

Balmis expedition: the children who carried the smallpox vaccine to America

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Abstract. Although today very few doubt the efficacy of vaccines, when in 1796 the English doctor Edward Jennet demonstrated the efficacy of his smallpox vaccine, not the entire scientific world welcomed the advance with enthusiasm. Among the most fervent defenders of the revolutionary method was the Spanish doctor Francisco Javier Balmis Berenguer from the outset. His enthusiasm led him to lead what can be considered the first humanitarian mission in history, which between 1803 and 1806 brought Jenner's vaccine to America and Asia.

Key words: Balmis expedition; smallpox; vaccination

Introduction

In the 18th century, smallpox had become the deadliest pandemic to hit humanity, also known as the *"black lady"* (1). According to calculations by the philosopher and scholar Voltaire, *"at least 60% of the world's population was affected by this disease and 20% died from it"* (2*). "A poisonous scythe that reaps without distinction of climate, rank or age",* in words of the doctor Timoteo O'Scanlan (3). The disease did not distinguish between sexes, ages or social class and that made it feared both among the poorest and in the aristocratic classes of all countries (4,5).

The survivors were marked for the rest of their lives with highly visible scars, especially on the arms and face. But that, if they didn't get sick again in successive waves. In 1796, an English doctor named Edward Jenner, known as the father of immunology, observed that the incidence of smallpox was lower in rural areas. Specifically, the farmers who milked cows with this disease suffered a less serious type of smallpox, without dying, and most important of all, they were immunized for life. He then experimented with children and corroborated his first observations (4,5). Jenner found a young dairymaid who had fresh cowpox lesions on her hands and arms. He inoculated an 8-year-old boy using matter from her lesions. Subsequently, the boy developed mild fever and discomfort in the axillae. Nine days after the procedure he felt cold and had lost his appetite, but on the next day he was much better. In July 1796, Jenner inoculated the boy again, this time with matter from a fresh smallpox lesion. No disease developed, and Jenner concluded that protection was complete (6).

Then in 1798, having added a few more cases to his initial experiment, Jenner privately published a small booklet entitled *"An Inquiry into the Causes and Effects of the Variolae Vaccinae, a disease discovered in some of the western counties of England, particularly Gloucestershire and Known by the Name of Cow Pox"*. Jenner concluded that cowpox not only protected against smallpox but also could be transmitted from one person to another as a deliberate mechanism of protection. The Latin word for cow is *vacca,* and cowpox is *vaccinia*; Jenner decided to call this new procedure vaccination. The publication of the Inquiry was met with a mixed reaction in the medical community (6,7).

Francisco Javier Balmis

The Balmis operation takes its name in homage to the Spanish doctor Francisco Javier Balmis. He was a military doctor and surgeon who was born in Alicante

on December 2, 1753. Son and grandson of surgeons, from a very young age he felt the family vocation. This led him, upon finishing his secondary studies in 1770, to begin his training in the field of medicine at the Military Hospital in his hometown. There he interned with the senior surgeon for five years. Later he volunteered to participate in the expedition that O'Reilly led against Algiers, where he had the opportunity to attend to a large number of wounded on the battlefield (8,9).

In 1778, after passing the test before the Court of Valencia, he received the title of surgeon and in 1779 he joined the Army to form part of the Military Health Corps. His first assignment was the Zamora Regiment, with which he took part in the siege of Gibraltar in 1780 and in the United States War of Independence (1783) (1,8).

Due to the merits contracted in these last campaigns, he was promoted to the rank of Army surgeon in 1781, and was assigned to America. In Mexico, Balmis was appointed senior surgeon at the Amor de Dios Military Hospital in 1786. There, he conducted research on the treatment of leprosy and venereal diseases (10). Despite the reactionary environment that his theories encountered, he managed to publish his Treatise on the virtues of agave and begonia in 1794, one of whose species - the *Begonia balmisiana* - was later baptized with his name. Also that year he was appointed consultant for surgery of the Army and the following year he was appointed honorary chamber surgeon to King Carlos IV of Spain (1).

Balmis expedition

In 1802, an epidemic of great proportions broke out in the viceroyalty of New Granada (now Colombia, Venezuela, Ecuador and Panama). In Europe alone, it killed 60 million people during that century and its ravages were very evident in America, since its introduction to the continent by the conquerors (4, 5, 11).

The viceroy of New Granada pleaded with King Charles IV for help. Other regions in the Americas were experiencing the same fate, with similar concurrent epidemics. Realizing that the Spanish colonies were being devastated by epidemics of incalculable magnitude, the king called for a meeting of the Council of the Indies. Dr. Flores's recommendations, the King's court physician, included sending a Spanish corvette carrying the vaccine to the New World. The plan to carry the vaccine consisted of the passage of vesicle fluid from child to child. As the skin vesicles began to exude fluid a few days after the initial inoculation, it would be transmitted through skin contact to another child (12). While at court in Madrid, Balmis learned of the discovery of the smallpox vaccine by Edward Jenner. It is from this moment on that his life changes completely, when he gets Carlos IV to approve his project to spread the smallpox vaccine throughout the world: the Royal Philanthropic Expedition of the Vaccine.

The Balmis expedition was a heroic, altruistic and pioneering deed in its time. An unprecedented humanitarian and health action carried out by Spanish health personnel and with royal patronage to deal with smallpox. Jenner himself wrote of the Balmis expedition, *"I cannot imagine that in the annals of history a nobler and broader example of philanthropy is provided than this"* (13).

The Balmis expedition involved a trip that would last for months (in fact, it lasted for three years), so the first problem that arose was that of preserving the sample, which only lasted a few days. The Madrid Gazette explained how the process would be carried out: *"the serum would be transported inside living receptacles, 22 children being successively inoculated arm by arm in the course of navigation, they will keep the bovine fluid fresh and unaltered"* as far as America and the Philippines (12). The idea was to inoculate children between three and nine years old, vaccinating them every nine days to keep the fluid fresh with smallpox two by two (in case there were fatal complications in any of them) with the pustules of those vaccinated the previous week. The plan was reckless and ethically more than doubtful. Children were chosen because, in the absence of tests that did not exist at the time, it could be established with certainty that they had not suffered from smallpox. Not only were they infected with a fatal disease, but they were also subjected to a sea voyage in which many adults did not survive (1,4).

Parents with children who were candidates to be part of the humanitarian mission flatly refused despite the commitment of the expedition to take care of them, provide them with good moral and intellectual

training and financial aid. In view of the crucial problem that he faced in attracting the child population, Balmis had no other choice but to go to orphanages. The 22 children, their rector, and a dozen doctors and nurses, including nurse Isabel Zendal, (considered by the World Health Organization as the first nurse in history to participate in an international humanitarian mission). Of the total of this first group of 22 children, only one lost his life. The rest entered hospices in Mexico to be adopted later (13,14,15).

The Balmis expedition, left on November 30, 1803 from the port of La Coruña for the New World aboard the corvette *María Pita* (16). Figure 1 shows the different routes of the Balmis expedition. The expedition anchored in its first port of call, the island of Tenerife, on December 9, where as soon as it arrived, *"ten infants from the most distinguished families of this island were inoculated"*, according to the Gazette. They were the first to be vaccinated in the mission and from them the vaccine was disseminated to the other islands (15).

In February 1804, the expedition arrived in Puerto Rico and, the following month, in the territory of present-day Venezuela. In May, the convoy was divided into two groups: the first, led by surgeon José Salvany, deputy director of the mission, headed south to distribute the vaccine throughout South America (15,17).

The expedition began with a shipwreck at the mouth of the Magdalena River and was full of hardships and obstacles. Most of its members would not survive. Salvany himself became seriously ill and became blind in his left eye. Finally, he died in the city of Cochabamba in 1810. For seven years he traveled through a territory with great distances between towns and a very hostile geography, which would take its toll on his already affected health, until finally arriving in Bolivia. This is what he reflected in his notes*: "The lack of roads, precipices, mighty rivers and depopulated areas that we have experienced have not stopped us for a single moment, much less the waters, snows, hunger and thirst that we have suffered many times."* Salvany contracted tuberculosis, malaria, diphtheria and lost the sight of one eye; died July 21, 1810 (18).

For its part, Balmis initially moved to the northern part. He was first in Caracas and from there he went to the Caribben and New Spain (present-day Mexico and some US territories) in many cases without the collaboration of local authorities. In February 1805 he left the American territory and sailed from the port of Acapulco aboard the ship Magellan, heading for the Philippine Islands, with a total of 26 Mexican children, with the same purpose of transporting and maintaining the vaccine throughout the journey across the Pacific Ocean, arriving in Manila on April

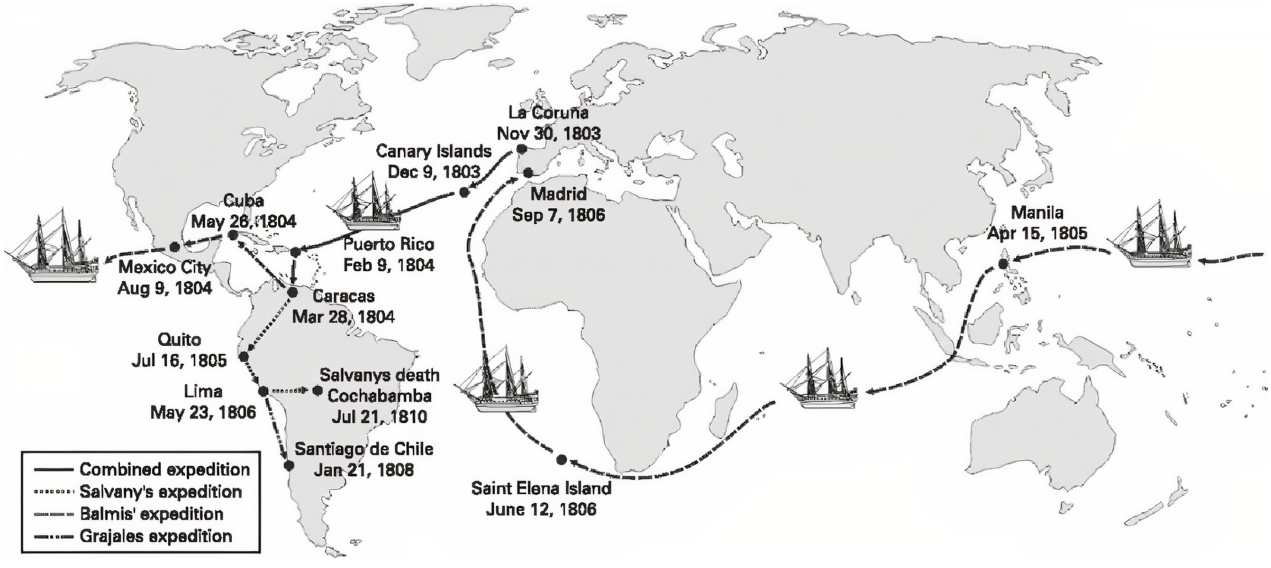

Figure 1. The voyages of the Royal Philanthropic Expedition of the Vaccine. (De : Soto-Pérez-de-Celis E, The Royal Philanthropic Expedition of the Vaccine: a landmark in the history of public health. Postgraduate Medical Journal 2008;84:599-602.

15, 1805. Unlike the Galician children, who were all orphans, most of the new children were not, and families ended up accepting their children's participation in exchange for care, training and economic aid (19).

The doctor was sometimes met with great reluctance among the local population. Not in vain did any parent want to let their healthy children introduce a deadly disease with the promise that (surely) nothing would happen to them. Given the lack of children, Balmis bought slaves, three women and incorporated a child from Cuba. Tomás Romay Chacón (1764-1849) was the doctor who introduced the smallpox vaccine in Cuba. Since 1802 he had been given the task of searching for the disease among cattle without success. In February 1804, he obtained the inoculum from vaccinated children in Puerto Rico (where the vaccine was introduced from the Danish Virgin Islands) and managed to preserve it by transferring it from one person to another. When Balmis arrived in Havana at the end of May 1804, he was pleasantly surprised at the number of vaccinations already carried out by Romay. A Vaccine Board was created, which was directed for three decades during which more than 300,000 people were vaccinated throughout Cuba (14).

In New Spain, he encountered the opposition of the viceroy, so he established several Vaccine Boards, agencies that were responsible for ensuring the freshness and distribution of the fluid, as well as the recruitment of children who had to be successively inoculated, which escaped the control of local authorities (12). After making sure that these Vaccine Boards functioned autonomously and following his guidelines, Balmis left him in charge of the vaccination of the Viceroyalty and the successive expeditions that were organized to the north that took the vaccine to Texas, Arizona, New Mexico or California.

The doctor went to sea again, this time heading for the Philippine Islands, to repeat the American enterprise there. The journey across the ocean must have been terrifying for those twenty young people. Balmis himself was in charge of highlighting the fundamental role of the children and their tutor. In a letter to Minister Caballero, the doctor explained how Zendal *"with excessive work and rigor from the different climates that we have traveled, completely lost his health, tireless night and day, he has poured out all the tenderness of the most sensitive mother, assisting the children entirely in their continued illnesses"* (20). The mission arrived in the archipelago in April 1805. Again, the highest political and ecclesiastical officials did not collaborate, but thanks to their perseverance and the lower-ranking authorities, by early August, nine thousand people had already been vaccinated. Balmis commissioned several of his subordinates to extend the vaccine to the rest of the islands (12).

After the first vaccinations in these Pacific islands, the expedition was divided in two. Balmis began his return to Spain in September 1805 and during his trip he made stops in which he still had time to vaccinate, with prior authorization from Portugal, populations belonging to his colonies in Macao and Canton (current Chinese territories), starting from the October 5, 1805. The rest of the contingent, including Isabel Zendal, remained in the Philippine Islands until 1807, when they returned to Acapulco (1,21).

Balmis went to Macao, then a Portuguese possession, and to Canton and thanks to the three children who went with him, he spread the vaccine throughout Chinese territory. After that, Balmis decided to return to the metropolis, so he had to ask for a loan to pay for a ticket to Lisbon, since he had run out of money. He arrived in the Portuguese capital in February 1806, but not before having left some vaccine on a stopover on the British island of Saint Helena (British Overseas Territory) and took the opportunity to vaccinate the popultion (12).

On August 14, 1806, Balmis finally arrived at the port of Lisbon. From the Portuguese capital, he went to Spain to be received by the kings and their ministers. This official reception took place on September 7, 1806, at the Royal Palace of La Granja de San Ildefonso, where he was effusively praised by all the attendees for the great work done in the service of Spain and humanity.

His return to Madrid took place on September 7. Carlos IV received him in his palace of San Ildefonso, where he showered him with honors and congratulations. What the natrulist Alexander von Humboldt called the *"most memorable voyage in the annals of history"* was over (8).

Thus ended almost three years of challenges and complications that only people with the great values

of those who directed it could be able to overcome. To the initial rejection of the project and the problem of recruiting the first children, shipwrecks, pirate attacks, misunderstandings, lack of support from local authorities (despite being ordered by the king), illnesses and even death had to be added. as in the case of Salvany.

In spite of everything, the results were a success, (21,22) since in the places where it was vaccinated, the positive cases for smallpox decreased considerably. We are facing an epic feat full of ingenuity and sacrifice that constituted the first step in the eradication of smallpox, considered one of the diseases that has caused the most deaths in the world population. In 1980 the World Health Organization declared it eradicated and it is largely due to the contribution made by the Spanish Military Health at the dawn of the 19th century.

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