
The Case For
LEAD

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INTRODUCTION

Lead ammunition is under attack. Shooting is hugely important to the rural economy to the tune of £1.6 billion per annum and of great benefit in terms of wildlife management and conservation. If lead ammunition is banned, or further restricted, it would have a profound effect on all forms of shooting in the United Kingdom.

Some environmental groups are campaigning for further restrictions, or a total ban, on lead ammunition. They argue that lead shot poses a risk to the environment and to human health. Scaremongering about lead has become a useful way to attack the sport for some who are fundamentally opposed to shooting.

The truth is very different. The vast majority of evidence presented to decision makers to place further restrictions on lead ammunition has failed to pass rigorous academic scrutiny. We believe this is unjust, unfair and highlights a way in which science can be used and manipulated to suit a political agenda.

Restrictions on the use of lead shot already exist to address any proven environmental concern. Any further unjustified restrictions could have serious implications for the gun trade, the rural economy and the natural environment.

WHAT IS LEAD?

- Lead is a naturally occurring metallic element
- Lead acid batteries are a vital component in vehicles
- Hospitals, the emergency services, telephone exchanges and public buildings rely on lead-acid batteries as back-up in case of mains power failure
- 80% of modern lead usage is in the production of batteries of which more than 95% are recycled
- A lead roof will outlast any other traditional building material, sometimes by hundreds of years
- As a barrier to radiation, lead is unrivalled and essential in hospitals, dentists' surgeries, laboratories and nuclear installations

Over the past decade, the lead industry has sponsored more than €3 million of independent research investigating the health and environmental impacts of lead.

WHY USE LEAD FOR AMMUNITION?

Lead has been used as the material of choice for ammunition owing to properties that make it ideal for use in projectiles:

- Its high density allows the momentum of the projectile to be retained. This allows the projectile to travel further and impart more energy when the projectile meets the target
- Lead's soft structure allows it to deform when contacting a target. This causes the projectile to create more efficient and consistent kills when shooting live quarry
- Lead ammunition is the most cost effective form of ammunition

The most common sporting projectiles are split into two main categories:

- Lead shot used in shotguns are small spheres of lead from around 1.8mm to 9mm in diameter. Many individual pellets are loaded into a single cartridge.
- Lead bullets are single projectiles, usually fired from rifles, and commonly shaped to give an aerodynamic form. Bullets used in higher velocity rifles are covered in a copper alloy "jacket" to prevent damage to the bullet when travelling through the bore.

EXPOSURE TO LEAD

All metals are potentially toxic, yet many metals are essential for life in small quantities. Most things can be toxic in sufficient quantity, or sufficient concentration. Lead is one of these elements and too much exposure can cause poisoning.

What is important is not that a metal is defined as toxic but the level at which it becomes a toxin i.e. harmful. Lead occurs naturally in various environments and at a variety of concentrations. Other metals which are also considered toxic include aluminium and silver, which like lead, also occur naturally.

Lead, like all other metals, occurs naturally in small concentrations in all rocks and soils. Lead is used extensively in a whole range of products, industrial processes and in lead ammunition used for shooting.

Humans can be exposed to lead in a number of ways. The main exposure routes to humans are:

- **Food** – Ingestion of traces of lead through food is the main source of lead intake to the general adult population. All foodstuffs contain small amounts of the metal.

- **Water** – Lead in drinking water is of intermediate significance as a source of lead Intake. Drinking water can be contaminated at source or through pipes. Many old houses still have pipes made of lead which can result in tap water concentrations above the maximum safe level recommended by the World Health Organisation.

- **Air** – Direct absorption by inhalation is a minor exposure route for most people, though it can be significant to individuals exposed through their occupation

- **Soil and dust** – soils can contain lead from many sources and this can remain for centuries. Household dust contains lead from road dusts brought indoors on shoes.

Despite all these potential sources of lead, the amount of poisoning in the United Kingdom is very low, especially when compared to other substances. Data from the NHS Hospital Episode Statistics illustrates the very low number of lead poisoning cases when compared to poisoning caused by other toxic substances. Between 1998 and 2011, the following figures show the average number of people admitted to hospital for the treatment of poisoning:

- 125 for the toxic effect of soap and detergent
- 982 for the toxic effect of ethanol
- 69 for the toxic effect of ingested mushrooms
- 40 for the toxic effect of snake venom
- 19.6 treatment for the toxic effects of lead.

Of these lead poisoning cases, the vast majority of those admitted to hospital were male and in their late 20s and early 30s. This demographic would not support an argument for the consumption of game as being the cause for lead poising, given the relatively young age range and the predominance of males. In addition, studies have shown that even those who have long term exposure to lead through their occupation show no adverse behavioural effects, or brain dysfunction (Osterberg et al.).

LEAD IN FOOD

Game meat is enjoyed by hundreds of thousands of people across the country as a lean and flavoursome alternative to other meats. Anti-lead campaigners claim that eating game shot with lead could result in lead poisoning. After centuries of game consumption there is no evidence of any cases of lead poisoning resulting from the ordinary consumption of game.

Every foodstuff contains lead and its consumption is unavoidable. The contribution of lead in the average diet was found by the European Food Safety Agency (EFSA) to be highest, by a large margin, in bread, tea, water and potatoes. Game meat was found to make a very small contribution to overall lead in the diet, behind almost all other common foodstuffs. The game meat which contained the most lead was wild boar, which is not commonly shot in the UK, and when this is removed the resulting level of lead is comparable to fish.

In October 2012 the UK Food Standards Agency (FSA) issued advice to frequent consumers of small game meat, such as pheasant and partridge, specifically those consuming over 100 birds a year. This advice only applies to a tiny minority of people who shoot. Small game has simply been added to a list of foods, such as oily fish and tuna, which the FSA advises should not be eaten more than twice a week. It also joins the myriad of foods that women are advised to avoid during pregnancy.

The FSA advice relied on evidence from research by wildlife scientists from the Wildfowl and Wetlands Trust (WWT), a wildlife charity known to be against the use of lead ammunition. Such evidence is usually provided by human toxicology specialists and in the absence of such expert advice, the potential for a false foods scare, such as that on BSE and Salmonella is great. Freedom of Information requests by the Countryside Alliance show elevated levels of communication between the WWT and the FSA, despite their differing remits.

Using the data from the EFSA report, eating the daily suggested minimum of five fruits and vegetables and one litre of tap water provides enough dietary lead to exceed the threshold for young children by a factor of two.

What the FSA advice also overlooks is that excessive consumption of any one foodstuff can have serious health implications. According to the NHS, eating too much fat can lead to serious health problems, such as heart disease; type 2 diabetes and high blood pressure. Similarly, too much salt can raise blood pressure, increasing the risk of heart disease and stroke. The effects of drinking too much alcohol are also well know and documented.

According to the same report, venison meat contains half that of garlic and pheasant meat a third of that found in certain mushrooms. Weight for weight, there is more lead in some forms of chocolate than any game meat found in the UK.

> *"The limited available evidence does not indicate a different average dietary exposure or risk for vegetarians from the adult population, consumer groups with higher lead exposure levels include high consumers of game meat (1.98 to 2.44 µg/kg b.w. per day) and high consumers of game offal (0.81 to 1.27 µg/kg b.w. per day). The estimated dietary exposures of these groups are also within, or at the higher end of the range of the respective BMDL intake values."*
> **EFSA Journal 2010**

> *"The many high results for wild boar meat skewed the distribution for this food category"*
> **EFSA Journal 2012**

> *Bread, tea, tap water and potatoes supply over one quarter of the amount of lead in the average adult's diet. Game meat does not even provide 1% of the average person's diet.*
> **EFSA Journal 2012**

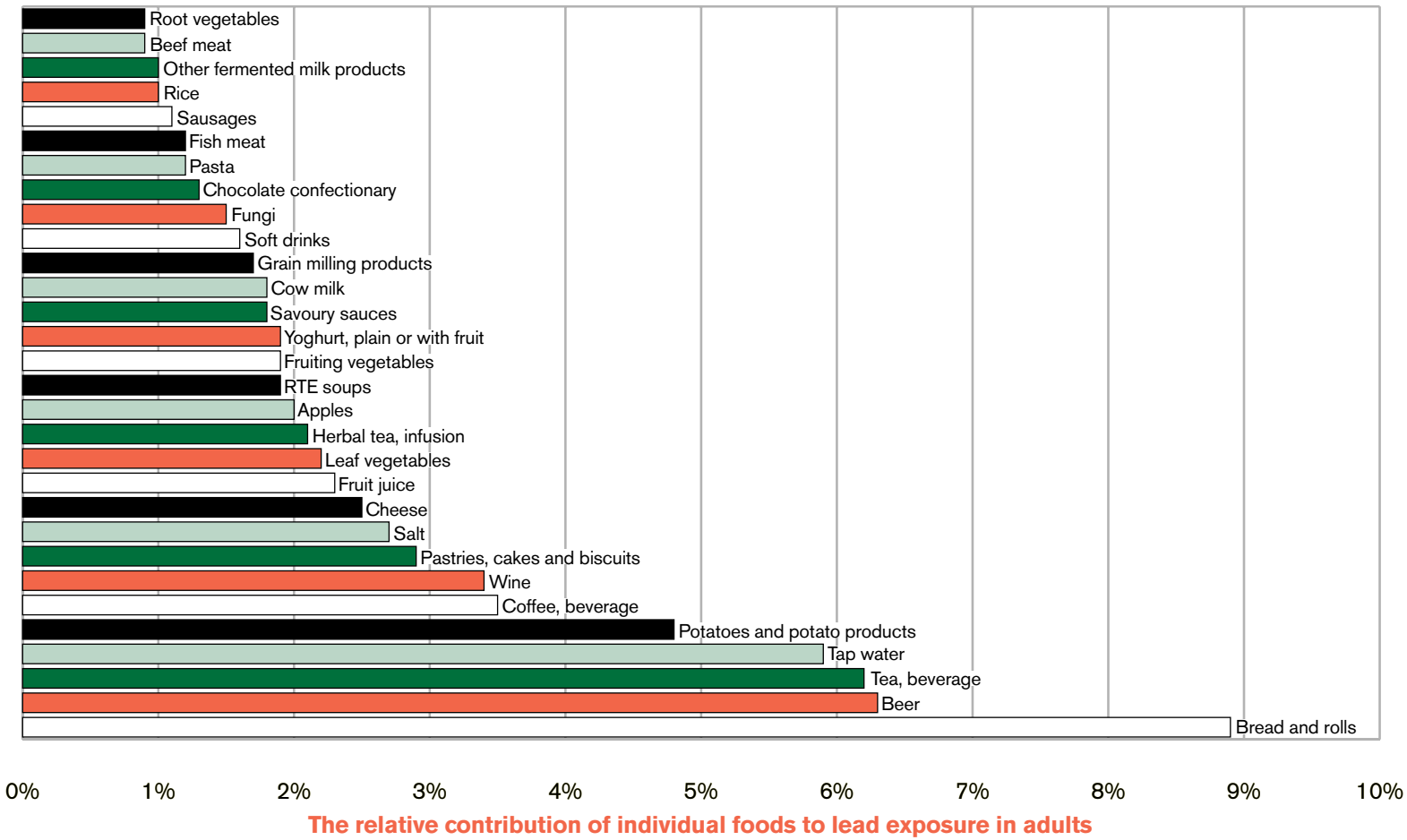


Figure 11: Major contributors to overall middle bound mean lead dietary exposure in adults at detailed food category level.

LEAD IN THE ENVIRONMENT

Much of the evidence that relates to the use of lead ammunition and its environmental impact comes from studies abroad. In a review by the Food and Environment Research Agency of the 300 peer reviewed articles and government agency reports, which were to be used by the UK Lead Ammunition Group as evidence, only 10 were from the UK.

Shooting practice, species and habitats are also very different from country to country. For example, much of the research is based on condors in the deserts of the United States of America. When life spans are considered, the condor is expected to live up to sixty years while the British buzzard averages around 8 years and the golden eagle 14 years. Such research is therefore not applicable to the UK situation.

Lead ammunition is unlikely to be a source of lead poisoning and mortality in wildlife, as lead in ammunition is a metallic, as opposed to compound form. Compound forms of lead are easily soluble and therefore bioavailable to wildlife whereas metallic lead only becomes available under certain circumstances. This simple fact is routinely overlooked by those advocating a lead ban.

Several studies from the WWT have suggested that a ban on lead for all shooting is required to prevent lead poisoning in wildlife. But this research is inconsistent, provides no new evidence and makes inferences on very low numbers of tested birds.

- Many of the wildfowl tested in the study are migratory species which could have obtained the lead from numerous locations. This is not acknowledged.
- Non migratory species, which were only tested from WWT reserves, can only have obtained the shot at those sites from legal historic use.

This however does not stop the organisations opposed to the use of lead ammunition presenting such research to international governments as hard science. Any evidence that supports a ban must be rigorous, peer reviewed and beyond all possible doubt.

ALTERNATIVES

For many years companies and individuals have been working on alternatives to lead for use in guns. Alternatives to lead are commonly called “non-toxic” but this is a misnomer as the alternatives potentially have greater toxicity than lead.

Such alternative ammunition must have four main factors:

- It must not be detrimental to human health or the environment
- It must work effectively and humanely for all shooting disciplines
- It must be suitable for use in existing guns
- It must be affordable

The current alternatives include: tungsten, bismuth and steel.

Tungsten

Tungsten is a much denser metal and harder than lead (tungsten carbide is used for tools). In order to prevent barrel damage, particles of the metal are suspended in a form of epoxy. Most tungsten shot can be fired through normally proofed guns, but the cost of tungsten cartridges can be up to ten times that of lead.

There are also concerns that tungsten can be dangerous for human and animal health. The US army stopped using training rounds made of tungsten in 2007, after research suggested that tungsten may elevate the risk of cancer. In the UK, the Lancet reported a case of a soldier developing seizures having consumed alcohol and trace amounts of tungsten metal.

Although evidence suggests that tungsten is not good for human health, there has not been any research into tungsten in the environment, or indeed, in wild animals.

Bismuth

Being less dense than lead, at 9.7 g/cm^3, bismuth does not match the ballistic performance of lead. Also being less malleable it does not deform in the target, but can fragment. Slightly larger shot is required to retain energy at the target, reducing the pattern of the shot. The cost of bismuth is around five times that of lead.

Despite the chemical make-up resembling arsenic, bismuth has relatively low toxicity. As a by-product of the lead mining process its price is only kept low by the continued extraction of lead.

Steel

Steel shot is actually made of iron and is comparable to lead in terms of price. However, being much less dense than lead, at 7.8 g/cm^3 (69% the density of lead), it shares very different ballistic capabilities. As such, larger shot is required to retain energy at the target, thus reducing the number of pellets in a given load. The reduced load density and hardness of steel greatly reduces its effectiveness.

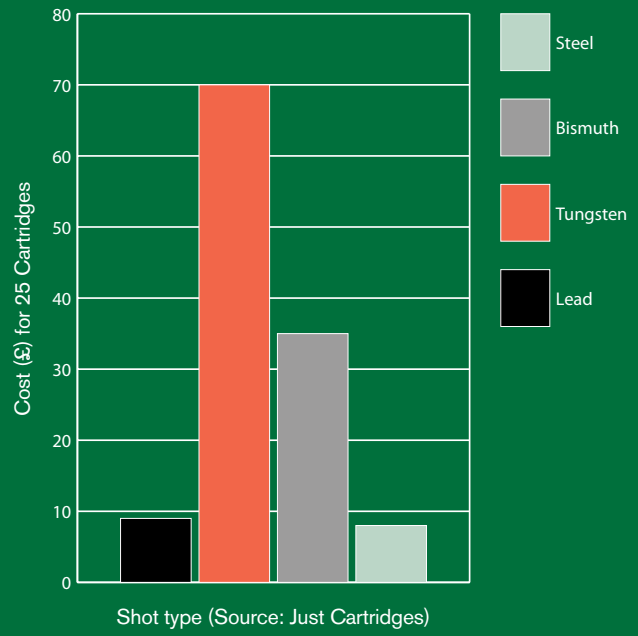
To solve this, larger cartridges are made, but these do not fit standard game guns. In order to impart more energy, some steel loads are loaded to give higher muzzle velocities. This means that steel shot is not suitable for use in traditional British shotguns which are extensively used for shooting in the UK.

Currently no alternative passes all the required tests. Great Britain, like many countries, have restricted the use of lead ammunition on wetlands to mitigate environmental concerns. This had a profound effect on shooting practices in those areas.

It is often claimed that bans in other countries have worked so 'why don't they do that here?'. This is a flawed argument as there is no country with a comparable shooting culture which has implemented a total ban on lead ammunition. Such claims are made without any evidence to the situation in the quoted country after the ban.

The impact the alternative elements could have on the environment and human health has not been explored. As is our position that any ban on lead shot or further restriction has to be based on peer-reviewed scientific evidence, we recommend the alternatives to lead shot should be subject to the same level of analysis.

Cost of Alternatives



	Ballistics	Suitability in Guns	Potential health or Environment Issues	Cost
Tungsten	Yes	Yes	Unknown	No
Bismuth	Yes	Yes	Unknown	No
Steel	No	No	Unknown	Yes

IMPLICATIONS OF A BAN

The United Kingdom has a very long tradition of shooting and has led the world in the development of the sporting shotgun. It is estimated that nearly 1 million people take part in shooting sports in the United Kingdom, from informal shoots to Olympic competition.

- Game shooting is worth £1.6 billion to the British economy and supports nearly 70,000 full time jobs, many in remote rural areas. Shooting also contributes nearly 2.7 million man days on conservation of the British countryside every year.

- The UK also has a unique game shooting tradition with a much greater focus on inland shooting than other European countries. As such, any further restriction or ban on lead shot would have a disproportionate effect on shooting in the United Kingdom compared to other European countries.

- In addition, a ban on lead in ammunition would have a seriously negative impact on the shooting industry because most of the guns made by the historic British gun makers, and many from abroad, are unsuitable for use with alternatives to lead that are economically comparable. The alternatives to lead with comparative ballistic capability can cost up to 10 times more.

- The negative effects a ban would have on shooting are wider than just driven shooting. Many forms of pest control, which are vital to retaining the balance of nature in our countryside, would also be curtailed due to spiraling costs of ammunition.

- Control of agricultural pests, such as rabbits and pigeons, relies heavily on individuals to cull the required numbers of these animals in order to protect vital food crops. Without such protection, crop yields across the country could potentially be reduced. Similarly, the same can be said for control of predator species, which need to be controlled in order to protect native flora and fauna from being overgrazed or predated.

WHO OPPOSES LEAD?

Worldwide, there are very few organisations calling for a ban on lead ammunition. Those pushing for a ban on lead in the UK are the Wildfowl and Wetlands Trust (WWT) and the Royal Society for the Protection of Birds (RSPB).

As has been seen, the WWT is at the forefront of the argument against lead ammunition. Its aim is stated as **"To Campaign for a ban on the use of lead gunshot for all shooting in England"**.

These two organisations also called on the Government to look into the issue. In 2010, the Department of the Environment, Food and Rural Affairs formed the 'Lead Ammunition Group' (LAG) of interested parties to review scientific research and advise Government at their request. The WWT and RSPB both sit on this group.

Whilst the LAG deliberates, the WWT has subverted the process by continuing to campaign against lead in the media and selectively withholding evidence from the group. In addition, the WWT and Birdlife (the RSPB's international partner) have been actively lobbying European agencies to bring about restrictions in any way they can. This too was highlighted in the leaked WWT documents.

> "We could be accused of cosying up to the Authorities and not making potentially important information available to the public and therefore not fulfilling a duty of public education and care"
>
> **Leaked WWT Board Paper**

"HRH and Buckingham Palace may not be amenable to this … unpredictable"

Leaked WWT Board Paper

"We strongly recommend that a wider group of interested stakeholders be convened by Government to address the evidence for lead poisoning of both wildlife and humans, with a mandate to make whatever recommendations it sees as necessary for the protection of the environment and human health."

RSPB and WWT Letter to the Secretary of State

CONCLUSIONS

- Along with many other metals, lead is a toxic substance that if consumed in excess can cause poisoning.
- Everyone is exposed to lead every day in a number of ways. However, these levels are low and the cases of lead poisoning are very low and usually associated with occupational hazards.
- Lead is present in game meat, but over many years of consumption, no one has been poisoned by eating game shot with lead to our knowledge. Advice by the FSA is overly cautious and overlooks the fact that excessive consumption of any one food type can have detrimental health effects.
- Lead in the environment comes from many sources, not just shooting. The majority of the studies in the area are based on environments and species that are not found in the UK. Those that are have significant flaws, but this does not prevent those opposed to lead ammunition from presenting this to government.
- The current alternatives to lead ammunition do not meet all of the requirements for a change from lead. There is the possibility that some alternatives could cause potential health or environmental issues, an area which should be explored in depth before any alternative is recommended.
- Game shooting is worth an estimated £1.6 billion to our economy. Many jobs in rural areas are dependent on shooting and it supports levels of conservation unequalled by all of the conservation charities combined. Any further ban on lead ammunition would greatly disrupt this fragile and important part of our rural economy and obstruct this vital conservation work.
- Very few groups exist which oppose the use of lead ammunition. The two main groups (RSPB and WWT) hide behind the fact that they are conservation organisations founded in science. Both organisations called for an official process to review the issue of lead. Despite this, they continue to subvert the process and have secret plans to get lead banned regardless of the science.
- The onus should be on those who push for a ban to prove that a ban is required. No further restrictions on lead ammunition, let alone a ban, should even be considered before there is peer-reviewed, UK relevant evidence that lead is detrimental to environmental or human health.

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