How Does Pork Prepared in Various Ways Affect the Blood

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An Investigation via Live Blood Analysis

Traditional preparation of pork involved salt-curing followed by smoking to preserve it, or marinating fresh pork in an acidic medium, usually vinegar, prior to cooking. Yet today some people simply cook fresh pork without giving any particular attention to traditional methods of preparation. How does consumption of these various preparations of pork affect the blood?

In this report, we examine three adults who normally eat a traditional Weston A. Price Foundation (WAPF) diet who participated in a pilot study to ascertain the effects of eating pork on the blood. These volunteers came to the laboratory once a week to consume pork prepared in various ways and to have their blood examined before and after eating it. Microphotographs of their blood show unexpected results.

ANCIENT SOURCE OF FOOD

Pork is one of the oldest sources of meat, with domestication of pigs documented as early as 5,000 BCE. Today it is estimated that 38 percent of the world's meat production is pork, although its consumption varies widely throughout the globe. Fresh pork is less common than its many processed forms, including "cured" and "uncured" variations such as bacon, prosciutto, and many other types of hams. Pork processing is an old traditional method that goes back to the times before refrigeration and was originally employed to preserve the meat. However, the curing and smoking of pork imparts interesting flavors to the meat as well, and so processed pork meats have remained popular over the years. Marinating fresh pork meat before cooking it is another traditional method used in preparing fresh pork, which both tenderizes it, and imbues it with more flavor.

In this pilot study, we investigate the effects on live blood of consuming these various forms of pork—to observe the effects, if any, on the biological terrain of the body. The research questions pursued here are as follows:

1. Is there an effect from consuming pork on the blood as observed in dark-field live blood analysis?

2. Does unprocessed pork have a different effect than processed pork? We thus determine whether traditional preparation methods of pork affect the blood differently than the modern method of simply cooking fresh pork.

THE STATUS OF PORK AND HEALTH

It is interesting to note that swine have much in common anatomically and physiologically with humans—more than meets the eye. The fact is that porcine tissues are the most similar to human tissues compared to other animal tissues. For example, in medicine, pig heart valves are used to replace damaged human heart valves without any tissue rejection from the human recipient.

There are even common diseases that we share with pigs, such as the most recent outbreak of influenza, which was caused by H1N1, a virus and disease associated with swine, known as the "swine flu."

There are two helminth (worm) parasites that we have in common, which cause the same diseases in pigs and in us: the nematode, *Trichinella spiralis*, which causes trichinosis, and the tapeworm, *Taenia solium*.

Taenia solium or tapeworm eggs hatch in a pig's intestines and the microscopic embryo penetrates the intestinal wall, travels through the bloodstream, and ends up in another body part, such as swine muscle (pork meat), where it develops into a cyst-like form. When a human ingests undercooked pork containing a cyst, the parasite pops out and attaches itself to the human's intestinal wall, and the tapeworm begins to grow—up to twenty feet in length. Moreover, if a human ingests eggs of the pork tapeworm, he can develop a disease known as *cysticercosis*, which creates cysts and lesions throughout the body, obviously causing health problems.

Trichinella spiralis is a roundworm parasite distributed worldwide. Trichinosis, the common name for this disease, was once quite common and even fatal. The larval form of the worm becomes encysted in bodily tissues and can cause a variety of symptoms. Both tapeworms and trichinosis can cause a large inflammatory response in the body.

These diseases were known to ancient cultures including the Egyptian and Greek cultures, and later among the Jews and Muslims. Both Judaism and Islam proscribe the eating of pork. In *Leviticus* 11:2-4, 7-8, and *Deuteronomy* 14:8, animals that do not possess split hooves and that do not bring up their cud, which include both pigs and camels, are not kosher. Moreover, in Islam, the flesh of swine is considered fit only for sacrifices for God and is forbidden to be eaten. Additionally, certain Christian and other religious sects consider it taboo to eat pork. The common diseases that swine and humans share are perhaps a reason that pork was forbidden by the ancient religious dietary laws, although it must be said that there is no scholarly agreement on whether there was an underlying rational explanation for these laws.

These diseases still plague humanity today and are more common in developing countries such as China and Mexico than in the United States. Besides the parasite eggs and larvae, undercooked pork and poor sanitation are contributing causal factors. Fully cooked pork should effectively kill these parasites, if present. Trichinosis has become relatively rare in the United States because cooking pork thoroughly has become a widespread practice.

CURED, UNCURED AND MARINATED PORK

Pork meat is highly perishable, even when refrigerated. In the distant past, curing pork was very important to prevent the meat of the large butchered animal from rotting, so that most of the meat was treated in that way in order to preserve it. It is "cured" with the use of curing salts, which typically include table salt, sodium nitrite, and sometimes sodium or potassium nitrate (saltpeter) to make bacon and ham.

Use of salts to pickle pork has also been shown to kill cysts of *Taenia solium* after twelve hours.[1] Such salts also inhibit growth of harmful microbes to prevent rancidity of the meat and food poisoning. Ordinary table salt, sodium chloride, is the essential salt used in curing, but nitrates and nitrites are commonly used to add color, flavor and texture. It is not completely understood how all of these salts contribute to flavor, but numerous chemical changes in the composition of the meat occur. In addition to salts, sugar is typically added in curing pork to improve flavor, to counteract the harshness of the salts, and to provide food for desirable microorganisms to ferment and produce compounds that are flavorful, such as organic acids.

Nitrate-reducing bacteria are facilitated in the curing process. They ferment the nitrate and nitrite to nitrous acid, which reacts with the muscle protein, myoglobin, to produce a stable, bright pink color characteristic of many hams and bacon. However, it is well known that nitrates and nitrites are weak mutagens and carcinogens. Moreover, consumption of such a nitrite- or nitrate-containing food may lead to the production of nitrosoamines, also carcinogenic, in our stomachs.

Another way of curing pork is to use condensed celery juice instead of the nitrate or nitrate salts. Celery juice is high in natural nitrates and contains other nutrients of celery that may counteract the carcinogenicity of the nitrates. Thus, it seems a safer alternative, although some individuals report adverse reactions to meat cured with celery juice. Bacon treated with celery juice is typically labeled "no nitrates."

The safest preservation of pork without any use of nitrates and nitrite salts is simply the use of sodium chloride and a natural sweetener, such as maple sugar, to treat the meat, sometimes with a few spices for flavor. This is the old traditional method of preserving meat over the ages. It results in a preserved pork product, a bacon or ham that is known today as “uncured.” It does not have the pink color, nor does it have the long shelf life of the cured products, but it has more flavor and shelf life than raw unprocessed pork.

All of these pork products—cured and uncured—are typically smoked after the salt treatment. After that, they may undergo further aging in which natural fermentation in the meat develops more flavor.

In addition to these methods using salts and sugar, another method of treating fresh pork is to marinate it in an acidic medium. This is an important traditional food preparation technique that can kill or at least inhibit the growth of most bacteria, keeping fresh pork from spoiling and safe for consumption. Acidic treatment of pork may also kill parasites, too. Marinating pork may also be used to infuse it with herbs and spices to enhance its flavor, as well as to break down and tenderize the meat while improving its texture. For example, a marinade of alcohol, salt, vinegar, and garlic has protein-penetrating properties so that the flavors are increased throughout the meat. This penetration allows flavors and spices to be delivered more completely into the meat. An example of a traditional marinade that uses acidic elements to treat the pork is a Tandoori pork recipe. The pork is coated with a marinade of yogurt, a paste of pungent spices, and mango chutney for at least eight hours or overnight before cooking.

In this study, we compared the consumption of cooked fresh pastured pork; apple cider vinegar-marinated fresh pastured pork; uncured pastured bacon; and uncured pastured prosciutto. We also investigated the consumption of cooked fresh pastured lamb, as another unprocessed meat for comparison with fresh pastured pork.

LIVE BLOOD ANALYSIS

The blood is the tissue most easily monitored to show rapid changes in response to nutrients. Live blood analysis involves visual examination of a small droplet of capillary blood from the fingertip. The blood is put on a glass slide and observed under a high-powered light microscope, typically dark-field. This method offers a qualitative visual perspective of the blood cells and plasma, known as the “biological terrain” in integrative healthcare, which supports and sustains the cells and their vitality.

Analysis of the blood can reveal numerous conditions, including the stickiness of red blood cells (RBCs) and their tendency to aggregate and clot, as well as the formation of fibrin—the chief clotting protein—and aggregation of platelets. The presence or absence of these clotting factors can be readily seen using dark-field live blood analysis. Early blood clotting has been linked to chronic systemic biochemical inflammation, which is at the root of chronic disease.

Live blood analysis is described in detail in a previous article by the author.[2] Moreover, the blood testing of adults consuming the traditional diet recommended by the Weston A. Price Foundation showed a much healthier biological terrain than those consuming the modern organic diet. There was considerably less RBC aggregation, platelet aggregation and fibrin in the blood.

SUBJECTS AND STUDY PROCEDURES

Inclusion criteria for subjects were normal healthy adults eating the traditional diet recommended by the Weston A. Price Foundation (WAPF) for over two years, and having a clean healthy biological terrain as observed in live blood analysis.

Three adults, including two females aged thirty-seven and sixty, and one male aged fiftytwo, participated in the study. The average length of time they had consumed the WAPF diet was forty-five months. Subjects each came to the laboratory once weekly for five weeks at the same time of day by individual appointment. On the days in which they participated, subjects were required to fast for at least five hours. A baseline blood test was first done. Each subject was then given a measured amount of meat to consume, at least three ounces.

All of the meats used were of the highest quality from sustainable small farms raising pastured livestock. Five preparations of meat were used:

1. Unmarinated pastured center-cut pork chop;

2. Apple cider vinegar-marinated (twenty-four hours while refrigerated) pastured center-cut pork chop;

3. Uncured pastured prosciutto;

4. Uncured pastured bacon;

5. Unmarinated pastured lamb chop.

The meats (1), (2) and (5) were cooked over low heat in a cast iron skillet for up to one hour, with a little water but no added fat, and salted to taste. The cooked meats were prepared well done. The bacon was cooked until slightly stiff, but not crisp or dry. The prosciutto was consumed from the package without any preparation.

After consuming the pork, subjects were allowed to leave the laboratory, instructed to drink only water as needed, and to refrain from eating anything else. Five hours later, each subject returned to the laboratory for a post-meat blood test.

Microphotographs of the blood samples were recorded and scored. The data for the three subjects were also averaged for each condition and plotted in tables and graphs.

PHOTOGRAPHIC COMPARISON OF BLOOD BEFORE AND AFTER EATING MEAT

The results show unequivocally that consuming unmarinated cooked pork shows a significant negative effect on the blood. Five hours after consumption, subjects showed extremely coagulated blood, with extensive red blood cell (RBC) rouleaux (cells in the formation of stacked coins), RBC aggregates, and the presence of clotting factors, especially fibrin, which is seen as white threads in dark-field microscopy.

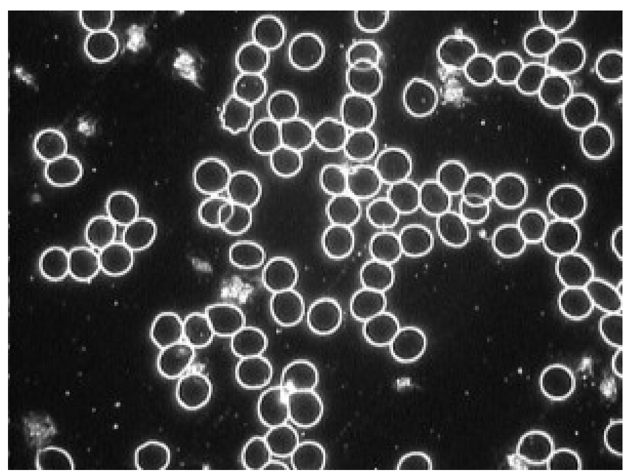


FIGURE 1. Microphotograph of blood of male, 52, before consuming the unmarinated cooked pork chop. RBCs are seen as round cells, and small white patches of platelet aggregates are seen. This is the picture of normal, healthy blood.

FIGURE 2. Microphotograph of blood of male, 52, five hours after consuming the unmarinated cooked pork chop. RBCs are entirely stuck together in rouleaux (stacks of coins) formations. This blood condition disrupts the microcirculation.

FIGURE 3. Microphotograph of blood of male, 52, five hours after consuming the unmarinated cooked pork chop. RBCs are entirely stuck together in rouleaux (stacks of coins) formations, and a high level of fibrin, white threads, means that early blood clotting has transpired.

Figure 1 shows the blood of a subject, male, age fifty-two, whose blood showed the most dramatic changes after eating unprocessed cooked pork. Initially, this subject's blood looks very healthy. The RBCs are separate and uniformly round, and there are no debris or clotting factors seen in the plasma, which appears black in darkfield. Figures 2 and 3 show his blood about five hours after consuming the unmarinated cooked pork chop. His RBCs are completely congealed in tight rouleaux. Additionally, Figure 3 shows that the blood has a high level of fibrin as well as rouleaux. Not a single free-floating RBC was observed throughout his blood sample after he consumed the unmarinated cooked pork. This subject also felt considerable fatigue about two hours after eating the pork chop, although he insisted that he was not sleep deprived that day.

The other two subjects showed similar blood results following consumption of the unmarinated cooked pork chop. Two of the three subjects felt fatigued after eating the pork chop, which suggests reduced peripheral blood circulation due to RBC stickiness and aggregation. Because the tiniest microcapillaries are smaller than the diameter of a single blood cell, each cell must pass through singly and deform its shape in order to do so; blood cell aggregates simply cannot pass through them.

By contrast, all three subjects reported no fatigue or other symptoms after eating the marinated cooked pork chop. Figure 4 shows the same subject's fasted blood on another day prior to eating marinated pork. The same cut of pork was marinated in the refrigerator for twenty-four hours, completely submerged in unfiltered live apple cider vinegar (with the "mother"). The subject's blood looks completely normal before consuming this pork chop. Then, five hours after consuming the same size portion of a marinated pork chop, the subject's blood is shown in Figure 5. The RBCs in this blood sample show a very slight stickiness or tendency to aggregate, and a few platelet aggregate forms are seen, with no fibrin. The subject's blood is largely unchanged from before. The other two subjects showed essentially no change before or after consumption of the marinated cooked pork.

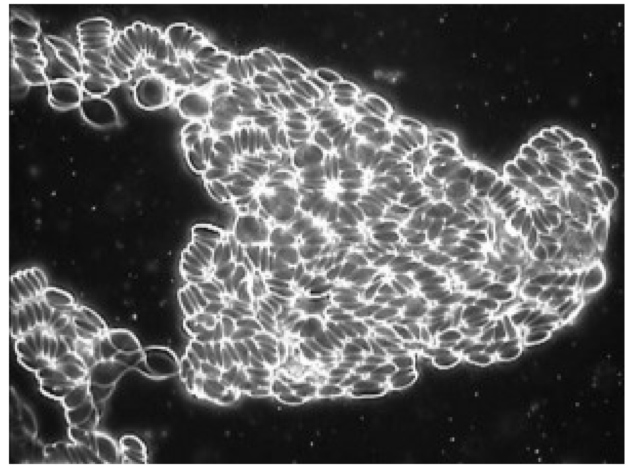


FIGURE 4. Microphotograph of blood of male, 52, before consuming a marinated cooked pork chop. RBCs are freely moving. Very few platelet aggregates are seen. This blood appears normal and healthy.

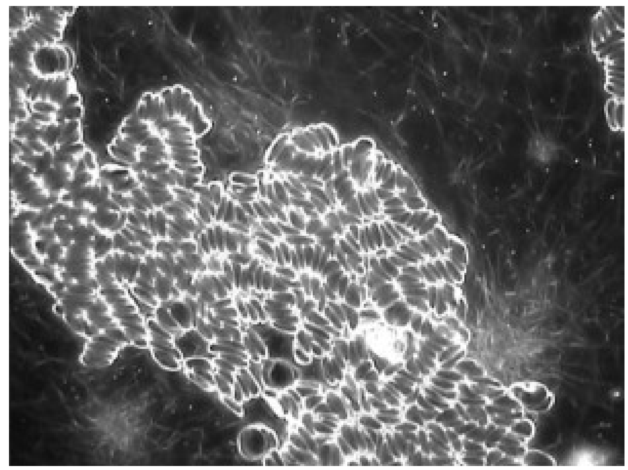


FIGURE 5. Microphotograph of blood of male, 52, five hours after consuming a marinated cooked pork chop. RBCs are mostly free to move, although there are a few small aggregates. This blood appears normal and healthy with little change compared to Figure 4.

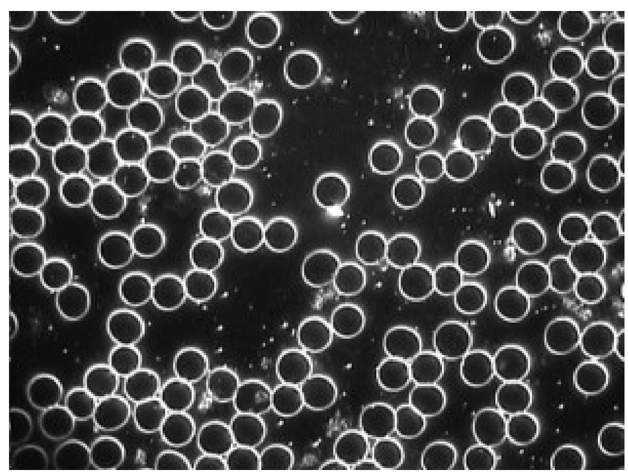


FIGURE 6. Microphotograph of blood of female, 37, before consuming uncured pastured bacon. This is the picture of completely normal, healthy blood.

Figure 6 shows the blood of the female subject, age thirty-seven, fasted, prior to consuming four strips of uncured pastured bacon. Again, this subject's blood is normal and healthy, without any RBC aggregates or fibrin. Figure 7 shows the blood of the same subject, five hours after consuming the bacon. The subject's RBCs are not aggregated; there is only a minuscule amount of platelet aggregates and fibrin. This blood is essentially unchanged over baseline. The other two subjects' blood samples also appear about the same, before and after consumption of bacon, too.

Figure 8 shows the blood of a subject, male, fifty-two, prior to consumption of prosciutto. This blood looks normal and healthy, with several platelet aggregates shown, and a white blood cell is also seen. Figure 9 shows the blood of the same subject about five hours after consuming three ounces of pastured prosciutto. Again, this blood looks normal and healthy, about the same as the subject's initial blood test that same day. Moreover, the blood of the other two subjects also did not change significantly pre-post eating prosciutto.

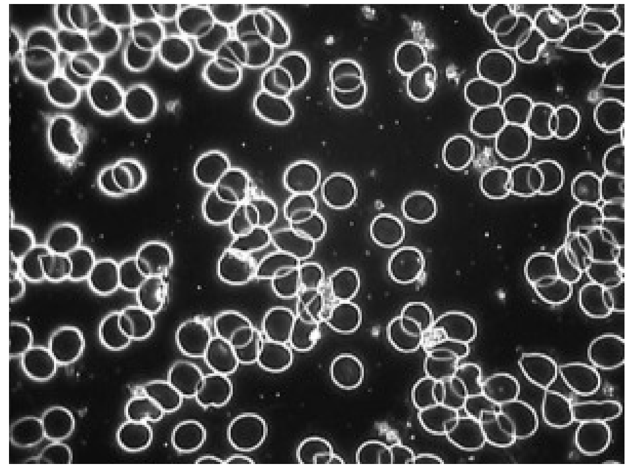


FIGURE 7. Microphotograph of blood of female, 37, five hours after consuming uncured pastured bacon. RBCs are free to move. This blood appears normal without any clotting factors seen.

As an additional control, we also looked for an effect from consuming an unmarinated, pastured lamb chop on the blood of the same three subjects. The blood of the female subject, age thirty-seven, prior to eating the lamb chop is shown in Figure 10. Her blood is seen as normal, healthy blood with a few platelet aggregates. About five hours after consuming the lamb chop, her blood appears as shown in Figure 11, which is about the same as the pre-lamb condition. Moreover, the blood of the other two subjects did not show any significant changes after consuming lamb either.

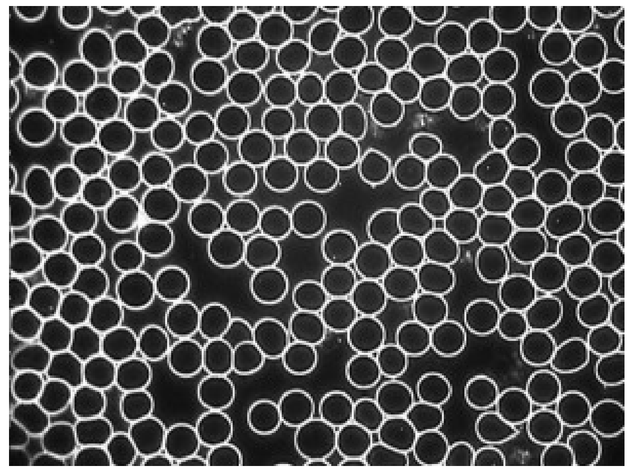


FIGURE 8. Microphotograph of blood of male, 52, before consuming proscuitto. RBCs are free to move. This blood appears normal and healthy with several platelet aggregates and a white blood cell present.

FIGURE 9. Microphotograph of blood of male, 52, five hours after consuming proscuitto. This blood appears normal and healthy. There is no apparent change over the initial blood test, as shown in Figure 8.

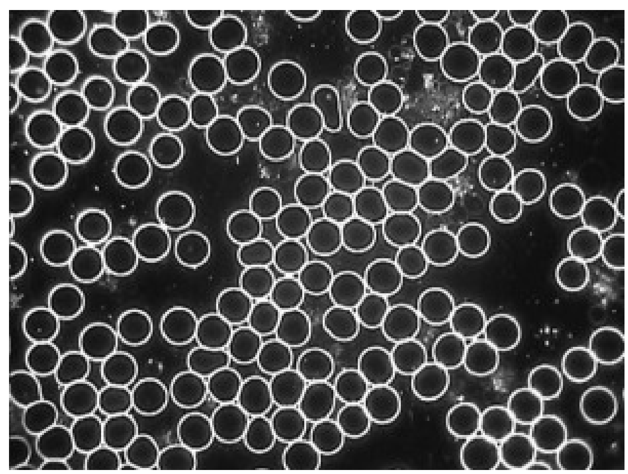


FIGURE 10. Microphotograph of blood of female, 37, before consuming an unmarinated cooked lamb chop. This blood appears normal and healthy with only a few platelet aggregates.

FIGURE 11. Microphotograph of blood of female, 37, five hours after consuming an unmarinated cooked lamb chop. This blood appears normal and healthy with only a few platelet aggregates. No changes are observed over the sample shown in Figure 10.

BLOOD COAGULATION SCORES

There were two blood tests (before and after) per condition times five conditions (five types of meat) times three subjects for a total of thirty blood tests. Blood tests were scored by a researcher with long-term experience using live blood analysis. A Likert scale was used as follows: 0 (none present); 1 (very small amount); 2 (small amount); 3 (moderate amount); 4 (moderately large amount); 5 (large amount); 6 (the highest level ever observed). The following variables were scored for each blood test:

• Rouleaux of RBCs, whereby the cells are in tight stacks like rolls of coins seen on edge;

• Other looser aggregates of RBCs (non-rouleaux);

• Stickiness of RBCs, which appears as cells try to break away from each other;

• Platelet aggregates, which appear as a grey sludge in the blood plasma;

• Fibrin, which appears as white threads in the blood plasma;

• Spicules, short forms of fibrin that appear in small clusters in the blood plasma;

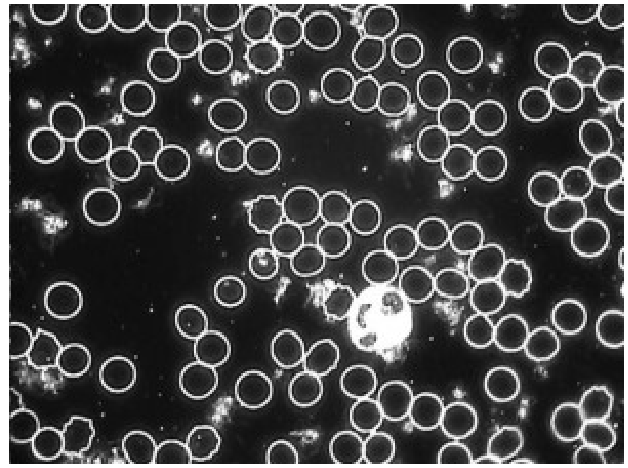
• Shape changes in RBCs, cell distortions involved in the clotting process.

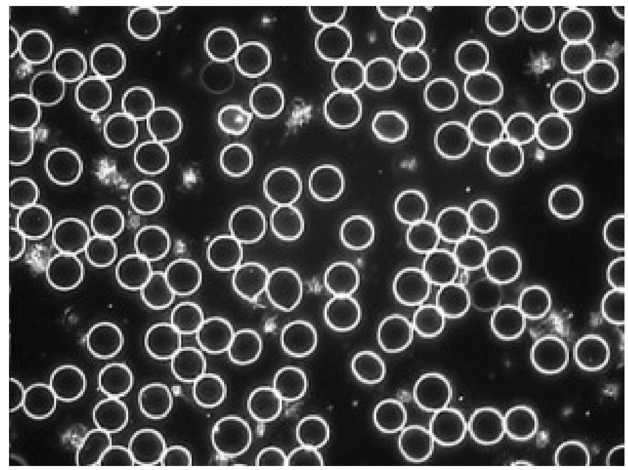
Figure 12 shows the results of the mean values of the three subjects' scores of the three most prevalent blood coagulation factors seen to occur after consuming cooked unmarinated pork, which were rouleaux, RBC aggregates and fibrin. Compare this with Figure 13, which shows the mean values of the three subjects' scores after consuming cooked marinated pork. The difference between these two charts is striking as well as significant. It is clear that consuming umarinated cooked pork shows a significant coagulation effect on the blood. However, no statistics are calculated in this study as the sample was small.

Figures 14, 15 and 16 depict the mean values of these same coagulation factors for before and after consumption of bacon, prosciutto and lamb for the three subjects. The results of these are similar to those for the marinated pork, with no significant changes observed before or after consumption of these meats.

FIGURE 12. This chart and accompanying table show the average values of scores for blood coagulation variables for the three subjects before and after consuming unmarinated cooked pork chops. The pre-post differences for rouleaux, RBC aggregation, and fibrin are significant.

FIGURE 13. This chart and accompanying table show the average values of scores for blood coagulation variables for the three subjects before and after consuming marinated cooked pork chops. The pre-post differences are insignificant.





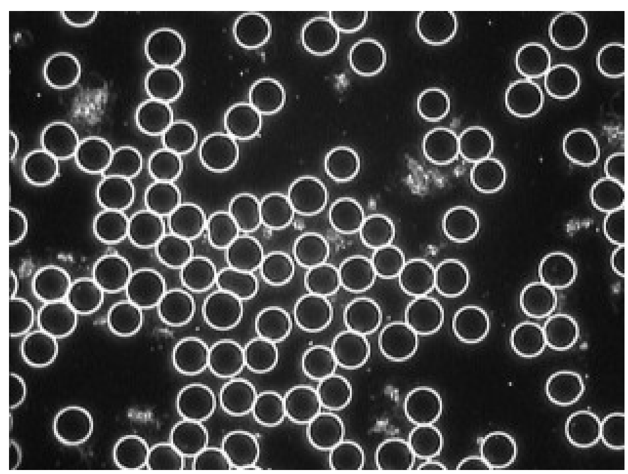
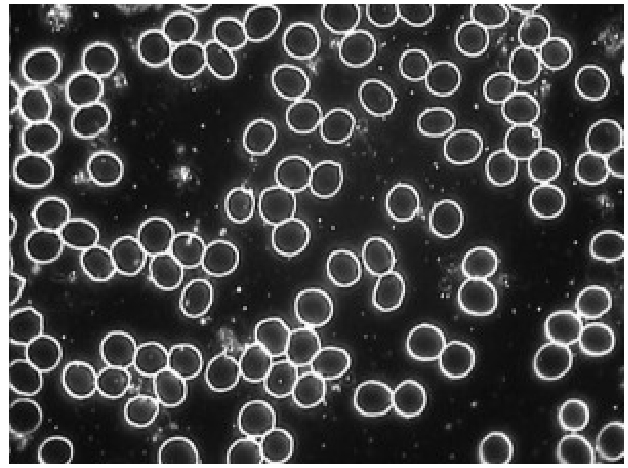


FIGURE 14. This chart and accompanying table show the average values of scores for blood coagulation variables for the three subjects before and after consuming bacon. The pre-post differences are insignificant.

FIGURE 15. This chart and accompanying table show the average values of scores for blood coagulation variables for the three subjects before and after consuming proscuitto. The prepost differences are insignificant.

FIGURE 16. This chart and accompanying table show the average values of scores for blood coagulation variables for the three subjects before and after consuming lamb chops. The pre-post differences are insignificant.

CONCLUSIONS

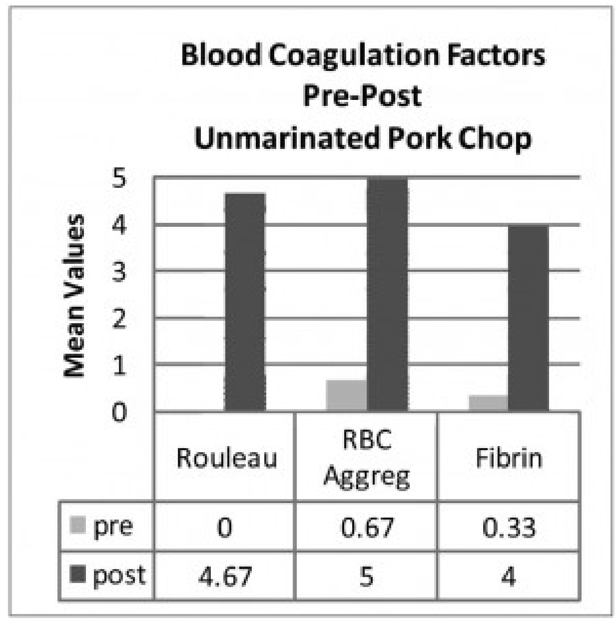


1. Consuming unmarinated cooked pastured pork produces blood coagulation and clotting in blood examined at five hours after eating; however, consuming marinated cooked pork does not produce any blood coagulation or clotting.

2. Consuming processed forms of pastured uncured pork, including bacon and prosciutto, does not produce any blood coagulation or other visible changes in the blood at five hours after eating.

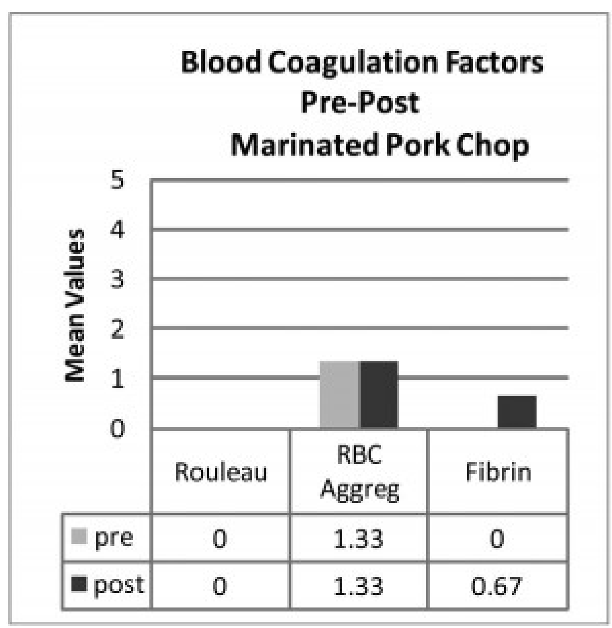
3. Consuming unmarinated cooked pastured lamb does not produce any blood coagulation or other visible changes in the blood at five hours after eating.

4. No changes in white blood cell activity, white blood cell clumping, crystals, microbes, or spicules (indicating liver stress), were found before or after consumption of all five preparations of pork and lamb.



The results suggest that unmarinated cooked pastured pork may be unique in producing these coagulation effects on the blood, which also appeared quite rapidly, in less than ten minutes after blood draw, and did not clear up during an hour of observing the blood under the microscope.

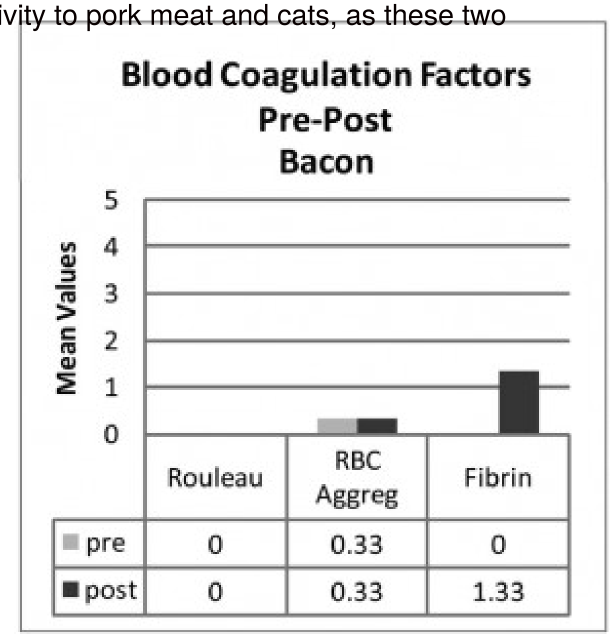
The early blood coagulation and clotting observed after consuming cooked unmarinated pork are adverse changes in the blood. A shorter blood coagulation time is associated with increased systemic biochemical inflammation as well as the possible formation of blood clots in the body, as in heart attack or stroke. This condition in the blood, if chronic, is associated with increased risk of chronic degenerative disease, including cardiovascular disease, cancer, autoimmune disorders and others.[2]



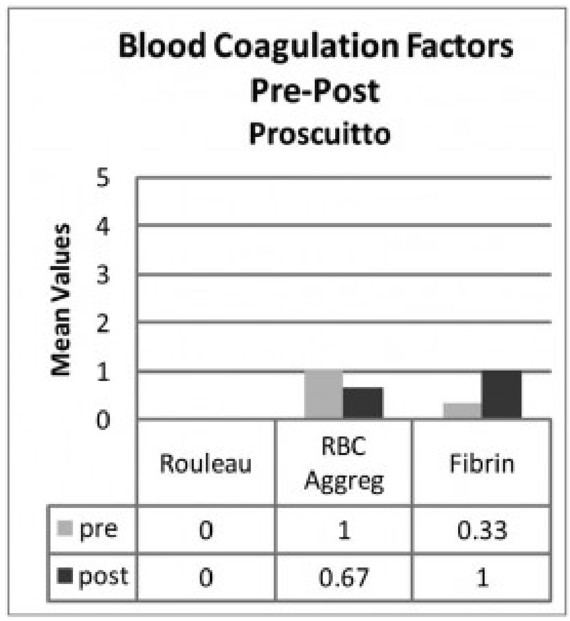
What is it about unmarinated cooked pork that may produce biochemical inflammation and early blood clotting? A literature search revealed use of pork in the *Materia Medica* of ancient China. In Chinese medicine, "pork has the medical properties of being bitter, somewhat cooling, and slightly poisonous, and was used for chronic madness."[3] Yet pork is the most common meat consumed in China, indeed throughout Asia. Usually it is marinated in vinegar before it is cooked; pickled pork is also a common dish throughout Asia.

It is well known that allergies cause unwanted inflammation. Is this a possible link? In modern medicine, meat allergies are rare in adults, typically outgrown during the first few years of life.[4] Those who are allergic to pork are typically sensitive to pork serum albumin.

There is also an interesting link that has been found between sensitivity to pork meat and cats, as these two allergies are frequency associated, suggesting a crossed allergenicity.[5] That is, those with allergy to pork frequently have respiratory allergies to cats. However, in this study, the subjects were allergic neither to pork nor cats. In searching the modern scientific and medical literature for clues, nothing was uncovered that might explain the results of this study.



What is most notable, however, is that the results demonstrate the wisdom of traditional food preparation. The processing of pork in customary ways by salts and acidic marinades makes pork safe for consumption— not only by inactivating parasites, killing off noxious bacteria that may cause food poisoning, and promoting safe fermentations in the meat that add flavor; traditional processing of pork also seems to prevent the inflammatory and blood clotting effects as observed here through live blood analysis, although we do not know why. We speculate that raw pork contains a toxin, unidentified to date, and that heat alone from cooking cannot destroy it, but that fermentation with salt, and also acid plus heat, do so. This toxin in pork, if it exists, is therefore heat-stable and requires further denaturation by salt or acid in order to detoxify it. This is exactly what traditional pork preparation provides.



ACKNOWLEDGMENT

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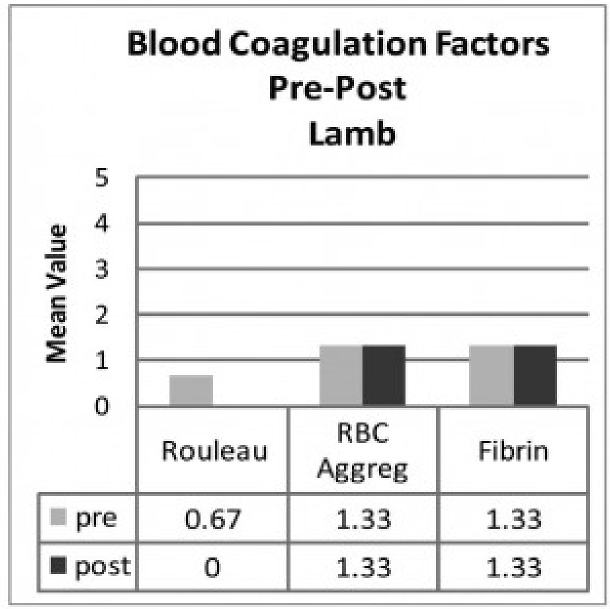
Blood Coagulation Factors
Pre-Post
Lamb
Mean Value
5
4
3
2
1
0
Rouleau
RBC Aggreg
Fibrin
pre
0.67
1.33
1.33
post
0
1.33
1.33