



Cultural, Behavioral, Social, and Psychological Perceptions of Saliva: Relevance to Clinical Diagnostics

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ABSTRACT

The search for a resource that can be used to detect a broad range of diseases easily and reliably is akin to a search for the diagnostic Holy Grail. Yet, each of us may have inside our mouths, a key to the pathological and disease biomarker library hidden inside our bodies. Saliva — the source of all this information — is the secretory product of glands located in or around the oral cavity. If one could read the stories of diagnostic information present within saliva, then the abundance of information waiting to be found could be comparable to a vast vault of information, such as the Internet.

Upon dissection of this data, it would be seen that the source of this information is from saliva's origin as a filtrate of blood, and that the validity of both mediums should be equal. Although one day this may be the view, most people's hold of saliva, current and past cultures, have fared much more diverse meanings to the secretion. Ivan Pavlov's experiments has shown how closely tied salivation is with the thought of food, one of life's primary indulgences. The relationship between salivation and behaviors within our daily lives is undeniable. Yet most people never appreciate the uniqueness of saliva. Throughout the world, saliva carries definite positive and negative connotations, based upon its social, psychological, behavioral, and cultural settings. The thought of saliva may be viewed as grotesque in one population, yet may be the vehicle of blessing in other cultures. Saliva's double nature brings up some interesting cultural, social, behavioral, and psychological points about how saliva is perceived in the world, some of which are subsequently stated in order to present saliva as the spirited fluid it is.

Some of the history for saliva's negative views stem from the discovery that saliva may carry airborne pathogens and respiratory diseases. This stemmed from various events throughout history around the world. Early in the mid-19th century, spitting in public was commonplace, usually associated with chewing tobacco. The turn from its socially acceptable position toward being shunned started in the mid-19th century, when human saliva was placed under the light microscope and was found to contain microorganisms and germs. The surge in placing saliva in a negative light continued during the late 19th century when the famous German physician



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Figure 1. Infant salivating, a lovable sight to a parent.



Figure 2. South America tradition of “chicha” using the digestive and fermentative properties of saliva.



Figure 3. The “Evil Eye,” the source of misfortune in Greek culture. Spitting is an effective way to ward off the evil eye.

Robert Koch discovered samples of sputum was found to harbor *Mycobacterium tuberculosis*, the deadly bacteria responsible for the widely spread disease of tuberculosis at the time.¹ Influenza and other respiratory pathogens soon were discovered to also be transmissible through respiratory droplets originating from infected individuals. Although saliva may, in fact, be the medium by which some diseases spread, it is merely an innocent vehicle. The phlegm and mucous from the respiratory tract is the original source of bacteria and viruses. It is arguable that saliva is not the problem; sputum is the true culprit and so saliva should not be automatically tied with germs and disease.

Social

Although ~1.5 liters of saliva is being produced by the salivary glands into our oral cavity daily, salivation, with the rare exception of infants and toddlers (Figure 1), is often perceived as socially inappropriate or even unacceptable. In America, accepted practices of spitting are usually reserved for sports athletes. In baseball, America's favorite pastime, spitting is a common practice in the dugout or on the field. Although commonly associated with chewing tobacco, the act is also a gesture of machismo, and even by players who are not chew-

ing. Pitchers spit on the mound; batters spit onto their hands, all in attempt to gain good luck. Football players are viewed as some of the toughest athletes in any sport, so it would not be uncommon to view them spitting on the field during a heated and competitive match. Basketball players such as the legendary Boston Celtics Larry Bird, is often remembered for spitting on his hands for good luck at the beginning of every game. Spitting is present even in the exclusive world of golf, where there are superstitions to spit over a bridge or onto one's shoes for good fortune.

Spitting in public, however, is seen as rude and, sometimes, offensive. The expectoration of saliva is generally not seen as being politically correct. In a motion of disrespect, spitting may also be used as the popular choice for an offensive gesture. Sayings such as “I spit on you” or “I spit on your grave” precisely convey those connotations. In the Mexican culture, “spitting on a parent” is a form of elder mistreatment, a form of family violence. However, in other cultures, saliva is much more intimately tied with common beliefs and rituals.

In South America, a tradition that originated with the Incans persists today. Women in Peru, Bolivia, Venezuela, and countries along the Andes continue the process of fermenting manioc root, maize,

or fruits into the intoxicating alcoholic “chicha,” using the digestive and fermentative properties of their own saliva (Figure 2). It is believed the amylolytic enzymes present in saliva convert starches within the plants into fermentable sugars. In fact, the name chicha is derived from the Spanish word “chical,” which is loosely translated as “to spit” or “saliva.”²

Hundreds of years ago, the drink was of great importance to the Incans. South Americans today still view it as an essential part of their culture. The Incans widely used the drink during their rituals, and chicha eventually became as valuable as gold itself as the drink was commonly sold as a key economic currency within their society. Today, chicha is still used among the Amazonians as a staple within their diets, as well as a work incentive and social drink. Although there are more modern ways to ferment the maize or other products, it is commonly believed the unique sour taste of chicha is lost if no contact with human saliva is made, a property that may be conferred from the presence of *Lactobacillus* bacteria within the sputum of donating women.

Ritual

The Greeks also have had long-standing traditions with saliva and the act of spitting. Generally, Greeks will

spit to ward off bad luck in hopes of good luck and well-being. The source of misfortune is usually believed to originate from the “evil eye,” thought to be a shadowing entity of bad luck and evil (Figure 3). It is believed that two ways of effectively warding off the evil eye are large quantities of garlic, or the more commonly practiced gestures of spitting. Spitting is commonly seen during ceremonious events. The source of this gesture is thought to be within the Greek Orthodox Church and the blessing of the Holy Trinity. During the ceremony of baptism, the priest will usually bless a child with holy water, after which he will spit three times on the ground to represent the Holy Trinity in renouncing the devil. This blessing is also carried on during Greek weddings, where the guests will gingerly spit on the bride to project their blessings and good fortune. Spitting also has its place in everyday life. Greek fisherman will commonly spit onto their nets before hoisting them over the bows of the ship to ward off any evil that may prevent them from catching a bountiful yield. The popular response to a compliment may be three spits to the ground. It is also common in Greek culture to make three spitting gestures onto their clothing and onto each other during greetings in order to ward off the infamous evil eye. Thus, the act of spitting is widely present in proper Greek etiquette.

Health and Medicine

Nowhere is saliva more integrated within celebratory rituals and as a form of alternative medicine than in various tribes of Africa. Different tribes may use saliva, pure or mixed, with traditional medicines, in a minor part of their healing treatment, where others may use saliva in large contribution, regarding it as the cure-all for most ailments. For example, the Somali use saliva as

Spitting

It is customary for Greeks to spit as a way to ward off evil, and particularly the evil eye (*mati*). It is not the typical sportsman spitting; it is very subtle and hardly any spit comes out. Greeks are often seen uttering “*ptousou*” when they feel that the evil eye could dawn upon something.

For instance, when attending a Greek wedding, the focus is usually on the bride. Everyone is looking at her, some with envy, which could possibly provoke the evil eye. Greeks usually spit and say “*na me se matiasou*,” which generally means one will not cause the evil eye to dawn on the bride. This is also common when buying a new car or house. Greeks spit to take off the evil eye that could be caused by jealousy (*evil*).

From: <http://www.europeans.co.za/cafeneio/superstitions.htm>

the primary remedy for an open blister.³ To alleviate the pain and swelling of snakebites, the Somali usually treat the ailment with mixed butter and saliva.⁴ Within other tribes, such as the Azande of Sudan and the Masai of East Africa, saliva may be used as a first-aid astringent for minor wounds, alone or mixed with herbal plants, respectively.⁵ The Bena of Tanzania use saliva to treat boils, and mothers of the Masai tribe use it to treat insect bites and swelling.⁶ The primitive, yet abundant, source of saliva makes it an easy medicinal agent for common ailments.

In other parts of Africa, saliva carries a more spiritual meaning. It is believed within the Wolof tribesmen that saliva may confer blessings and curing properties from the source to the target.⁷ The theory behind this parallels the beliefs of homeopathy, in which water is able to retain the memory and essence of its source. Therefore, following the birth of a child, it is common practice to invite the newborn’s elders to bless him or her with their salivary secretion. The female elder graciously spits on the newborn’s face and the male elder spits into the ear and rub his saliva across the infant’s face, as a welcome into the world.⁸ Similar rituals of direct salivary inoculations occur within the people of Ashanti in Ghana, where the spiritual enlightenment of

an infant is brought about through the grandfather spitting into the mouth of the newborn.⁹ Saliva is not viewed as a medium for disease transmission, but instead as a mode of passing on spiritually, curing properties, and life.

In Asia, the act of spitting may date back to 4,000 years ago when the betel nut (an areca nut, betel leaf, and lime mixture) was habitually chewed in Thailand, India, Philippines, Taiwan, and Indonesia. This legal stimulant is likened to chewing tobacco. The exotic drug releases plant alkaloids, which are readily absorbed through the mucous membranes of the mouth, causing excessive secretions of saliva.¹⁰ This effect is clearly visible as the saliva is reddish-brown in color. Spitting is recommended since swallowing can produce an uncomfortable burning sensation. Betel nut chewers find the drug pleasurable, aromatic, and cleansing. The streets of Taiwan and India are noticeably stained with reddish splotches from this habit. Besides in the practice of betel nut chewing, the act of spitting is a traditionally accepted practice in Asia, regarded as an appropriate component of good personal hygiene. In large cities with severe air pollution, coughing and spitting is widespread due to the need to remove phlegm and clear the throat.

More recently, however, much is

being done to decrease the act of spitting. After the severe acute respiratory syndrome outbreak in 2003, China sent 1,000 sanitary workers to Guangzhou City to monitor public spitting to prevent further spread of SARS. China, Hong Kong, and Taiwan have since launched many campaigns to discourage the “filthy” act by issuing fines and summons to any public spitters. The desire to reduce this practice on public streets has resulted in strict government fines of up to \$5,000 in Singapore¹¹ (Figure 4). Whether or not these fines are warranted remains arguable, but the shift from spitting as a natural part of life toward a more serious link with death is the current trend.

Psychological Aspects

Darwin's Theory

In any culture, a kiss is seen as a heavenly gentle gesture, shared during the most intimate of settings. Yet, in order to appreciate the joys of kissing, one must inevitably make contact with the other person's saliva. People are generally willing to undergo the act with a loved one, yet are more reserved about the thought of kissing a stranger. Pet owners may allow their own pets to lick them, yet the affection of other pets may be rejected. A certain amount of trust or an intimate bond between two entities is required to get over the idea of sharing saliva with another being.

Throughout the history of mankind, this selective nature may have evolved as a method of protecting oneself from being exposed to the many potential diseases carried within saliva. However, the persistence of the act must hint toward the presence of positive benefits as well. Perhaps, kissing not only spreads noxious bacteria to the organism, but also bacteria that may actually be beneficial

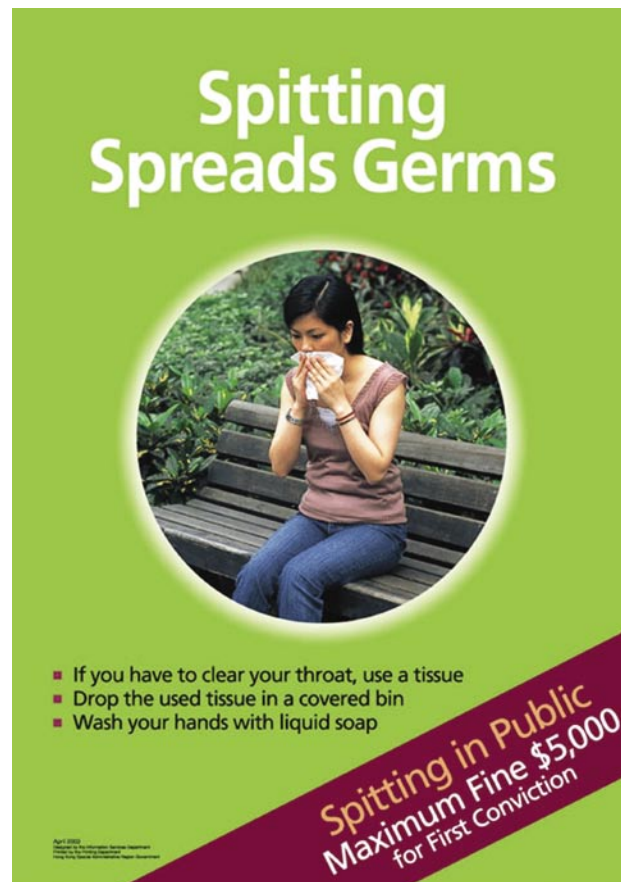


Figure 4. “Don’t spit” fliers in Asian countries, (courtesy of the Hong Kong Special Administrative Region Government).

to it. In nature, it is widely observed in various animals that a mother will inoculate her offspring by covering them with her own saliva within the first few hours of birth. This ensures the passing of vital bacteria and antibodies that will assist in the offspring's digestive and immune functions without which may lead to a loss of certain immune functions. Saliva may play an additional role during infancy by having a large influence on the development of an individual's future social behaviors. Scientists have observed that among Mongolian gerbils, cues within saliva play a key factor in deciding the response behaviors between the young and the old, parents and offspring, and males and females.¹²

Perception

Although most people do not have a problem sharing saliva during kissing, there is a much more conservative view in sharing inanimate objects associated with saliva contact. A toothbrush, a spoon, and even a straw are all objects that are taboo to share, simply because contact has been made with someone else's saliva. The psychological disconnection between saliva inside the mouth, and saliva exposed to the outer environment may be due to the way our mind sees a difference between saliva that has passed beyond the mouth and saliva that remains within the confines of our bodies. Dr. Gordon Allport, a social psychologist from Harvard, depicted a scenario in

his book, where if one were asked to drink from a cup that had previously been filled with saliva from the same individual, how hesitant would one be to drink his or her own saliva.¹³ Allport hypothesized that although the saliva came from the same person, the saliva became nonself and alien to the mind the moment it exited the mouth. This modification in perception may be the leading factor in why people may have difficulties adjusting to the fact that saliva has true and viable diagnostic information about the internal body from which it came.

Science and the Future

When evaluating saliva on a molecular level, saliva contains mostly water. It is fitting that saliva is predominantly composed of the essence of life, since saliva is the vehicle for so many things relating to it. Saliva is also composed of various constituents, which confer numerous properties to the rich medium, many of which are crucial in everyday acts of living. Among the top functions of saliva include antibacterial roles through peroxidases, mucins, and cystatins; buffering roles using carbonic anhydrases and histatins; digestive functions using amylases, mucins, and lipases; and the more obvious role of lubrication through mucins and statherins.

The importance of this heterogeneous mixture cannot be understated. Yet, the robust duties of saliva are commonly taken for granted and only truly appreciated when the precious medium is not found in abundance within the mouth, as in radiation or oral cancer patients. It is within these individuals where speech and severe eating difficulties routinely surface. It becomes extremely difficult for patients with minimal salivary flow to eat normal everyday types of food, such as bread, meat, and other solid foods due to the difficulties in chewing and swallowing.¹⁴

Along with sacrificing some of the comforts of life, functional pathologies within the oral cavity also quickly begin to emerge. Cavities are much more prevalent in patients with lowered salivary flow due to the loss of salivary bathing of the teeth, which normally confers a buffering role and antibacterial medium. Fittingly, Frank Oppenheim, chairman of the department of periodontology and oral biology at Boston University, summarized the importance of saliva's constituents with the statement, "If saliva were (merely) water, we would have little stumps of teeth or no teeth at all by age 20 — we would have dissolved our teeth away."¹⁵

The functional value of saliva has long been thought to outweigh the diagnostic possibilities. More recently, however, the evidence for using saliva as an accurate diagnostic tool in diseases such as HIV, various forms of cancer, diabetes, arthritis, and heart disease show there is much more information in saliva than previously thought. With the abundance of information that may be contained within, saliva might possibly play an even greater role in the daily lives of people.

Scientists are slowly transitioning from viewing saliva as a diagnostic outcast in comparison with blood or urine, and are starting to view saliva as an abundant valuable resource. The advantages of using saliva testing as a diagnostic tool are due to its noninvasive nature, in addition to the quick and reliable results.¹⁶ The current trend in the psychology of scientists is leaning toward saliva being seen in a positive light, with the potential for extracting data higher than ever.

However, there may be cultural perceptions that form barriers against that which professionals already are beginning to discover, and those will slowly be overcome inevitably with time. Four

articles in this issue of the *Journal of the California Dental Association* highlight the exciting science that is emerging from the utilization of saliva as clinical diagnostic fluids. The gap between saliva and other disease diagnostic biomedica (blood, urine, cerebral spinal fluid, tear, nipple aspirate, fecal matter) is rapidly closing. This is primarily due to the rapidity of the emerging sciences, sparked by the initiatives from the National Institute of Dental and Craniofacial Research. Scientific data to benchmark the diagnostic value of saliva against other biomedica will be necessary to assess the disease discriminatory value of saliva. It may well turn out that, similar to the recent finding that saliva is more accurate than blood for oral cancer detection, saliva diagnostics will outperform other biomedica for other disease diagnostics as well.^{17,18} This is the quest.

Summary

In summary, it is clear that saliva, due to its readily available nature and noninvasiveness, has historically been associated with a Dr. Jekyll-Mr. Hyde personality. However, when one closely and carefully examines the undesirable associations of saliva, one often concludes that links are largely mythical in origin and/or unscientific. The positive values of saliva, on the other hand, are scientifically based and continue to emerge. If the scientific values and diagnostic utilities of saliva is as good as or better than other bodily biomedica, it will be clear that its ease of obtainment, total noninvasiveness, ease, and pleasantness of use compared to other biomedica (blood, urine, cerebral spinal fluid, tear, nipple aspirate, fecal matter) will and should eventually place saliva as the biomedica of choice in clinical diagnostics. The day when saliva is considered a diagnostically diverse and charismatic fluid should not be far away. CDA

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