The great and terrible French emperor, Napoleon Bonaparte once wrote, “An army marches on its stomach.”[1] In other words, without proper food provisions, an army is useless in battle; the same holds true today. Soldiers back in the 19th century had fewer consumable options to work with than that of their modern counterparts. Fruits and vegetables had short shelf lives, breads quickly staled and molded, milk could not be far from the cow, and meat only lasted as long as it was salted. It would not be until after the Civil War that military food rations would begin to focus less on simply survival but more on providing the soldier with healthy and useful options. It was during the Civil War that condensed milk changed the way the U.S. military would feed their soldiers.

For American soldiers, there was nothing more important than avoiding starvation while in combat. Luxuries like flavorful food, the ability for a soldier to have food selections, or at the very least an option that was nutritious and good for the body were second to survival. Prior to the outbreak of the Civil War, tasteless and unhealthy foods were cost effective for governments. Bad rations were cheap to produce and inexpensive to buy, making them all that soldiers had access to while in combat.

The turning point for military rations occurred during the Civil War. The dietary conditions of the soldiers were driven mostly by cost effectiveness and food availability. Since then much has changed, even the definition of a ration. During the civil war a ration was meant to last three days and consisted of two staple foods; bread and meat. The bread was typically a combination of only flour and water. Known as hardtack, it was not nutritious, not flavorful, and

---

[1] Klooster, J., *Icons of Invention: The Makers of the Modern World from Gutenberg to Gates,* (Santa Barbara, Calif.: Greenwood Press, 2009), 103.

hard as a rock. Southern soldiers had “Johnnie Cake” a field-made bread prepared from cornmeal and milk. As for the meat that was consumed by soldiers, it was preserved through salt. While high in sodium, the salt brine stripped away any nutritional value the meat would have under other circumstances, such as vitamins and proteins. There were other rations, but for either confederate or union soldier much rarer to come by, including, dried fruits, vegetables, sugar, and coffee. Soldiers were given individual rations, but those rations were so small that the best way to get ones’ fill was to combine all the rations and divide it evenly.

While both sides struggled to eat anything that would allow them more than mere survival, it would be the Union troops who would gain the advantage. This advantage was the consumption of a higher quality ration. A ration that was easy to move, carry, and was packed with nutrients; condensed milk. Subsequently leading to Union success in the war and forever changing the way the American military made and produced food rations. This monumental change came when Gail Borden developed the first *nutritious* and *durable* food item, canned condensed milk. It was product that was full of healthy vitamins and other nutrients that provided energy to soldiers in combat. It was also easily transported via railroads and able to be carried due to its strong sealed container. Condensed milk was a commodity only the North had access to.

This product provided soldiers with nutrition that had yet to be matched by other rations available at the time. It also was a durable product. Easily transported, quickly produced, with a lasting shelf life, low cost, and more sanitary than anything else. Due to the qualities maintained

by condensed milk, it set the groundwork for all future U.S. military rations. The Civil War set the stage, and condensed milk stole the show.

While the Civil War split the country in ways that still affects race and politics today, it also affected the way we eat. The war transformed old local markets into nationalized industrialized food suppliers. The war also forced the development of the Northern canning industry propelling brands like Borden's condensed milk into everlasting glory. Borden's canned product made it more possible for the North to beat the South and proved its worth in a soldier's diet. The love of the product, its versatility as a ration, dessert, and baby formula made it the food item that all future military rations would be based off. In so far that all future rations in all future wars would maintain the same properties as Borden's condensed milk nutrition and durability.

Condensed milk was the culmination of years' worth of work to be able to preserve and transport food. The demand for humans to preserve their food for longer than natural processes allow has been around for as long as humans have been producing food. Since the dawn of the agricultural revolution, mankind has sought out many ways to keep food lasting longer and provide options outside of the natural cycle. Particularly, seasonal changes like the rainy seasons or winter have prevented the growth of certain staple foods.

Several preservation techniques like the curing and smoking of food items such as meat or vegetables proved to be successful but only to a certain extent. Other types of food preservation like salting, drying, and sugaring were also used to preserve many food products. Such techniques stripped away any nutritional value of the food products as well as any

distinguishable flavors. The demand for food preservation only increased during times of war or crisis. Soldiers, specifically, needed food that would last long durations while they were in foreign lands fighting for their states or leaders.

Not surprisingly, advances in food preservation were made to be an opportunity for profit. It is recorded that in 1795 Napoleon Bonaparte offered 12,000 Franks to any person who could successfully preserve food for the French Army and Navy. Over a decade following this grand offer Nicolas Appert developed a process that would preserve nearly all foods in containers similar to that of wine.[2] Nicolas was a French chef by trade. He had been testing methods of preservation since roughly the mid to late eighteenth century.[3] It would 1809 when Appert would prove successful and utterly change the way food items would be preserved. Foods such as soups, vegetables, juices, fruits, and milk were able to be sealed within containers and last exponentially longer than with if kept with no preservation processes.[4] However, Nicolas Appert did not know why his methods of preservations were successful.

It would not be until the 1850s that Louis Pasteur would discover the existence of microbes and bacteria related to lactic fermentation.[5] Bacteria proved to really be the leading cause of food spoilage and food borne illnesses. Until this development in bacteriology it would

---

[2] Klooster, *Icons of Invention* 103.

[3] Klooster, *Icons of Invention,* 103.

[4] Featherstone, S., *A review of development in and challenges of thermal processing over the past 200 years: A tribute to Nicolas Appert*, (Food Research International, 2012), 158.

[5] Feinstein, Stephen, *Louis Pasteur: The Father of Microbiology,* (Enslow Publisher, 2008), 6.

widely accepted that air and water was the sole perpetrator of food spoilage and illness.[6] For example, cooked meats were immersed and covered in a layer of fat to prevent the penetration of air. Thus, Appert's attempts to preserve food items was a direct response to removing the element of air from food items.[7] It would not be for another year, 1810, that Appert would discover the usefulness and necessity of heat in the best preservation of food items. The containers were put through a process very much like that of wine. They were covered in canvas and boiled.[8] The discovery of heat to prevent spoilage was accurate, but like many other historical discovers, like electricity, there was not true understanding as to why. Thus, making Pateur's discoveries all the more interesting and credible. Appert's discoveries and processes were deemed useful to the French governments and he was awarded the 12,000 Franks.[9] His legacy remains to this day, he is renowned as the father of canning, even though his cans were typically made of glass.[10]

Appert's innovation inspired many aspiring inventors to develop their own methods of food preservation. In 1812 Thomas Kensett developed the first hermetically sealed metal containers otherwise known as the tin can.[11] A hermetically sealed container or space is so tightly closed that no air can leave or enter it. The product inside is separated and protected from very

---

[6] "How Food Spoils UNL Food," University of Nebraska: Institute of Agriculture and Natural Resources, last modified 2017, assessed May 2, 2017, 2017. http://food.unl.edu/how-food-spoils

[7] Featherstone, *A review of development in and challenges of thermal processing over the past 200 years*, 157

[8] Featherstone, *A review of development in and challenges of thermal processing over the past 200 years,* 157.

[9] Hunziker, Otto Frederick, *Condensed Milk and Milk Powder: Prepared for the use of Milk Condenseries, Dairy Students and Pure Food Departments* (LaGrange, Illinois: By Author, 1918), 19.

[10] Savage, William, *Canned Foods: In Relation to Health* (Cambridge, United Kingdom: Cambridge University Press, 1923), 92.

[11] Melnykovich, George. "*A Milestone for an Industry Ancestor*" (National Provisioner 224, 2010), 47.

different outside conditions like microorganism or bacteria that cause food spoilage. The hermetically seal tin cans allowed a product to last longer and maintain a sanitary environment.

The earliest tin plated cans looked a lot like the cans used today; a flat sheet of metal shaped to be cylindrical. Cans were originally made by hand and then manufactured on a mass scale in the U.S. especially during the Civil War. One person could make nearly 100 cans per day, but with modernizing technologies, a factory could produce thousands of cans a day. The cost of tin cans was relatively cheap and only became less expensive as time went on. The amount of metals used reduced as cans got thinner, opening the can got easier, and ever still the can become cheaper.

Oddly enough, it would take nearly fifty years after the invention of the can to the invention of the can opener. Tin cans were initially opened with hammers, chisels, or bayonets. The process of making the can and sterilizing the food was expensive and as a result canned food was consumed mostly by the military. Canned food found a home in the United States during the Civil War. Cans today are made from better quality materials. The original tin plated cans were replaced with aluminum cans. Tin cans were light weight and incredibly easy to transport. Rather than barrels of salted meat or vegetables that were heavy, cans made food much less sedentary and more transportable.

The following year in 1813 John Hall and Bryan Dorkin opened the first commercial factory in England.[12] As the demand for preserved foods increased in Europe, so to did the demand for such innovations in the United States. By 1818 the tin plated can was introduced to

---

[12]Melnykovich,"A Milestone for an Industry Ancestor," 47.

Americans as well as, can making machines.[13] As commercial canning was born, so to was the true development of and success of canning and condensing milk.

For the first time in human history the consumption of milk did not demand being in the direct vicinity of the cow. Mentions of condensed milk are able to be traced back to the endeavors of Marco Polo in the mid 1200's.[14] However, it would not be until the 1850's that milk would be able to be consumed in a nontraditional form. Condensed milk is achieved when the milk of a cow has had its water content evaporated.[15] In addition, if stored properly, condensed milk can last years. This was successfully performed in 1852.[16]

Gail Borden, inventor and entrepreneur from Texas was the first to commercialize condensed milk. Born in 1801, he worked as a Texas surveyor, school teacher, and government official.[17] Borden had a knack for inventing. A few of his most notable inventions include the lazy Susan, the meat biscuit, and a wagon with sales.[18] His product, condensed milk, was revolutionary. It came in a form that was easily transported, with a shelf life of more than a few hours, and with just as much nutrition as raw milk from the cow.[19]

---

[13]Melnykovich,"A Milestone for an Industry Ancestor," 48.

[14] Brooks, Noah, *The Story of Marco Polo,* (New York: The Century Co., 1896), 89.

[15] Frantz, Joe Bertram, *Gail Borden: Dairyman to a Nation* (Oklahoma, United States: University of Oklahoma Press, 1951), 229.

[16] Frantz, *Gail Borden*, 224.

[17] Frantz, *Gail Borden*, 55.

[18] Frantz, *Gail Borden,* 220.

[19] Hunziker, *Condensed Milk and Milk Powder*, 19.

Since milk could only last for short period of time. The modern comforts of refrigeration technologies were not yet developed, making the preservation of highly spoil prone food, like milk, particularly difficult. Joe Frantz writes that it was when Borden was returning to the states in 1851, that he was devastated by the deaths of multiple children due to milks inability to last moderate durations of time.[20]

With the knowledge left behind by Nicolas Appert, Borden knew that heat played a role in keeping food consumable longer. Borden developed a process to do just that. Following in the footsteps of Appert who believed air cause food spoilage, so too did Borden believe that air as well as water caused food and specifically milk to go bad, therefore, with heat and hermetically sealed containers both air and water could be removed from the milk. Borden, like Appert was successful but only be accident, Louis Pasteur later would prove that Borden's use of heat is what actually prevented the milk from spoiling.[21] After many failed attempts of scorched or curdled milk, Borden was forced to figure out a new way to heat the milk without making it inedible. He was inspired by the Shakers of the Northeast and their use of the vacuum pan used to condense fruit juices.[22] With the idea of the Shakers vacuum pan, Borden could successfully evaporate the water from the milk and create a slimy sweet substance, in his patent he wrote, "… concentrating, milk in a vacuum-vessel out of contact with the atmosphere, to prevent incipient

---

[20] Frantz, *Gail Borden*, 136.

[21] Featherstone, *A review of development in and challenges of thermal processing over the past 200 years,*158.

[22] Frantz, *Gail Borden,* 259.

decomposition, or any hurtful change in the constituent elements of the milk during the process of evaporation."[23]

In other words, Borden developed a process that evaporated water and air from the milk with the belief that it was those elements that caused raw milk to spoil. He would heat the fresh milk to at least 185°F for between five and ten seconds.[24] It would not be until later that Borden would begin to add sugar in equal portions to his condensed milk.[25] He wrote, "I do not claim this as my discovery or invention; but what I claim, and desire to secure by Letters Patent, is Producing concentrated sweet milk by evaporation in vacuo, substantially as set, forth, the same having no sugar or other foreign matter mixed with it." By the time he began adding sugar in 1864, he didn't know why sugar worked so well but it would later be discovered that the sugar increased the osmotic pressure which prevents the growth of bacteria.[26] The substance was intended to be mixed with water to again return it to a state similar to that of fresh milk. After this success Borden coined the term "condensed milk" as a name for his revolutionary creation.[27] The final product is then cooled and divided into measured portions and sealed into tin cans.[28]

What made Borden's brand of condensed milk stand out from others was the steep requirements for dairy farmers who wanted to sell their milk to the New York Condensed Milk

---

[23] Borden, Gail, "Patent", United States Patent Office, last modified October, 2006, assessed May 2, 2017, 1856 https://www.google.com/patents/US15553.

[24] "Patent" Borden, Gail.

[25] "Patent," Borden, Gail.

[26] Frantz, *Gail Borden*, 50.

[27] Hunziker, *Condensed Milk and Milk Powder,* 17.

[28] "Patent," Borden, Gail.

Company. In The Dairyman's Ten Commandments, Borden required potential farmers to wash the utters of the cow before her milking and maintain a clean and mostly sanitary environment for the cows. The second commandment reads as follows: "Thou shalt not starve nor stint thy cow for food, nor give her poor, innutrious, or unwholesome food of any kind…"[29] Should a dairy farmer not abide by the commandments set out by Borden, the dairy farmer would not maintain business relations with Borden's companies. The condensed milk that Borden produced was sanitary coming from the cow and even more so once condensed through the heating process and then hermetically sealed in a can. The product was safe and delicious.

Not only did condensed milk provide soldiers the vitamins and other nutrition the Confederates lacked, but condensed milk was also a delectable ration desired by many a soldier. One soldier wrote, "Borden's condensed milk in cans was one of the luxuries invented at this time for our delectation and comfort."[30] Condensed milk was easy to transport, long lasting, and fast to make, condensed milk seemed to be a great option for milk and all consumers. Yet the United States Patent Office did not initially see the value if this new item. Borden was denied a patent three times over the course of 5 years. It would not be until August of 1856 that Borden was finally awarded the official patent for his product.[31] Following this critical milestone,

---

[29] "Papers Past: DAIRYMAN'S TEN COMMANDMENTS," (Bruce Herald, 1885-10-23) 2017.

[30] Tyler, Mason Whiting, *1840-1907, Memoir of Mason Whiting Tyler, in Recollections of the Civil War: with Many Original Diary Entries and Letters Written from the Seat of War, and with Annotated References,* Tyler, William S., ed., (New York, NY: G.P. Putnam's Sons, 1912), 379.

[31] Frantz, *Gail Borden,* 229.

Borden set up shop in Wolcottville, Connecticut.[32] Borden was selling across the region, while innovative; condensed milk did not have a place or demand in the public sphere just yet.

While Borden's condensing process was successful, his business operations were not. Following the failures of the first two factories established by Borden it would only be the third factory that was successful in not failing. Alongside business partner and personal bank Jeremiah Milbank, Borden was able to create the newly titled New York Condensed Milk Company.[33] With the newly found funds, Borden was able to advertise his product in a way that was not previously available to him. He advertised in an issue of "Leslie's Illustrated Weekly".[34] What made this advertisement so successful was that the issue of Lesli's Illustrated addressed the unsanitary conditions of dairy farms.[35] This convenient coincidence caused Borden's sales to increase dramatically. By 1858 Borden's milk was marketed as the "Eagle Brand" of which many are familiar with today. The popular brand was renowned for its "purity, durability, and economy."[36] The public consumers did not see the value in the product and thus, it was not a money maker. Yet, the best sale Borden would make would not be to housewives or families it was to the U.S. government in 1861. The 500 pounds of milk order would be provided to the Union soldiers fighting in the Civil War.[37]

---

[32] Frantz, *Gail Borden*, 234.

[33] Frantz, *Gail Borden*, 246.

[34] Hunziker, *Condensed Milk and Milk Powder*19.

[35] Hunziker, *Condensed Milk and Milk Powder*, 19.

[36] Frantz, Joe Bertram, *Gail Borden: Dairyman to a Nation*, 245.

[37] Fisher, John C, and, Carol Fisher, *Food in the American Military: A History* (Jefferson, North Carolina: McFarland &Company, Inc., Publishers, 2010), 61.

The war began in 1861 and is still considered to have been the bloodiest war in American history. The number of battle related casualties range from 650,000 to 850,000, nearly double the roughly 400,000 lost in the second World War.[38] Not only were hundreds of thousands of lives lost, it is estimated that nearly two million and seventy-five thousand men fought in the civil war. With this huge number of soldiers, the U.S government and the government of the rebellious Confederate states were forced to deal with the heavy burden of feeding all the soldiers. In numerous studies conducted by food historians, it is now widely agreed on that Union soldiers were better fed than that of their Confederate counterpart.[39] The industrial revolution that was beginning to pick up in the more industrial north making the transportation of greater quantities of equipment, weapons, men, and food easier and more efficient.

The tin cans that housed Borden's condensed milk were an ideal packaging for food products. The food is preserved, with a long shelf life, in an air tight environment keeping it fresh, all while marinating the nutritive value. Tin cans are also easy to transport, also across longer distances. Preservative cans made it easier to preserve, transport, sell, and buy food. Canned foods could be sent long distances without spoiling. The development of railroads in the North meant that cans of product, specifically condensed milk were used to transport large amounts great distances without spoiling. Condensed milk was made to be very durable product.

The Civil War was the first war in which railroads were a major factor in the ultimate success of the North, they provided a fast and efficient way of moving large volumes of

---

[38] "Statistics on the Civil War and Medicine," Ohio State University, last modified 2017, assessed May 2, 2017, 2017. https://ehistory.osu.edu/exhibitions/cwsurgeon/cwsurgeon/statistics

[39] Smith, Andrew, *Starving the South: How the North Won the Civil War* (New York: St. Martins Press, 2011), 5-6.

condensed milk to soldiers scatter around the infant country. During the 1850's, the same time as the development of condensed milk, the U.S. had seen an exponential growth in the railroad industry. By 1861, nearly 22,000 miles of track had been laid in the Northern states compared to the nearly 9,500 miles in the South.[40] With an increase in transportation, canned food prices decreased as industrialization increased and new technologies developed that would make the creation of tin cans faster and more efficient. This led to less spoilage; lower transportation costs, people saved money, became easier to preserve foods. When discussing railroads during the Civil War their role is often overlooked. However, railroads were an incredibly vital and important vehicle in the movement of troops and materiel which ultimately enabled the Union to win the conflict.

In 1860, the South was still predominantly agricultural. In 1815, cotton was the most valuable export in the United States; by 1840, it was worth more than all other exports combined. But while the southern states produced two-thirds of the world's supply of cotton, the South had little manufacturing capability and only about 29 percent of the railroad tracks. The south was at an industrial disadvantage.

The south in many respects lacked those industrial properties found in the North. Andrew Smith, author of *Starving the South* argues that the war tactics employed by the north prevented the south from receiving any tradable goods.[41] The Blockade was proclaimed by President Abraham Lincoln in April 1861 stopping the trade of items specifically food stuff. As the war

---

[40] "Railroads of the Confederacy," Civil War Trust, last modified 2014, assessed May 2, 2017, 2017. http://www.civilwar.org/education/history/warfare-and-logistics/logistics/railroads.html?referrer=https://www.google.com/

[41] Smith, *Starving the South*, 5-6.

progressed the blockade crippled the Confederate army as well as the southern Homefront. Dolly Sumner Lunt Burge, a widow who lived in Covington, Georgia wrote in her journal about the trials and tribulations faced by the south. She wrote:

> "Jan. 1, 1864, The prices of everything are very high. Corn seven dollars a bushel, calico ten dollars a yard, salt sixty dollars a hundred, cotton from sixty to eighty cents a pound, everything in like ratio, Nov. 16, 1864, Paid seven dollars a pound for coffee, six dollars an ounce for indigo, twenty dollars for a quire of paper, five dollars for ten cents' worth of flax thread, six dollars for pins, and forty dollars for a bunch of factory thread."[42]

Daily publications also expressed the dire food situation in the south. One paper describes "alternatives foods" such as domesticated animals, snakes, worms, frogs, and locust.[43] The South was starving, and the north had food aplenty, specifically the availability of Borden's condensed milk. While those left in Southern cites were instructed to eat their pets and bugs. The Confederate men on the war front had only a very limited selection at their disposal. They did not have condensed milk and thus lacked nutrition, making them susceptible to illness and disease. Matters were only made worse when the Blockade

The blockade prevented the South from obtaining supplies that were essential to its survival. Salt, which is critical in the preservation of many foods was nearly impossible to find. Lacking such an item meant that the Confederate soldiers were unable to preserve the meat they could find. The Confederates was also unable to commandeer the necessary salted pork or beef. Salt was one of the South's largest imports and there were no other alternatives to be used. By early 1863, a Raleigh newspaper reported that the price of salt had risen from twelve dollars to

---

[42] "The Southern Experience in 19-Th Century America." (Documenting the American South, 2017), 16- 49.

[43] March, William C., "Food and Rations in the Civil War," last modified 2000, assessed May 2, 2017, 1965. http://www.cincinnaticwrt.org/data/ccwrt_history/talks_text/march_food_rations.html

one hundred dollars for a two-bushel sack.[44] Since meat could not be properly cured it left the Confederates with little to fill their bellies and allow them to be adequately nourished for battles. Robert Ransom a confederate soldier wrote in 1863, "Dream continually nights about something good to eat seems rather hard such plenty at the North and starving here."[45] Without condensed milk and limited access to imports, the South was starving and not in a position to win the war.

The Confederate soldiers were not being adequately nourished with their cured pork with no flavor and virtually no nutritional value, sugar was also not common in the diet of the soldiers. Molasses was rare but for the lucky few able to consume it they were much better off than the men who were only dreaming about pre-war food. Randolph Harrison McKim a confederate soldier wrote:

> "Turkey, Ham, Round of Beef, Fresh Beef, Fried Oysters, Lobster Salad-- Hominy, Potatoes, Beans, Salsafy, Rice, Dried Fruit-- Plum-pudding, Charlotte Russe, Jelly, Pound Cake, and Jelly Cake, Puffs, etc., and Java Coffee! That will do for the Southern Confederacy, where everybody is starving!"[46]

It has been argued that without such a strategic naval strategy, the Union would never have been able to win the Civil War. The vitality of the Confederate soldiers was severely impaired by their diet. John Beauchamp Jones, a confederate soldier wrote in 1863, "…nor did the troops diet contribute much to the health of the troops."[47] Because Confederate soldiers did

---

[44] Raymer, Jacob, *Confederate Correspondent: the Civil War Report* (United States: McFarland & Company, 2009), 48.

[45] Ransom, Robert, *1828-1892, Diary of Robert Ransom, March, 1864, in Andersonville Diary: Escape and List of Dead, With Name, Co., Regiment, Date of Death and No. of Grave in Cemetery*. (J.L. Ransom, 1881), 304.

[46] McKim, Randolph Harrison, *1842-1920, Memoir of Randolph Harrison McKim, in A Soldier's Recollections : Leaves from the Diary of a Young Confederate, with an Oration on the Motives and Aims of the Soldiers of the South.* (New York, NY: Longmans & Co., 1910), 362.

[47] Jones, John Beauchamp, *1810-1866, Diary of John Beauchamp Jones, March, 1863, in A Rebel War Clerk's Diary at the Confederate States Capital, vol. 1.* (Philadelphia, PA: J.B. Lippincott & Co., 1866), 392.

not have such a nutritious ration, they were far less capable of fighting or traveling the distances demanded by war. Starvation was just as common as exhaustion. John Yates Beall a confederate soldier wrote in a letter to his wife, “we are weary, hungry, and exhausted.”[48] Lacking many of the nutrients that condensed milk provided, the Confederate soldiers were easily worn down.

Unlike the northern troops, the south did not have access to food rations that were nutritious least of all flavorful. This nutritional advantage came primarily from the consumption of Borden’s brand condensed milk. Andrew Smith writes, "the superior physical stamina of the well-nourished soldiers and sufficient food on the home front helped the North win the Civil War. Borden’s condensed milk and a few other canned products made Union soldiers better fed and arguably better fighters. What makes Borden’s cans of milk extraordinary is that in the 186’s it was able to fulfill all the considerations for modern military rations. Modern rations are provided to soldiers are based on several components. Bernadette M Marriott writes, “… operational rations are designed to provide necessary nutrition regardless of the tactical situation.[49]” She further explains that acceptance, nutrition, wholesomeness, producibility, cost, and sanitation have been the main considerations for the American Military since the civil war[50]. It was a much better food ration than any other food consumed by the Union soldiers.

Union rations such as the 12-oz. pork or bacon or 1lb. fresh or salt beef, 1 lb. condensed milk provided soldiers with better flavor options, as well as, the calories and several vitamins the

---

[48] Beall, John Yates, *1835-1865, Diary of John Yates Beall, August, 1862, in Memoir of John Yates Beall : His Life, Trial, Correspondence, Diary, and Private Manuscript Found Among His Papers, Including His Own Account of the Raid on Lake Erie*. (Lucas, Daniel Bedinger, Montreal, QC: John Lovell, 1865), 297.

[49] Marriott, Bernadette M., *Not Eating Enough: Overcoming Underconsumption of Military Operational Rations. Committee on Military Nutrition Research*, (Washington, DC National Academy Press, 1995), 116.

[50]Marriott, *Not Eating Enough,* 110.

preservation processes stripped from meats. Condensed milk also could provide vitamins to supplement the other field rations such as: 6 oz. soft bread, or flour, or 1 lb. hardtack an aptly named food make solely from flour and water, or 1 lb. 4 oz. cornmeal, 15 lb. beans or peas, 10 lbs. rice or hominy, 10 lbs. green coffee or 8 lbs. roasted coffee, 1 lb. 8oz tea, 15 lbs. sugar, 4 quarts' vinegar, and 1 quart molasses per 100 men.[51] These traditional Union rations hardly provided soldiers with enough nutrition to fight years of battles.

During the war soldiers who returned home or wrote back to their loved ones spoke very enthusiastically about Borden's condensed milk as a field ration. Many at first were spectacle, specifically doctors with the intention of finding a way to feed infants without breastmilk. However, the stories of condensed milk told by soldiers made it more appealing to struggling mothers and doctors who has no other recommendations. The babies who were fed condensed milk as a substitute for breast milk appeared healthy and the soldiers loved it. Thus, the government continued to purchase it. This made condensed milk the civil war most importantfood.

And as the war progressed the demand for Borden's condensed milk increase tenfold. The demand from the government was so intense that Borden was forced to license his product to other manufactures to keep up with the demand.[52] Borden also was forced to build and license his product to more factories. Several of Borden's factories were established in Connecticut, Pennsylvania, two in New York, one in Illinois, and another in Maine by 1861 and many more in

---

[51]Fisher, John C, and, Carol Fisher, *Food in the American Military: A History* (Jefferson, North Carolina: McFarland &Company, Inc., Publishers, 2010), 61.

[52] Hunziker, *Condensed Milk and Milk Powder*, 20.

the 1860s. The Civil War brought a steady and high demand for Borden's condensed milk, and sales grew rapidly. With the success, he was awarded four more patents on condensed milk throughout the 1860s.

Due to the process employed by Borden in his numerous factories, milk was able to be condensed while still maintaining its nutritional value. With Borden's use of the vacuum pans, that only thing removed from the raw milk was the water, thus, the nutrients within raw milk are equally measured in Borden's condensed milk. The nutritional advantages of condensed milk were exploited by soldiers in the midst of battle, but also by the soldiers fighting for their lives after that battles had ended. A union field nurse Emily Bliss Thacher Souder wrote to Mrs. J. Heulings, "It was hard to get it in sufficient quantity… that precious condensed milk, more precious to us at that moment than beef essence![53] We commenced our labors at once in the field hospital of the Second Corps, to distribute milk punch, prepared from condensed milk, an invaluable thing in the hospitals, and to prepare nourishing food for our wounded soldiers… "[54] The nutritional properties did more than just make for better soldier, it saved lives.

Milk in either form provides the body with calcium, a mineral critical to propelling life.[55] However, calcium cannot be made by the body after birth, calcium must be consumed. Calcium allows blood to clot preventing someone from bleeding out. This is necessary intake for soldiers

---

[53] Souder, Emily Bliss Thacher, *1863-1864, Letter from Emily Bliss Thacher Souder to Mrs. J. Heulings, July 16, 1863, in Leaves from the Battlefield of Gettysburg: a Series of Letters from a Field Hospital: and National Poems,* 144.

[54] Souder, Emily Bliss Thacher, *1863-1864, Letter from Emily Bliss Thacher Souder to Mrs. J. Heulings, July 16, 1863, in Leaves from the Battlefield of Gettysburg: a Series of Letters from a Field Hospital: and National Poems.* (Philadelphia, PA: C. Sherman Son & Co., 1864), 144.

[55] "Calcium/Vitamin D," National Osteoporosis Foundation, last modified 2017, assessed May 2, 2017, 2017. https://www.nof.org/patients/treatment/calciumvitamin-d/

who tend to bleed frequents due to a number of causes. Calcium also increases bone density, which allows a soldier to carry his items without snapping bones beneath the weight. Soldiers face very intense physical demands, thus, the maintenance and encouragement of bone health kept soldiers battle ready. Calcium also plays a critical role in both neurotransmitter release and muscle contraction; calcium deficiencies can bring on seizures in otherwise healthy people.[56] Complications from calcium deficiency disease include eye damage, an abnormal heartbeat, and osteoporosis. If left untreated, calcium deficiency could eventually be fatal.

Condensed milk contained vitamins A, C, D, and B^{12}[57] Vitamins and minerals are required to maintain health. Rations consumed during the civil war by soldiers on both sides experienced deficiencies. Thus, a higher nutrient intake was necessary to optimize military performance. Condensed milk made up of the deficiencies in the other rations. While northern hardtack was made from flour which is a good source of protein, vitamins, fiber and carbohydrates, it did not provide soldiers with enough nutrients to make them better fighters. Nor did the Johnny cake, eaten by the south, even come close to hardtack. Vitamin A assists immune functions, vision, and cellular reproduction and communication.[58] For a soldier being able to see is crucial and being able to fight off disease can mean life or death. Luckily, what other rations fail to provide, condensed milk does.

---

[56] National Osteoporosis Foundation. “Calcium/Vitamin D,”

[57] Dupuis, E. Melanie, Nature’s Perfect Food: How Milk Became America’s Drink (New York, New York: New York University Press, 2002), 116.

[58] “Vitamin A: Fact Sheet for Health Professionals,” Office of Dietary Supplements, last modified August, 2016, assessed May 2, 2017, 2016.

Vitamin C is required for brain health, protein metabolism, and is an essential component of connective tissue, which plays a vital role in wound healing.[59] Fruits and vegetables are the best sources of vitamin C, however the civil war soldiers have very little access to any kinds of fresh fruit or vegetable. Vitamin D is needed for bone growth and bone remodeling. While Vitamin D also comes from sunlight, it is simply not enough to ensure bone health.[60] Not to mention the skin damage that results from over-exposure to ultra violet light. Since most soldiers did not have the option of taking a train to their destination, soldiers walked miles. Stress fractures were common as were broken bones from accident or battle related injury. This made bone health critical to soldier.

Vitamin B^{12} is naturally found in animal products, including fish, meat, poultry, eggs, milk, and milk products, but is generally not present in plant foods.[61] The meats and other animal byproducts were stripped of nutrients through their preservations process. The vitamin benefits your mood, energy level, memory, heart, skin, hair, digestion and more, all very important to a soldier fighting in a war.[62] Vitamin B^{12} deficiency include symptoms such as feeling tired or unfocused, a terrible combination for soldiers. With the lack of vitamins in other rations, condensed milk proved to be the best source of vitamins. As for protein, phosphorus,

---

[59] "Vitamin C," Office of Dietary Supplements last modified February, 2016, assessed May 2, 2017, 2016. https://ods.od.nih.gov/factsheets/VitaminC-HealthProfessional/

[60] "Vitamin D," Office of Dietary Supplements, last modified February, 2016, assessed May 2, 2017, 2016. https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/

[61] "Dietary Supplement Fact Sheet: Vitamin B12 "Office of Dietary Supplements -, last modified February, 2016, assessed May 2, 2017, 2016. https://ods.od.nih.gov/factsheets/VitaminB12-HealthProfessional/

[62] "Vitamin B12," Office of Dietary Supplements, 2016.

magnesium, sodium, potassium, iron, riboflavin, and zinc, condensed milk provides all 8 nutrients. [63]

Protein is needed for virtually all bodily functions, especially for muscle health.[64] Phosphorus, like calcium strengthen bones and teeth, both necessary for a soldier to fight.[65] Magnesium is necessary for muscle and nerve function, blood glucose control, and blood pressure regulation.[66] Soldiers often operate in a negative energy balance, meaning they expend more energy than they take in. In stressful and demanding conditions, like war, and with little opportunity for rest or recovery, increased protein intake is essential for quality soldiers. Protein encourages muscle endurance and fine motor skills, a soldier consuming enough protein has high endurance and can last longer in battle all while being able to quickly and efficiently reload his weapon with better motor skills.

Sodium, while plentiful in other rations like salted beef or bacon, still is necessary for the body but not in excess. A human body needs some sodium to function properly, to maintain the right balance of fluids in your body, transmits nerve impulses, influences the contraction and relaxation of muscles.[67] Hard physical work in high temperatures greatly increases the amount

---

[63] "Milk," Dairy Council of California, last modified 2017, assessed May 2, 2017, 2017. http://www.healthyeating.org/Milk-Dairy/Nutrients-in-Milk-Cheese-Yogurt/Nutrients-in-Milk.aspx

[64] "Protein," The Nutrition Source, mast modified 2016, accessed May 2, 2017, 2012. https://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/protein/

[65] "Phosphorus," University of Maryland Medical Center, last modified August 2015, accessed May 2, 2017, 2015. http://www.umm.edu/health/medical/altmed/supplement/phosphorus

[66] "Magnesium," Office of Dietary Supplements, last modified February 2016, accessed May 2, 2017, 2016. https://ods.od.nih.gov/factsheets/Magnesium-HealthProfessional/

[67] "Sodium: How to Tame Your Salt Habit," Mayo Clinic, last modified April 2016, accessed May 2, 2017, 2016. http://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/sodium/art-20045479

of sodium lost in sweat. Civil War soldiers tracked through many hot summer days and fought brutally in many different conditions losing a lot of their sodium. While not the most common deficiency, decreased sodium levels may cause altered mental states. Sodium deficiencies include, physical impairment, headache, lethargy, fatigue, confusion, and hallucinations.[68] All states that would be certain death for a soldier trying to fight for his life in battle.

Potassium, is a type of electrolyte that helps your nerves to function and muscles to contract, it also helps your heartbeat stay regular, and encourages nutrients to cells and waste out of them.[69] Unlike sodium that is lost though sweat due to natural thermal processes like hot days, potassium is lost most significantly during the cold weather. As much work as soldiers did during the hot summer months, the war did not subside while it was cold. Potassium deficiencies lead to muscle loss, muscle cramps or weakness, nausea, diarrhea, frequent urination, dehydration, low blood pressure, confusion, irritability, paralysis, and changes in heart rhythm.[70] Low potassium levels can also lead to death. To combat this loss of potassium, potassium nitrate was developed for curing meat. However, potassium nitrate is better used a gardening fertilizer, and poses many health problems when consumed. Luckily condensed milk had potassium that would ensure that the northern troops would not have to suffer the effects of potassium deficiencies. Overconsumption of potassium can harm those whose kidneys are not fully functional. If the kidneys cannot remove excess potassium or phosphorus from the blood, it could be fatal.[71]

---

[68] Mayo Clinic. “Sodium: How to Tame Your Salt Habit,”

[69] “Potassium,” U.S. National Library of Medicine, last modified March 2017, accessed May 2, 2017, 2017. https://medlineplus.gov/potassium.html

[70] “Potassium,” U.S. National Library of Medicine.

[71] “Potassium,” U.S. National Library of Medicine.

The iron in condensed milk is found in every cell of the body and is needed to make hemoglobin, a part of blood cells.[72] Iron deficiency leads to anemia which occurs when your body doesn't have enough iron to produce hemoglobin. Hemoglobin is the part of red blood cells that gives blood its red color and enables the red blood cells to carry oxygenated blood throughout your body. Iron deficiency anemia may lead to a rapid or irregular heartbeat. A human heart must pump more blood to compensate for the lack of oxygen carried in your blood when you are suffering from anemia.[73] This can lead to an enlarged heart or heart failure. Most frightening of all bleeding to death due to the inability for a wound to clot[74]. Since soldiers during the civil war were often impaled by mortars or shrapnel it was literally life or death as to whether their bodies could clot the injury and allow them hope for survival.

Riboflavin plays a major role in energy production, cellular function, growth, and metabolism.[75] A lack of riboflavin in the body leads to nervous symptoms like numbness of the hands, decreased sensitivity to touch, temperature, and vibration making a lethal deficit for soldiers whose lives depend on their ability to pull a trigger.[76]

---

[72] "Iron in Diet: MedlinePlus Medical Encyclopedia." Last modified December 2015, accessed May 2, 2017, 2015. https://medlineplus.gov/iron.html

[73] "Iron in Diet" MedlinePlus Medical Encyclopedia.

[74] "Iron in Diet" MedlinePlus Medical Encyclopedia.

[75] "Riboflavin," Office of Dietary Supplements, last modified February 2016, accessed May 2, 2017, 2016. https://ods.od.nih.gov/factsheets/Riboflavin-HealthProfessional/

[76] "Riboflavin," Office of Dietary Supplements.

Zinc, like Vitamin A is needed for the body's immune system to properly work, it is critical for cell division, cell growth, wound healing, and the breakdown of carbohydrates.[77] While symptoms can vary, people who have zinc deficiency display poor memory, weakened immune system or constant minor illnesses like colds, a symptom deadly to soldiers who fight in all conditions are face many a disease. Diarrhea and slow wound healing are also side effects of low zinc levels.[78] Zinc is found most prominently in organ meats like liver or heart but like potassium, zinc is stripped from cured meat.

The 12 grams of carbohydrates in condensed milk provide the body with glucose, which is converted to energy used to support bodily functions and physical activity.[79] Carbohydrates provide fuel for your body, organs and brain. When a human drops to an intake below 50 grams a day, your body must find another fuel source. To compensate for low carb intake the body goes into a state of Ketosis. The body has switched to burning fatty acids and is producing ketones, chemicals that fuel the brain, leading to exhaustion, fatigue and irritability, headache, nausea, muscle ache and cramps.[80] In combination with hardtack, which has many grams of carbohydrates, condensed milk is a complimentary product for soldiers.

The 7.9 grams of fat store energy, insulate us and protect vital organs, they also start chemical reactions that help control growth, immune function, reproduction and other aspects of

---

[77] "Zinc in Diet," U.S. National Library of Medicine: MedlinePlus Medical Encyclopedia, last modified April 2017, accessed May 2, 2017, 2017. https://medlineplus.gov/ency/article/002416.htm

[78] Zinc in Diet," U.S. National Library of Medicine: MedlinePlus Medical Encyclopedia,

[79] "Carbohydrates," The Nutrition Source, last modified 2012, accessed May 2, 2017, 2012. https://www.hsph.harvard.edu/nutritionsource/carbohydrates/

[80] "Carbohydrates," The Nutrition Source.

basic metabolism.[81] With lower body weights than men today, natural fats found in condensed milk were critical to the soldier's food intake. Natural fats are also important components of a person's vision. Low fat intake leads to decreased blood pressure and heart rate preceding kidney disease and ultimately failure.[82] No other ration had as much fat as condensed milk. Only if eaten in excess could hardtack meet the same amount of fat.

The 12 grams of sugars or glucose in condensed milk without any additives are the cornerstone of the benefits of this ration. without proper sugar consumption the human body must battle hypoglycemia. Since glucose is the body's main source of energy, a lack there of, may lead to a loss of balance, difficulty with speech and coordination, and potential loss consciousness then death. Without sugar in the diet of a soldier, they risk many accidents.[83]

Due to this nearly miraculous creation the U.S. Government ordered huge amounts of the canned milk during the war. The 14 ounce can Borden was producing at the time contained a whopping 1,300 calories[84]. The ideal caloric intake for active tactical soldiers as defined by the National Center for Biotechnical Information is between 3,250 to 4,600 calories per day.[85] The caloric intake of a person is the food consumed working its way through the digestive track and other bodily functions in order to become the energy the body needs to survive. That energy is

---

[81] "Milk," Dairy Council of California.

[82] "Milk," Dairy Council of California.

[83] "Facts about Sugar," World Sugar Research Organization, last modified 2012, accessed May 2, 2017, 2012. http://www.wsro.org/AboutSugar/FactsaboutSugar.aspx

[84] "Civil War Rations, Hardtack, and Civil War Diseases," Visit Gettysburg, last modified 2017, accessed May 2, 2017, 2016. https://www.visit-gettysburg.com/civil-war-rations.html

[85]Marriott, *Not Eating Enough*, 116.

then used by the body to allow basic bodily functions to be performed, like a heartbeat or cellular reproduction. Failure to consume the minimum caloric intake will always result in a slow painful death aptly named, starvation. While it is true that a healthy human can survive without eating for roughly six weeks, there is no empirical evidence that that person would be capable of fighting in battles, let alone being able to travel there.

Scholars know that soldiers did not spend much of their time in battle, but rather vast amounts of time were spent traveling to destinations and the everyday routine of battle camps. During the war soldiers traveled miles per day through many harsh conditions, condensed milks calories alone made such treks better able to be performed. While the camp food might include some fresh fruits or vegetables much of the soldier's food consisted of a high-calorie cracker, fatty bacon or salt pork and sometimes coffee it was not enough to sustain an army. There was an element necessary to the diet of a soldier, and that element was Borden's condensed milk.

Since the invention of condensed milk and its employment as a military ration was so successful, all military rations since have based their composition of the original product. The two major advantages of condensed milk were its durability and nutrition. The cans were able to be made from quality ingredients in a food safe and fast manner. The durability of the product meant that it could last through almost any condition and for yeas on end. Condensed milk also did not need to be prepared in any specific fashion outside of being opened. It was fast, easy, and a life saver for starving soldiers. The nutrition of condensed milk was rivaled by none. All the necessary nutrients required for life and health were found in a can of condensed milk. Modern

ration research and technology has worked to fulfill what Borden's condensed milk did almost by accident.

Today's military rations have been developed to be much better suited for combat. Otherwise knows today as Meals Ready to Eat or MRE's have replaces archaic salted, and tasteless food.[86] Bernadette M Marriott Ph.D., holds the positions of Professor, Division of Gastroenterology and Hepatology, Department of Medicine and Professor, Military Division, Department of Psychiatry, Medical University of South Carolina (MUSC) writes, "…operational rations that are designed to provide necessary nutrition regardless of the tactical situation." [87] The MRE's allow soldiers to eat while in direct combat without the need for any kind of kitchen set up. Often in self-contained packaging, certain MRE's can utilize chemical reactions to be heated independently. A far cry from the Civil War food rations that either needed to be cooked over open flame, such as, raw salted meat, or quickly became inedible due to mold or rot. Before the scientific and technological breakthroughs of the 20th century, active combat soldiers ate to keep from starving. Civil War soldiers had no choice but to consume food that was barely edible, even by standards at the time.

The durability of modern rations was also lacked by Civil War food except for condensed milk. Today's food rations chosen to be placed in a MRE's do not spoil rapidly.[88] The combat rations have also been expressly created to last years, rather than weeks or months.[89] Due to the

---

[86] Marriott, *Not Eating Enough*, 3.

[87] Marriott, *Not Eating Enough*, 110.

[88] Marriott, *Not Eating Enough*, 3.

[89] Marriott, *Not Eating Enough*, 31.

little technological advancement during the time of the Civil War, there were very few products that would last years. Like condensed milk which could last years unopened, so too can modern rations. The last thing a soldier in combat needs to be concerned about is whether his or her food is spoiled or not. There is a reassurance associated with a quality product, leaving a soldier to focus on battle and survival. Nor do most MRE's require refrigeration.[90] Modern soldiers in combat do not have access to a refrigerator while in the field, like the way civil war soldiers did not have the technology at all. For a product to not need to be kept cool is critical for survival especially where natural conditions conflict.

Today's MRE's rely heavily on their packaging to propel a rations durability. The packaging provided the ability to be easily transported and carried.[91] Especially while facing heat, cold, rain, snow, dust, sand, or any other natural element it may be exposed to. The packaging prevents spoilage or any other kinds of contamination.[92] Except for condensed milk, Civil War soldiers did not have the luxury of sanitary well packaged food ration. Today's MRE's are typically hermetically sealed in plastic bags allowing them to withstand most of the conditions in the battlefield, or even its ability to reach the soldiers in the first place while still intact and edible.[93] Plastic has replaced the tin can in most field rations. Plastic is a more lightweight product that serves the same purpose as a tin can, just a more technologically advanced version.

---

[90] Marriott, *Not Eating Enough,* 7.

[91] Marriott, *Not Eating Enough*, 26.

[92] Marriott, *Not Eating Enough,* 28-29.

[93] Marriott, *Not Eating Enough*, 73.

While the packaging of rations has changed as technology has, one this has remained the same. The need to feed soldiers food that will make them healthier and better soldiers. What good is a soldier who does not have the energy to take up the battle? Modern MRE's are scientifically designed and enhanced to provide soldiers with the energy and stamina necessary to survive. Such foods are designed to nourish and to give soldiers a whole lot of energy for combat. Usually MRE's consist of high calorie count, many nourishing vitamins, large amounts of sugar, and high sodium all to make up for what had been lost during combat. Before food products were genetically modified or infused with nutrients not naturally present in food, there was only condensed milk. No other ration up until that point had as much nutritional value as Borden's condensed milk. The condensed milk had nothing added to it and only water removed leaving all the good stuff behind. The health benefits of milk include increased bone strength, stronger immune system, prevention of illnesses such as hypertension, dental decay, dehydration, respiratory problems, obesity, and osteoporosis. The beneficial health nutrients obtained from milk are essential for the human body and the soldier who is much more active than the average person.

In total, without condensed milk as ration during the Civil War the North would probably still have won the war. The blockade crippled any means of importing goods the south would have had otherwise. The south also was inferior in terms of industrialization. They had far fewer factories and an economy based on the slave labor of agriculture. The few southern railroads were targeted, attacked, and destroyed leaving the south with very few means of transportation. The south also did not have the quality of rations the north had, specifically condensed milk.

Modern military rations may have taken much longer to develop were it not for condensed milk. Luckily, condensed milk was enjoyed immensely considering soldiers in combat had very few options and often eat the same thing three times a day for months. Because soldiers enjoyed the product so much the government continued to purchase it. The success of the product made it the food item all other rations would be based off following the civil war. Today, the MRE is continuously changing and improving as a combat ration. They are tailored to the ever-changing tastes and nutritional needs of soldiers, all because condensed milk was so successful.

Annotated Bibliography:

Arrington, Benjamin T. “Industry and Economy during the Civil War.” (National Park Service 2017.) https://www.nps.gov/resources/story.htm%3Fid%3D251.

This source helped me to explain how much of a disadvantage the south was at in terms of railroads and economy.

“A Short History of the Department of State: Milestones- 1861–1865,” Office of the Historian, 2017. https://history.state.gov/milestones/1861-1865

This source allowed me to support my argument that in addition to condensed milk, the blockade where Union forces blocked Confederate ports to prevent the export of cotton and the import or smuggling of war materiel or salt into the Confederacy, leading to their loss of the war. Thus, allowing the Union to win and propel condensed milk into the spotlight forever changing military rations in the United states.

Bardeen, Charles William, 1847-1924, Memoir of Charles William Bardeen, in A Little Fifer's War Diary. (C. W. Bardeen) 1910, pp. 329. http://solomon.cwld.alexanderstreet.com.ezproxy.csupueblo.edu/cgi-bin/asp/philo/cwld/getdoc.pl?S1593-D003

The memoir of Charles Bardeen allowed me to support my claim that condensed milk could satisfy the modern requirements of military rations. The low cost of modern rations is supported by a statement made by Charles Bardeen who explains the price of Borden’s condensed milk.

Beall, John Yates, *1835-1865, Diary of John Yates Beall, August, 1862, in Memoir of John Yates Beall : His Life, Trial, Correspondence, Diary, and Private Manuscript Found Among His Papers, Including His Own Account of the Raid on Lake Erie*. (Lucas, Daniel Bedinger, Montreal, QC: John Lovell, 1865) pp. 297. http://solomon.cwld.alexanderstreet.com.ezproxy.csupueblo.edu/cgi-bin/asp/philo/cwld/getdoc.pl?S1447-D006

The diary of John Beall and his explanation of being hungry supports my argument that the Northern soldiers were much better off than that of the Confederates. This allowed me to support my thesis that the win of the Civil War by the Union put condensed milk on the radar.

Borden, Gail, Borden’s Condensed Milk Label, 1859. http://infoweb.newsbank.com.ezproxy.csupueblo.edu/iw-search/we/HistArchive/?p_product=ABEA&p_theme=abea&p_nbid=D62S57ATMTQ4OTUwNzQ3Mi4zNDExMjoxOjE

zOjE1OC4xNDIuMTUuOTI&p_action=doc&p_queryname=28193&p_docref=v2:10D2F64C960591AE@ABEA-10F4558FB57A1810@28193-10F87A352C2ABB70@1

The label that was printed on the cans of Boden's condensed milk allowed me explain the importance of condensed milk and one of the justifications for the Union Government making such large purchase of the product. The multiple uses of the condensed milk as well as its durability being in a can made it an excellent option of military rations.

Borden, Gail, "Patent", (United States Patent Office, 1856). https://www.google.com/patents/US15553

Borden's patent that would be the one that was approved by the U.S. Patent Office helped me to explain the process by which condensed milk is made. By doing this I could explain how only water was evaporated from the milk. Thus, retaining all the vitamins and nutrients of raw milk. It supported my argument that the process of condensing milk did not detract from its nutritional value prior to its condensing.

Brooks, Noah, The Story of Marco Polo, (New York: The Century Co., 1896) pg. 89.

The mention of Marco Polo, while slightly antiquated, could fulfill my need to fully explain the history of condensed milk.

"Calcium/Vitamin D," National Osteoporosis Foundation, 2017, https://www.nof.org/patients/treatment/calciumvitamin-d/

The calcium condensed milk contains is critical to the soldier's ability to be an efficient soldier. From allowing the blood to clot to providing strength to bones, calcium was lacked my all other rations during the civil war making condensed milk necessary ad allowed for the North to win the war. Condensed milk with as much calcium as it had, made it the base for military ration research.

"Carbohydrates," Harvard School of Public Health: The Nutrition Source, 2017. https://www.hsph.harvard.edu/nutritionsource/carbohydrates/

Carbohydrates provide the body with energy that is lost during combat. Without the carbohydrates in condensed milk it would have been very difficult for Union soldier to win the war. Another aspect of condensed milk that military ration research would be based from.

"Civil War Rations, Hardtack, and Civil War Diseases," Visit Gettysburg, 2016, Visit Gettysburg, https://www.visit-gettysburg.com/civil-war-rations.html

This source explains the number of calories contained in a 14 ounce can of Borden's condensed milk. Calories are critical to survival of any living creature. For a can of condensed milk to have so many more calories than other civil war rations set the product a part, supporting my thesis.

Dickinson, Henry Clay, *1830-1871, Diary of Henry Clay Dickinson, May, 1865, in Diary of Capt. Henry C. Dickinson, C.S.A. Morris Island, 1864-1865*, (Press of Williamson-Haffner Co.,

1910) pp. 189. http://solomon.cwld.alexanderstreet.com.ezproxy.csupueblo.edu/cgi-bin/asp/philo/cwld/getdoc.pl?S1904-D009

The diary of Henry Dickenson supports my argument that the confederate soldiers were starving as well as, the confederate home front was starving.

Dupuis, E. Melanie, *Nature's Perfect Food: How Milk Became America's Drink* (New York, New York: New York University Press, 2002) pg. 116.

This book supports my thesis, in that, condensed milk had many vitamins that other rations lacked.

"Facts about Sugar," (World Sugar Research Organization, 2017) http://www.wsro.org/AboutSugar/FactsaboutSugar.aspx

The amount of sugar in a can of condensed milk made it essentially an energy drink for soldiers. This helps me support my thesis but also supports my argument as to why the government used the product as a ration.

Featherstone, S., *A review of development in and challenges of thermal processing over the past 200 years: A tribute to Nicolas Appert*, (Food Research International, 2012). pg. 157-158.

This book allowed me to fully explain the history of canning and the notable Nicholas Appert. By providing necessary context I was able to then better explain the process by which Gail Borden condensed and canned his product, as well as, the safety of the product.

Feinstein, Stephen, *Louis Pasteur: The Father of Microbiology*, (Enslow Publisher, 2008) pg. 6.

Louis Pasteur was a scientist who made many discoveries revolving around food and medicine. I use this book to explain the lucky break Gail Borden had when he heated and vacuum sealed his product.

Fisher, John C, and, Carol Fisher, *Food in the American Military: A History* (Jefferson, North Carolina: McFarland &Company, Inc., Publishers, 2010) pg. 61.

This book defines how much condensed milk was purchased by the Union Government. It is significant because without this purchase condensed milk may never had made the impact it did.

Frantz, Joe Bertram, Gail *Borden: Dairyman to a Nation* (Oklahoma, United States: University of Oklahoma Press, 1951) Pg. 50-259.

This book provided me with ample information about the life and accomplishments of Gail Borden.

Freeman, Warren Hapgood*, 1844(?)-, Letter from Warren Hapgood Freeman to J. D. Freeman and Mrs. J. D. Freeman, November 5, 1863, in Letters from Two Brothers Serving in the War for the Union to Their Family at Home in West Cambridge, Mass.* (Cambridge, MA: H.O. Houghton and Co., 1871) pp. 164. http://solomon.cwld.alexanderstreet.com.ezproxy.csupueblo.edu/cgi-bin/asp/philo/cwld/getdoc.pl?S1472-D045

This letter further supports my argument that confederate soldier were starving due to the blockade but also because they did not have access to condensed milk.

Hunziker, Otto Frederick, *Condensed Milk and Milk Powder: Prepared for the use of Milk Condenseries, Dairy Students and Pure Food Departments* (LaGrange, Illinois: By Author, 1918.) Pg. 17-20.

This book focuses on the invention and the industry of condensed milk. It provided me information on the relevant history of Gail Borden and the invention of condensed milk.

"Iron in Diet: MedlinePlus Medical Encyclopedia," U.S. National Library of Medicine, 2017, https://medlineplus.gov/ency/article/002422.htm

The iron found in condensed milk is critical in supporting human life. It supports my argument about the nutritious value of condensed milk in relation of other civil war rations.

Jones, John Beauchamp, *1810-1866, Diary of John Beauchamp Jones, March, 1863, in A Rebel War Clerk's Diary at the Confederate States Capital, vol. 1.* (Philadelphia, PA: J.B. Lippincott & Co., 1866) pp. 392. http://solomon.cwld.alexanderstreet.com.ezproxy.csupueblo.edu/cgi-bin/asp/philo/cwld/getdoc.pl?S1458-D024

This snippet of diary supports my argument that confederate soldiers were starving and that it was damaging to their health. This, unlike what was experienced, for the most part, by union soldiers was critical in promoting condensed milk after the war.

Klooster, J., Icons of Invention: The Makers of the Modern World from Gutenberg to Gates, Santa Barbara, Calif.: Greenwood Press. 2009, pg. 103.

This book highlights great inventors through the ages, particularly Nicholas Appert. I was able to use this source to provide relevant background about the history of canning.

"Magnesium," Office of Dietary Supplements, 2017. https://ods.od.nih.gov/factsheets/Magnesium-HealthProfessional/

Like the other nutrients contained in condensed milk, magnesium is very beneficial to human life. It is just one of the many factors that made condensed milk stand out among the rest of what was available for soldiers during the Civil War.

March, William C., "Food and Rations in the Civil War," 1965. http://www.cincinnaticwrt.org/data/ccwrt_history/talks_text/march_food_rations.html

This source provided with relevant background information of the other food rations that both Union and Confederate soldiers were allotted. With this I was able to draw comparisons showing how much better condensed milk was than other rations.

Marriott, Bernadette M., *Not Eating Enough: Overcoming Underconsumption of Military Operational Rations.* Committee on Military Nutrition Research, (Washington, DC National Academy Press, 1995). Pg. 3-116.

This book describes in great detail the development of rations used by America's military war by war from the Revolutionary period to the present, especially the challenges of preserving

and transporting the food. I was able to use this source to draw comparisons between modern rations and condensed milk during the civil war.

McKim, Randolph Harrison, *1842-1920, Memoir of Randolph Harrison McKim, in A Soldier's Recollections : Leaves from the Diary of a Young Confederate, with an Oration on the Motives and Aims of the Soldiers of the South.* (New York, NY: Longmans & Co., 1910) pp. 362. http://solomon.cwld.alexanderstreet.com.ezproxy.csupueblo.edu/cgi-bin/asp/philo/cwld/getdoc.pl?S1601-D010

Like the other soldier stories, this one is no different. It supports my argument that confederate soldier were starving because they did not have access to condensed milk.

Melnykovich, George. "*A Milestone for an Industry Ancestor*" (National Provisioner 224, 2010) pg. 47-48.

This book provided me a more in depth relevant history of the canning industry.

"Milk," Dairy Council of California, 2017, http://www.healthyeating.org/Milk-Dairy/Nutrients-in-Milk-Cheese-Yogurt/Nutrients-in-Milk.aspx

This source outlines all the nutritious properties contained in condensed milk. It helped me to further my argument about condensed milk being a spurious ration. Ultimately supporting my thesis that due to this property and others condensed milk was the ration that changed military rations forever.

"Office of Dietary Supplements - Dietary Supplement Fact Sheet: Vitamin B12." 2017. https://ods.od.nih.gov/factsheets/VitaminB12-HealthProfessional/.

I used this source to support my argument about the nutritional advantages canned milk had over other rations used during the civil war.

"Office of Dietary Supplements - Vitamin C," 2017, https://ods.od.nih.gov/factsheets/VitaminC-HealthProfessional/.

This source helped me to explain the benefits of vitamin C in the human body as well as the issues that can be faced in the case of deficiency.

"Office of Dietary Supplements - Vitamin D." 2017. https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/.

This source provide me with the information to support my claim that vitamin D is an important nutrient in condensed milk.

"Papers Past: Dairyman's Ten Commandments," (Bruce Herald, 1885-10-23) 2017. https://paperspast.natlib.govt.nz/newspapers/BH18851023.2.16.

This source allowed me to promote my argument that Borden's condensed milk was sanitary.

Phinney, Mary, Baroness von Olnhausen. Letter from Mary Phinney, Baroness von Olnhausen, September 21, 1862. http://solomon.cwld.alexanderstreet.com.ezproxy.csupueblo.edu/cgi-bin/asp/philo/cwld/getdoc.pl?S1010-D003

This letter explains the difficulty faced by the governments in feeding all of the soldiers fighting in the civil war.

"Phosphorus," University of Maryland Medical Center, 2017, http://www.umm.edu/health/medical/altmed/supplement/phosphorus

Calcium, followed by phosphorus is the most abundant mineral in the body. These two nutrients work closely together to build strong bones and teeth, critical to the efficiency of a soldier.

"Potassium," U.S. National Library of Medicine, 2017, https://medlineplus.gov/potassium.html.

Potassium is critical to nerve and muscle function. I was able to take all of these aforementioned nutrients and compare them to the nutrients contained by other rations consumed during the war.

"Protein," Harvard School of Public Health: The Nutrition Source, 2012, https://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/protein/

Protein is a critical component of human life. It makes for strong muscles and healthy blood cells. Again, supporting the nutrition argument.

"Railroads of the Confederacy," Civil War Trust, 2017. http://www.civilwar.org/education/history/warfare-and-logistics/logistics/railroads.html

This source was able to help me support my thesis that condensed milk in cans was easily transported to Northern troops because, it was the north who had more rail than the south.

Ransom, Robert, *1828-1892, Diary of Robert Ransom, March, 1864, in Andersonville Diary: Escape and List of Dead, With Name, Co., Regiment, Date of Death and No. of Grave in Cemetery*. (J.L. Ransom, 1881) pp. 304. http://solomon.cwld.alexanderstreet.com.ezproxy.csupueblo.edu/cgi-bin/asp/philo/cwld/getdoc.pl?S1476-D005

Ransom, a confederate soldier wrote about his yearning to be fed by the North rather than the starving state he was in as a confederate soldier.

Raymer, Jacob, Confederate Correspondent: The Civil War Report (United States: McFarland & Company, 2009) pg. 48. https://searchworks.stanford.edu/view/7812816

Raymer emphasizes the traumatic toll the northern blockade placed on the south. Specifically, the lack of salt which was used primarily for curing meat. Without cured meat to feed the confederate soldiers with it was contributing factor to their loss of the war.

"Riboflavin," Office of Dietary Supplements, 2017. https://ods.od.nih.gov/factsheets/Riboflavin-HealthProfessional/

Riboflavin plays a major role in energy production, cellular function, growth, and development. Given that many soldiers who fought in the civil war were minors, this nutrient supports my thesis. In addition, it supports my argument for the justification of the initial government purchase of condensed milk, as it was also used as infant formula.

Savage, William, *Canned Foods: In Relation to Health* (Cambridge, United Kingdom: Cambridge University Press, 1923) Pg. 92

This was a more entertaining use or sources. Savage named Nicholas Appert the father of canning, and apt title.

Smith, Andrew, *Starving the South: How the North Won the Civil War* (New York: St. Martins Press, 2011) pg. 5-6.

This book details the tactics employed by the North to ensure they would win the Civil War. It helped me to support my thesis that the Northern win and the use of condensed milk as a ration made it an important commodity that would forever change the way the government would feed their soldiers.

"Sodium: How to Tame Your Salt Habit," Mayo Clinic, 2017, http://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/sodium/art-20045479

With the north has access to salt in a way the south did not, the fact that condensed milk had a level of sodium made it critical to soldiers in the north who were not as well off as other northern soldiers. In addition, the sodium in canned milk was critical in military hospitals saving soldiers lives.

Souder, Emily Bliss Thacher, fl. *1863-1864, Letter from Emily Bliss Thacher Souder to Margaret Souder, July 20, 1863, in Leaves from the Battlefield of Gettysburg: a Series of Letters from a Field Hospital: and National Poems.* (Philadelphia, PA: C. Sherman Son & Co., 1864) pp. 144. http://solomon.cwld.alexanderstreet.com.ezproxy.csupueblo.edu/cgi-bin/asp/philo/cwld/getdoc.pl?S1410-D008

Souder explains the importance of condensed milk in military hospitals. Yet another justification for the governments purchase of the product and change in rations.

Souder, Emily Bliss Thacher, fl. *1863-1864, Letter from Emily Bliss Thacher Souder to M. L. Thacher, July 22, 1863, in Leaves from the Battlefield of Gettysburg: a Series of Letters from a Field Hospital: and National Poems.* (Philadelphia, PA: C. Sherman Son & Co., 1864) pp. 144. http://solomon.cwld.alexanderstreet.com.ezproxy.csupueblo.edu/cgi-bin/asp/philo/cwld/getdoc.pl?S1410-D011

Souder explains the importance of condensed milk in military hospitals. Yet another justification for the governments purchase of the product and change in rations.

"Statistics on the Civil War and Medicine," Ohio State University, 2017, https://ehistory.osu.edu/exhibitions/cwsurgeon/cwsurgeon/statistics

Nearly 2 million soldiers fought in the civil war. With this information, I could express the gravity of the food situation faced by both sides.

"The Southern Experience in 19-Th Century America." (Documenting the American South, 2017) pg. 16- 49. http://docsouth.unc.edu/fpn/burge/lunt.html

Again, this source exemplifies the struggles the south faced due to the blockade as well as the lack of condensed milk.

Tucker, Spencer C. *American Civil War: The Definitive Encyclopedia and Document Collection* (United States: ABC-CLIO, LLC., 2013) pg. 290-295.

The amount of time spent in military camps for both the north and the south was far increased than the time spent in actual battle. Due to this it was critical that the soldier be fed so to increase energy and maintain health. This source supports my argument that condensed milk was the best food to consume and gave the north an advantage over the south.

Tyler, Mason Whiting, 1840-1907, *Memoir of Mason Whiting Tyler, in Recollections of the Civil War: with Many Original Diary Entries and Letters Written from the Seat of War, and with Annotated References*. Tyler, William S., ed. New York, NY: G.P. Putnam's Sons, 1912, pp. 379. http://solomon.cwld.alexanderstreet.com.ezproxy.csupueblo.edu/cgi-bin/asp/philo/search3t?dbname=cwld&CONJUNCT=PHRASE&OUTPUT=CONC&word=&CONJUNCT=PHRASE&DISTANCE=3&PROXY=or+fewer&allauthorforms=Tyler%2C+Mason+Whiting

Tyler explains in his memoir that Borden's condensed milk was a luxury for northern soldiers. This supports my claims about the acceptance requirement for modern MRE's that was fulfilled by condensed milk.

University of Nebraska: Institute of Agriculture and Natural Resources, "How Food Spoils UNL Food." 2017. http://food.unl.edu/how-food-spoils

Like many other scientific discoveries made, many of the most important were by accident. Both Appert and Borden believed that air and water were the sole perpetrators of food spoilage. Through this understanding, both developed ways to combat their preconceived notions about spoilage. However, both were wrong but right at the same time. Air and water did play a role but it would Pasteur that would discover bacteria and microorganism that primarily contribute to spoilage.

"Vitamin A: Fact Sheet for Health Professionals," Office of Dietary Supplements, 2017, https://ods.od.nih.gov/factsheets/VitaminA-HealthProfessional/

Since disease was as rampant as mortar wounds, it was crucial for soldiers to be able to have a strong enough immune system to combat illness. Vitamin A, which is found in condensed milk did just that. Making condensed milk very important to military hospital and a lucrative commodity for the Union government to give to their soldiers to win the war. This source supports my argument that the use of condensed milk helped the Union win the war.

Volo, Dorothy, and James M. Volo, *Daily Life in Civil War America* (United States: Greenwood Press, 1998) pg. 116.

This source describes in detail exactly what kinds of rations were given to southern and northern soldiers. With this information, I was able to compare the nutritious value of condensed milk with other rations in order to support my claim about nutrition.

Wormeley, Katharine Prescott, 1830-1908, Letter from Katharine Prescott Wormeley, June 5, 1862, in The Other Side of War With the Army of the Potomac: Letters From the Headquarters of the United States Sanitary Commission During the Peninsular Campaign in Virginia in 1862. (Boston, MA: Ticknor & Co., 1889) pp. 210. http://solomon.cwld.alexanderstreet.com.ezproxy.csupueblo.edu/cgi-bin/asp/philo/cwld/getdoc.pl?S382-D025

Wormeley explained the importance of condensed milk. Following the acceptance argument I made, condensed milk fulfilled the modern requirements.

"Zinc in Diet," U.S. National Library of Medicine: MedlinePlus Medical Encyclopedia, 2017, https://medlineplus.gov/ency/article/002416.htm

This substance supports the immune system, a crucial element necessary to fight off illness.