

SALT AND PEPPER: SIGNIFICANT MEDICAL AND BIBLICAL CONTRIBUTIONS

Samantha Selesny

Like many middle-aged men, my father has hair that is turning gray. Some time ago, people decided to give that look a name: salt and pepper. Salt and pepper, however, is not just a more distinguished reference for “turning older and grayer.” Its reference to someone who has experienced much of life brings a connotation of stability, of something that is comforting and enduring. The real salt and pepper, from which the hair color gets its name, is just as enduring. They have been paired together on tables for years, but their historical significance is rarely considered. The medical and biblical effects of these dinner condiments are numerous and have had great impact on society.

Salt

Salt makes its debut in the Bible at the very beginning of Genesis (1:6). On the second day of creation G-d created a firmament between the upper and lower waters to separate them. Distressed over the physical distance between themselves and G-d, the lower waters complained that they, too, wanted to be like the upper waters that were privileged to remain with Him in heaven and that they did not want to remain on earth with mere mortals. To rectify the situation, G-d promised the salty waters of the ocean that in the future, salt would eventually be an integral component of the sacrifices brought in the Holy Temple, as it is written in Leviticus (2:13), “You may not discontinue the salt of your G-d’s covenant from upon your meal-offering - on your every offering shall you offer salt” (*Bereishis Rabbah* 5:4).

With the Temple no longer standing, we still try to maintain this covenant today through symbolic actions. When eating religious meals, a blessing is recited on two loaves of bread that rest on a tabletop, which represents an altar. The loaves are accompanied by salt to symbolize the sacrificial worship that took place in the Temple. Furthermore, salt strengthens a person’s health so that he may serve his Creator more vigorously (*Shulchan Aruch Orach Chayim* 167:5).

Salt becomes significant once again prior to the blessing that we recite after meals, commonly known as *Birkat Hamazon* (*Erwin* 17b). The Rabbis deemed it obligatory to wash one’s hands before this blessing, not for symbolic reasons, but rather for medical pur-

poses. They considered a certain Sodomitic salt that causes blindness if exposed to the eyes. This blindness occurs because of the osmotic properties of salt. Osmosis is the movement of water molecules through a selectively permeable membrane into an area of higher concentration of solute. This is in order to preserve an equal balance of solute concentrations on both sides of the membrane [1]. When a highly concentrated salt solution (in this case, Sodomitic salt) is placed upon living tissues of the eye, water flows out from the ocular cells to maintain solute equilibrium. A significant amount of water is lost from the cells causing permanent damage to the eye (Tosefet Chulin 105a) [2].

Although the osmotic property of salt is a fascinating process, perhaps the most incredible Biblical reference to salt is the transformation of Lot’s wife into this substance.

The osmotic property of salt also manifests itself in another part of Judaism: koshering meat. The Bible explicitly prohibits any consumption of blood: “Any person who consumes blood will have his soul cut off from its people” (*Leviticus* 7:27). To remove blood from newly slaughtered meat, a *shochet* (ritual slaughterer) uses the osmotic property of salt to create a hypertonic, or relatively highly concentrated, salt solution. When applied, the blood is drawn from the meat. Because of the large quantities of blood present in the animal, a *shochet* needs to salt heavily, using larger grains of salt than those of common table salt. This heavier, more capable salt that is used is now called “kosher salt” because of this particular use. Although it is crystallized into larger particles when processed, kosher salt is chemically identical to all other pure forms of salt [3].

Although the osmotic property of salt is a fascinating process, perhaps the most incredible Biblical reference to salt is the transformation of Lot’s wife into this substance. When G-d destroyed

the evil-ridden city of Sodom, raining upon it “sulfur and fire” (*Genesis* 19:24), He mercifully allowed Lot and his family to escape this terrible fate on the condition that they not turn back and view the destruction of their fellow man. Disobeying G-d’s command, Lot’s wife turned around to view the demise of the city’s inhabitants and as a punishment, was immediately transformed into a pillar of salt (*Genesis* 19:15-26). Scientifically speaking, a rapid change in the homeostasis of Mrs. Lot must have occurred for this chemical mystery to take place. To explain this phenomenon from a chemical perspective, we must recognize that the term ‘salt’ used here may not be referring to sodium chloride (NaCl), which we have been discussing until now. Rather, Lot’s wife may have turned into a different salt, calcite (CaCO_3), which is unlikely to be found on our tables.

Solid calcite is formed through a very favorable relation between aqueous calcium cations, Ca^{+2} , and carbonate anions, CO_3^{-2} . It should be noted that the solubility product of $[\text{Ca}^{+2}][\text{CO}_3^{-2}]$ is 4.57×10^{-9} , where brackets represent concentrations of the respective species. This value indicates the very low solubility of calcite, which further decreases when the temperature is increased. CO_3^{-2} is also important in regulating blood pH. In order to maintain proper blood pH, the concentrations of CO_2 , CO_3^{-2} , HCO_3^- , and H_2CO_3 , must be maintained, as shown in the equilibrium:



Heightened levels of CO_2 force the equilibrium backwards (to the left), which raises blood pH. To connect the concentration of calcium with the concentration of CO_2 , we use the equation: $[\text{Ca}^{+2}][\text{PCO}_2]/[\text{CO}_3^{-2}] = 1.55 \times 10^{-5}$, which combines the carbon dioxide pressure (PCO_2), the free calcium cation concentration, and the precipitous appearance of CaCO_3 . Furthermore, about half of the Ca^{+2} in the human body is bound to plasma albumin. Lowering the pH drastically reduces this interaction, freeing these cations into the blood stream. A high concentration of CO_2 and of free calcium cations, along with an increased temperature, results in a high precipitation of CaCO_3 [5].

With these facts in mind, two events must have occurred with regard to Lot’s wife. Firstly, because of the high temperatures radiating from Sodom, Mrs. Lot’s body temperature must have risen because of her proximity to the fiery destruction. Secondly, she was hit in the face with a large blast of CO_2 when she turned around. The high temperature denatured the albumin to which calcium was formerly bound, and the rise in CO_2 concentration lowered her blood pH, creating elevated concentrations of free calcium cations. This surge of calcium cations coupled with the invasion of CO_2 into her organs, along with the subsequent rise in blood pH, possibly triggered a massive scale formation of solid

calcite throughout her entire body. Lot’s wife was transformed into one large pillar of salt [4].

Pepper

There are several varieties of pepper, but the one used as a condiment is generally black pepper, derived from the vegetable, *Piper nigrum*. This form of pepper is the world’s most widely used spice [5]. Pepper possesses several qualities that can be attributed to one of its chemical components, piperine. Piperine is an alkaloid of pyridine, which gives pepper many of its specific characteristics. The qualities of black pepper give it not only positive taste-related properties, but contribute to a variety of favorable physiological effects, as well. In recent studies, piperine has been shown to enhance the bioavailability of therapeutic drugs by increasing their plasma half-life and delaying their excretion. Piperine also possesses an antioxidant effect. Oxygen radical injury and lipid peroxidation are suggested as major causes of cancer. Reactive oxygen species generated from chemical carcinogens can cause cell damage and in turn stimulate the process of carcinogenesis. Antioxidants have properties that inhibit this oxidation. Piperine protects against oxidative damage by preventing the formation of reactive oxygen species and lipid peroxidation [6].

Furthermore, piperine has a positive influence on the gastrointestinal system. It improves intestinal motility and it enhances intestinal functioning by increasing the length of the intestinal microvilli. The increased length raises the absorptive ability of the small intestine. This property enhances the efficient permeation of nutrients through the epithelial cell barrier and thereby increases the absorption of nutrients [6].

Talmudic scholars refer numerous times to the benefits of this spice. In Shabbat 90a, pepper is identified as a sweetening condiment, and a mixture of wine, honey, and pepper was a delicacy served to dinner guests. It also functions as a deodorizer of bad breath. Bad breath is listed as one of the imperfections that prevents a *kohen*, or priest, from serving in the Holy Temple. A treatment to remedy this physical shortcoming was to place pepper in his mouth, which enabled him to successfully continue his duties (Shabbat 90a). Pepper is elsewhere identified as beneficial for the entire body, not just the mouth, and to improve overall health (*Pesachim* 42b), as shown in modern day studies.

Rabbis have also deemed it important to discuss the *kashrus* of pepper, which draws attention to its significance in Judaism. Although pepper is naturally kosher because it is a botanical, it is important to note that as a spice, it must be checked that it does not harbor any insects, which would deem it non-kosher. The method of drying spices, as a means of preservation, can also pose interesting *kashrus* issues. Since most spices that are dried in

their original countries are dried in the sun or hot air equipment specifically made for those products, there are little concerns. However, freeze-dried spices pose a special *kashrus* concern. In the process of freeze drying, much of the equipment used is often not specifically reserved for spices and may be used for other non-kosher foods. Therefore it is important that pepper, or any spice, have a reliable *mashgiach*, or supervisor, overseeing the drying process [3].

While salt and pepper may seem mundane when compared with other spices, they have been a part of religion, medicine and history like no others have. They have been staples of both diets and rituals for thousands of years. While other spices are stored away in kitchens and pantries, salt and pepper almost always sit in special shakers in the middle of every table. This place of honor provides just a hint of the importance that salt and pepper have maintained in people's lives and beliefs for generations. ■

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REFERENCES

- [1] Kotz, J.C., P.M. Treichel, and P. Townsend. (2009). *Chemistry and Chemical Reactivity*. 7th edition, United States: Brooks/Cole.
- [2] Levi, Y. (2004). *The Science in Torah*. Jerusalem: Feldheim Publishers.
- [3] Blech, Z.Y. (2004). *Kosher Food Production*. USA: Blackwell Publishing.
- [4] Klotz, I.M. (1988). The Chemical Death of Lot's Wife: Discussion Paper. *J. Royal Soc. Med.* 81:397-398.
- [5] A. Dyer and A. Palmer. (2004). *Piper: A Model Genus for Studies of Phytochemistry, Ecology and Evolution*. New York: Kluwer Academic/Plenum Publishers.
- [6] Srinivasan, (2007). K. Black Pepper and its Pungent Principle - Piperine: A Review of Diverse Physiological Effects. *Crit. Rev. Food Sci. Nutr.* 47:735-748.