeters. These include .177 inch (4.5 mm), .22 inch (5.5 mm) and .25 inch (6.35 mm).

**Design and Shape:** Diabolos, known as smooth lead pellets, are available in flat tip, wadcutter (sharp edge), hollow point, metal spitfire and platinum mixture alloy (PBA) types. (Kuligod et al., 2006).

**Weight:** The weight of pellet bullets is measured in grains or grams depending on their intended use, design, and caliber.

Some basic laws of physics that apply to firearms also apply to non-firearms. These are Newton's Laws of Motion, Conservation of Momentum, Conservation of Energy, Aerodynamics and Air Resistance, Impact and Penetration. The projectiles of air weapons are exposed to these principles at shorter ranges and targets due to their mechanisms and are also taken into account in ballistic analysis (Rhee et al., 2016).

Air weapons, like firearms, raise serious social and legal issues that can be associated with violent crime. However, the issue here is the injuries, accidents, or crimes that occur as a result of their effects, which can be enhanced by modifications made to these air guns. For example, shotguns have been used extensively in

incidents involving firearms, such as suicide or murder (Kim et al., 2021). For functional convenience, it is sometimes possible to make modifications to the weapon, such as cutting and shortening the barrel. Similarly, it is possible to add or remove such modifications to long or short-barreled air weapons (Abdelhalim et al., 2023). However, considering that it will not be as effective as firearms, it may be possible to make modifications for some high-pressure 300 bar (30000 psi) or more, which increase the projectile exit velocity rather than shortening long-barreled air weapons (Patrawala, 2022).

It is observed through research on this subject that modifications can be made to the bullets related to air weapons. It is possible to add small amounts of gunpowder to many types of parachute bullets. However, it should not be overlooked that people who have the equipment and technical knowledge to implement this are people with a high potential to commit crimes. The gunpowder added to parachute bullets serves a non-functional function in airborne weapons because there is no firing mechanism in either capsule. Additionally, the air gun system does not have a firing pin like firearms. However, when the parachute bullet hits the target or hits an object, powdered lead or azide (lead azide), which also consists of micrograms of explosive compounds consisting of magnesium, titanium, aluminum and other metals, will react to ignite the gunpowder. Thus, it will leave a destructive effect or trace on the substance or object it hits. In forensic cases, the modification of airborne weapons through the addition of gunpowder ammunition, effectively turning them into lethal "zip" weapons, has been highlighted and observed and reported in the cases. (Milroy et al., 1998).

Of course, placing gunpowder in millimetric pellets and changing the design of air gun bullets may endanger the integrity and safety of air weapons. In legal terms, such changes may cause the air weapon to not comply with local laws and create dangerous situations (Apelt et al., 2020). To give an example of the laws of some countries, in the Canadian Criminal Code, air guns are also accepted within the definition of firearms. This is because they can be modified and firearms or explosives such as gunpowder can be added. Such an air weapon can cause severe bodily injury to human body integrity or cause death (Daaid, 2013).

#### **Injuries and Deaths Caused by Air Weapons**

Injuries caused by air weapons are usually

seen among children and young people when they are used for recreational and sporting purposes. For training purposes, it is known to be used in military schools and police organizations and there are similar injury cases (**Donegan et al., 2022**). However, in cases where it is used for training purposes, rules must be followed in and on the firing range, and failure to comply with these rules can lead to serious injuries and fatal consequences (**Hatch, 2020**). At this point, when attention is paid to the literature, it is observed that most injuries are around the eyes, ears, and neck due to air weapon projectiles (**Donegan et al., 2022**). Of course, the muzzle velocities, bullet types, masses, and ranges of air weapons, which can cause injuries or deaths, are among the factors that can determine the severity of tissue damage. In the case of bullets that have been modified and supplemented with gunpowder, traumatic wounds to the tissue can cause cavitation or crushing, which can cause permanent damage that is not temporary. Other modifications, such as the use of parachute or ball-type bullets, can also cause tissue damage, with gunpowder residues or ignition materials being found in the traces of tissue crushing in the penetration path (**Wan et al., 2019**).

It was concluded that the minimum velocity of a 0.177 caliber (4.5 mm) air weapon projectile must be 331 fps to penetrate the skin of human tissue. It was concluded that the larger the caliber and weight of the projectile, the less velocity is required to contact and penetrate the skin. However, the diameter or weight of the bullet is not the only binding cause of injury or death due to such bullets and weapons (**Berryman, 2019**). Larger and heavier bullets may be able to deliver more energy because kinetic energy is proportional to the square of the velocity and the mass of parachute or ball bullets with large diameters. Of course, small projectiles have lethal effects at close range (**Wan et al., 2019**). It is worth noting that speed and mass, as well as the kinetic energy produced by the modified bullet and weapon, are important factors in reaching the target. At this point, the weight and speed of bullets modified with the addition of extra gunpowder from pellets and other non-fire weapons do not change much. However, an air gun bullet with added gunpowder, which reacts upon impact even at distances where it cannot penetrate human tissue, can cause serious injuries and deaths due to hitting critical points of the penetration zone (**Berryman, 2019**).

Another situation of air weapons related to forensic injuries is caused by bullets, i.e. pellets and balls, which cause mechanical injuries, as well as lead poisoning (**Chęciński et al., 2021**).

The advantages of air weapons are that they are silent, light, flexible, and easily available. Their disadvantage is that they are less effective and not as powerful as a firearm. Although the distinction between firearms and non-firearms is clear in forensic medicine and criminalistics, several modifications that can be made to air weapons make it difficult to find suspects and make it difficult to examine during autopsy (**Spencer, 2012**).

It is difficult to find evidence of cerebral lateralization in the brain region according to Glasgow Coma Scores, although the penetrating power of gunpowder-supported parachute bullets may be high, it is important to determine whether there is collapsed or perforated bone. Similarly, other local areas should be carefully monitored for skin defects caused by projectiles. Among all these findings, the absence of gunpowder burns or traces on the surface of the skin or in the brain, including in the tracings, should be carefully monitored. The reason is that gunpowder in micrograms will not produce high temperatures and will prevent the appearance of gunpowder marks (**Dalgıç et al., 2010**).

#### **Forensic and Criminalistics Challenges of Pellet Traces**

Compared to firearms, crime scene investigations or autopsy examinations for injuries or deaths caused by air weapons in another situation can be more challenging. This is because these projectiles are millimetric and difficult to detect, and are unlikely to cause as much damage as firearm bullets, which have a much higher velocity (**Vanzi, 2005**). For example, a gunpowder-modified pellet striking the head, where hair and hairy tissue are located, is difficult to see on external examination. However, similar cases are more likely to be seen with computerized tomography scans (**Dalgıç et al., 2010**). Similarly, they are less likely to be seen at crime scenes due to their small size. Because of this, they present more challenges than guns when it comes to criminal investigations (**Vanzi, 2005**).

In difficult cases of injury, death, threats, theft, or robbery, forensic experts often carry out tests on glass-like materials for reconstruction purposes. It is possible to understand the tissue damage caused by a gunpowder-modified parachute-type bullet hitting the chest with these

tests. They have a penetrating power of between 3 and 10 cm and above, depending on the distance, diameter, velocity, and the air weapon or pellets that can be modified. (Hsiao and Meng 2018). The probability of penetration or destruction of air weapons can vary depending on whether they are rifle-type long-barreled or short-barreled pistols (Beach, 2020).

#### **Chemical Traces of Air Weapons**

It is possible to obtain chemical traces of the gunpowder components used in firearms on the person or object that fired the gun and with which it came into contact. However, while gunpowder chemicals (barium, lead, antimony, copper, zinc and nitroglycerin) can be obtained from modified air rifle or pistol pellets, it is not possible to fire them with the same working principle as in firearms. For these reasons, it will not be possible to reach chemical traces on the hands, face, and even the clothes of the person using the air weapon (Harrington, 2021).

#### **Evaluation from a Legal Perspective**

It is known that many homicides and injury incidents are intentionally and negligently caused by projectiles of air guns (Mogni and Maines, 2019). For this reason, it is usual for air weapons and projectiles that are open to modification to be included in the scope of firearms since they can cause forensic incidents. In order to prevent modifications, it is appropriate to include them in the classification of firearms (Birkett et al., 2021). However, in some countries, preventive measures are still not fully legalized. Air weapons are not recognized as "weapons" in the laws on weapons (Glowinski et al., 2023). As stated, conditions vary depending on the laws of the countries, and there are countries where firearms can be purchased without a firearm certificate, in stores or even by ordering online. Although there are preventive legal conditions in some countries, these are not sufficient (Bruce-Chwatt, 2014).

In this case, it seems that the way is open for the production of homemade modified air gun ammunition for criminal purposes. In forensic cases, it can be predicted that in the future, traces of the use of gunpowder, especially to increase destruction, will be encountered in autopsies or examinations and at crime scenes (Birkett et al., 2021).

Depending on the characteristics of the powdered and modified form, a 0.5 mm to 1 cm hole can be observed on the surface of the human tissue it comes into contact with. In addition, there are also pellet marks around the entrance

hole due to the reaction reaction due to impact (Kuligod et al., 2006). Today, it has been observed that 4.5 mm and 5.5 mm parachute and ball-type air gun bullets are mostly used in judicial cases related to air weapons. In addition to these, other bullets produced are 6.35 mm, 7.62 mm, and 9 mm, but their use and number in judicial cases are low. However, 4.5 mm and 5.5 mm air rifle and pistol bullets are the types most commonly encountered in accidents, suicides and deaths. In contrast, 6.35mm, 7.62mm and 9mm bullets can be modified for intentional criminal purposes as they are capable of holding more gunpowder (Petrus et al., 2023). Although pellet guns are produced for sports, education, and recreational purposes, they can cause negative forensic consequences under most circumstances. It is necessary to prevent the use of pellet bullets developed with all the aforementioned characteristics for criminal activities outside their intended purpose, which can only be done through legal means (Vanzi, 2005).

#### **Flash Feature Powder Modified Pellets**

If air gun bullets are externally modified to increase their diameter and powder absorption capacity, they are more likely to be used for intentional wounding and killing than bullets of lower caliber. Bullets of all calibers produced for sports and training purposes are also available with flash. Although the content of these flash bullets varies, they consist of magnesium, titanium, aluminum, powdered lead, and lead azide. The reason for their production is to determine accuracy (Milroy et al., 1998). There are flash-type parachute bullets that have similarities as well as chemical differences with blanks. It is a risky issue that needs to be taken into consideration as large-diameter flash-type gun parachute bullets can take more gunpowder. This is because there is a higher risk of injury and a higher risk of causing death. Some of these types of flash-capable air weapon projectiles are encapsulated, while others are parachute-type projectiles. It is important to note that the prevention of their use for wounding and killing is a matter of law as well as of sales policies of the manufacturers (Frank et al., 2017).

#### **DISCUSSION**

While the research has addressed the potential risks of injury and death by focusing on air weapons and their modifications, it is a topic that needs to be expanded. Air weapons are generally non-firearms that cause cranial injuries with low kinetic energy, but can be made

firearms with gunpowder and similar chemicals as examined. In the literature, it is stated that air weapons are open to more modifications than firearms and these modifications may pose potential hazards (**Wan et al., 2019**).

The bullet types and criteria for air weapons are based on factors such as diameter, design, shape, and weight. In general, there are diameters such as .177 inch (4.5 mm), .22 inch (5.5 mm), and .25 inch (6.35 mm). In contrast, the larger diameters of 6.35 mm, 7.62 mm, and 9 mm air gun bullets are ignored. Their risk is that they are projectiles of a diameter size that can be modified by taking more gunpowder (**Kuligod et al., 2006**). The materials used to make these projectiles include steel, aluminum, plastic, brass, and other alloys (**Herrera-Ramirez and Zuñiga-Aviles, 2022**).

The working principle of air weapons is to use compressed air or carbon dioxide to launch a projectile with kinetic energy. It is stated that the laws of physics are factors that are taken into account in ballistic analysis that air weapons are exposed to shorter distances and targets than firearms. In addition, the need to take into account not only the laws of physics but also several other principles and laws for air weapon projectiles due to their potential to be modified outside their normal activities. Here, only the addition of gunpowder to the bullets as a matter of debate may also arise from the confusion of whether the air weapon is included in the concept of a firearm or not (**Rhee et al., 2016**). Their modifiability, especially with the addition of gunpowder, reveals the fact that air weapons can be transformed into lethal weapons. These modifications can be carried out by people with criminal intent, which can increase the number of criminal cases (**Milroy et al., 1998**).

In terms of autopsy and other applications in forensic medicine, injuries caused by air weapons usually occur around the eyes, ears, and neck. Bullet types, diameters, and velocities are important factors determining tissue damage. It is emphasized that modified pellets, especially those supplemented with gunpowder, carry and increase the risk of injury and death (**Wan et al., 2019**). From a legal perspective, the modifications of air weapons and the regulations on the use of these weapons affect forensic investigation processes. The possibility that modified air weapons may cause forensic cases raises the possibility of including these weapons in the scope of firearms (**Birkett et al., 2021**).

The reviews suggest that lawmakers and

governments should ensure that the right to arms is brought to a certain standard. Taking into account the risk and danger rates, it is possible to take precautions by keeping records of air weapons and bullets according to their age groups and with certain documents. (**Vanzi, 2005**).

When we examine the air weapons and bullets that can be used, it is obvious that the research may result in injuries and deaths. Another suggestion is that it should be carried out through the laws on firearms, taking into account that it can be modified with gunpowder (**Dalgiç et al., 2010**). It would be beneficial to increase the scope of forensic analyses, criminalistic investigations, and tests on residues at crime scenes where pellets modified by air guns could be fully combined with gunpowder and other similar explosives (**Frank et al., 2017**).

Furthermore, raising public awareness and organizing information campaigns play a critical role in encouraging the avoidance of such dangerous practices. The filling of pellet air pistol bullets with gunpowder is important to distinguish them from firearms in forensic and criminalistics examinations. In conclusion, air weapons and their modifications may pose new problems in the field of forensics and criminalistics. The potential dangers of these weapons should be addressed through legal regulations and manufacturer policies. Furthermore, forensic processes related to the use of modified air weapons must be conducted more carefully. It has been emphasized how modifications can lead to criminal incidents and, in particular, how parachute rounds with added gunpowder can be transformed into a lethal weapon. Such modifications can complicate forensic investigations and make it difficult to identify criminals. Forensic medicine experts must contribute to research and development on the subject by each specialization. In this way, the resolution of investigations in forensic incidents that will be experienced or encountered will ensure the fulfillment of the requirements of criminal justice. As it is understood from the research, there are similarities as well as differences between the trace evidence left on humans by firearms and bullets and the bullets of air guns modified, improved, and reinforced with gunpowder.

#### **RECOMMENDATIONS**

The framework of laws regarding air guns and bullets needs to be expanded. Producing air

guns and bullets in a way that they cannot be changed is a preventive factor for legal problems and judicial cases that may arise. It is recommended not to sell or supply to minors and minors. It is also important to increase ballistic studies on modifications to air guns and bullets that may be encountered.

#### **AUTHOR CONTRIBUTION**

As the author of the research, all the literature was examined by me. The comparison was provided by the author through literature reviews in databases. As the author, information has been carefully presented in this study, taking into account sensitive evaluations. Differently, data on the risks of this type of non-firearm was provided according to forensic and criminalistic techniques or science. A single author contributed to and approved the final text.

#### **CONCLUSION**

The research draws attention to the existence of significant problems when addressing the potential risks of injury and death of air weapons and their modifications. The potential for air weapons to transform into firearms, especially the presence of interchangeable bullets, increases the risks of these weapons. From a forensic and legal perspective, modified air weapons have the potential to lead to criminal cases and complicate criminal investigations. Therefore, legal regulations regarding the use of air weapons need to be strengthened and judicial processes must be carried out more carefully. By raising public awareness and contributing to forensic medicine experts, it may be possible to reduce these potential risks and ensure justice.

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#### **ETHICS APPROVAL and CONSENT to PARTICIPATE**

This article does not contain any studies with human participants or animals performed by any of the authors.

#### **DECLARATION OF CONFLICTING INTERESTS**

The authors affirm that they have no conflicts of interest to declare.

#### **CONSENT for PUBLICATION**

The author gave approval for the publication of this study.

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## مقذوفات بيليه مسدسات الهواء المعدلة بالبارود في الطب الشرعي والطب الجنائي

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### خلاصة

الخلفية: تستخدم مسدسات الهواء عادة للأغراض الرياضية أو الهوايات، وعادة ما تكون رصاصاتها مصنوعة من البلاستيك أو الفولاذ المطلي بالرصاص. ومع ذلك، كانت هناك حالات قام فيها أفراد بتعديل هذه الرصاصات بإضافة البارود. وبسبب هذا التعديل، تتمتع مدافع الهواء بطاقة حركية أكبر ويمكن أن تكون قاتلة إذا أصابت كرياتها المعدلة هدفاً بشرياً. الهدف: تم إجراء هذا البحث لدراسة المخاطر والأخطار التي قد تحدث نتيجة تعبئة رصاصات مسدسات الهواء بالبارود. وتم تقييم طلاقات البنادق الهوائية، أي الكريات والأنواع الأخرى التي يمكن تعديلها، من حيث المقذوفات والجنائية. مصادر البيانات وطرقها: بالنسبة للبحث والتحليل، تم فحص قواعد البيانات الأكاديمية والكتب والمقالات وقواعد بيانات الإنترنت بعناية. يتم تقديم البيانات العلمية في جميع أنحاء البحث من خلال ملاحظة نتائج بيانات مراجعة الأدبيات والعديد من الدراسات التجريبية. النتائج: كشفت الأبحاث أن ملء كريات بندقية الهواء بالبارود يمكن أن يشكل مخاطر جسيمة. وتزيد الطاقة الحركية العالية لهذه الكريات المعدلة من خطر التعرض لإصابة أكثر خطورة أو حتى الوفاة إذا أصابت الشخص. كانت هناك تقارير عن حالات وفاة ناجمة عن إطلاق مثل هذه المقذوفات والتي تعزى إلى تعديل أو سوء استخدام سلاح البندقية الهوائية بما يتجاوز التصميم المقصود. وتشكل هذه الأحداث تهديداً خطيراً للصحة والسلامة العامة. الاستنتاج: لا بد من التأكيد على أهمية الضوابط القانونية وعمليات التفتيش نظراً للمخاطر التي تنطوي عليها تعبئة كريات مسدس الهواء بالبارود وما يترتب، على ذلك من وفيات قضائية. وينبغي أن تتضمن القوانين تدابير لمنع مثل هذه التعديلات والتجاوزات. بالإضافة إلى ذلك يعد رفع مستوى الوعي العام من خلال الحملات الإعلامية أمراً ضرورياً لمساعدة الأشخاص على تجنب الانخراط في هذه الممارسات الخطيرة وتعزيز الاستخدام الآمن لبنادق الهواء. من خلال اتخاذ تدابير السلامة الأساسية هذه، يمكنك حماية صحة الجمهور وسلامته وتقليل المخاطر التي ينطوي عليها تحميل مقذوفات مسدسات الهواء بالبارود. علاوة على ذلك، فإن هذه الممارسة مهمة في التمييز بين مسدسات الهواء الصغيرة والأسلحة النارية في فحوصات الطب الشرعي والجنائي. الكلمات المفتاحية: مسدس هوائي، سلاح ناري، بارود، بيليه، رصاصات