

Microbial Safety of Unpasteurized Juice

Increasing Consumer Awareness of the Pathogenic Risks of Unprocessed Fruit and Vegetable Juice

Tag Words: Pasteurization, Juice, cold-pressed juice, vitamins, pathogens, microbial contamination, foodborne illness

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Summary: Most cold-pressed juice companies choose not to pasteurize their fruit and vegetable juice. The use of high heat in pasteurization destroys heat-sensitive vitamins and nutrients and inactivates beneficial digestive enzymes. Companies that sell unpasteurized juice mainly do so in order to preserve as much of the nutritional value of the juice as possible. However, unpasteurized juice has a greater risk of contamination by pathogenic microorganisms. In lieu of pasteurization, some cold-pressed juice companies use high pressure processing which keeps most of the vitamins and nutrients intact while still ensuring the microbiological safety of the juice. Those who want to consume juice that both maximize safety and nutritional content should consider purchasing the high pressure processed cold-pressed juice.

Video Link: <https://youtu.be/YRzDxid5Ekc>

The cold-pressed, raw juice trend

Cold-pressing is a method of producing fruit and vegetable juice in which ground fruits and vegetables are placed into a permeable pouch that is subjected to a large amount of pressure until all the juice is freed from the pulp (1). In recent years, the appeal of cold-pressed fruit and vegetable juice has expanded from raw foodies and Hollywood celebrities undergoing a “juice cleanse” to a broader, health-conscious audience, stimulating the creation of a growing industry. Major companies have started to invest in the trend. For example, Starbucks created the cold-pressed juice line Evolution Fresh, and Danny Meyer, the creator of Shake Shack and other popular restaurants, started Creative Juice (1). Danielle Charboneau, the creator of Juice Maids, a cold-pressed juice delivery service in Los Angeles, attests that in addition to major companies, more individuals have become involved in the juice business due to the potential of monetary returns of millions of dollars (1). Her statement seems accurate - earlier in 2015, startup cold-pressed juice company Juicero raised \$120 million from investors (2).

The problem with pasteurization

Most fruit and vegetable juice sold in the United States is pasteurized. Pasteurization of juice involves the application of temperatures near 100°C in order to kill pathogenic and spoilage microorganisms and inactivate degradative enzymes. Though the primary purpose of juice pasteurization is to prevent spoilage and extend the shelf life of the juice, it is also used to ensure the microbiological safety of the juice. Unfortunately, the high temperatures of pasteurization destroy heat-sensitive vitamins and nutrients in the juice and inactivate enzymes that contribute to the juice’s nutritional value, such as digestive enzymes. For example, pasteurization has been shown to decrease the content of vitamin C in orange juice, likely due to thermal degradation of the vitamin (3). In addition, oxidation, the major cause of carotenoid loss in orange juice, can be

stimulated by heat (3). The damaging effect that pasteurization can have on the nutritional value of juice is why most cold-pressed juice companies do not pasteurize their juice and why more consumers are choosing to drink unpasteurized juice. The reasoning is that the intact nutrients and enzymes are better for human health.

The downsides of raw juice

However, the benefits of unpasteurized juice are not universally lauded, and some wonder if the supposed boost in nutritional value is worth the premium price of \$12 a bottle. The *Wired* magazine article “Nobody Can Prove That Cold-Pressed Juice is Better For You” claims that because the gut ecosystems of each person is unique, it is difficult to predict if the potential benefit of the additional nutrients found in cold-pressed juice is worth the premium price that consumers pay for these juices (2). The article also points out that heat is not necessarily always damaging to the nutritional value of a food. In some cases, it is actually beneficial because it converts compounds present in the juice into more bioavailable forms (2). For example, while the trans isomer of the nutrient lycopene found naturally in red tomatoes is not absorbed well by the body, the application of heat converts them into cis-lycopenes, which are more easily absorbed by the human body (2).

There is also, of course, the risk of microbial contamination. Despite the acidic environment of most fruit and vegetable juices, some pathogenic microorganisms are still able to contaminate and grow in the juice, and unprocessed juices are not processed to ensure that these microorganisms are killed or inactivated (4). These pathogenic organisms include several species of *Salmonella* and *E. coli* O157:H7, which can cause serious illness and have been responsible for serious foodborne illness outbreaks (4). In 1995, unpasteurized orange juice was found to be responsible for an outbreak of *Salmonella* among visitors of an Orlando, Florida theme park (5). In October 1996, unpasteurized apple cider was linked to outbreaks of *E. coli* O157:H7 infection and cryptosporidiosis. More recently, in 2009, foodborne salmonellosis in 152 people across six states in the United States was attributed to unpasteurized orange juice.

Due to the risk of microbial contamination in unprocessed juice, the U.S. Food and Drug Administration (FDA) officially advises against the consumption of these products, especially for immunocompromised people, such as pregnant women and young children (4). The following warning label is required to be placed on unpasteurized juice that is sold in the refrigerated sections of grocery stores, health-food stores, cider mills, or farmers markets:

WARNING:

This product has not been pasteurized and therefore may contain harmful bacteria that can cause serious illness in children, the elderly, and persons with weakened immune systems.

High pressure processing

Regardless of the potential risk that unpasteurized juice poses, the consumer demand for minimally processed and more nutritionally dense fruit and vegetable juices has not gone unnoticed by the food industry. In order to meet the demand, novel processing technologies have been and are currently being developed as an alternative for pasteurization in order to assure the same microbiological safety and preservation of shelf life that pasteurized juice provides while preserving as much of the nutritional value as possible.

One such novel processing method is high pressure processing. In high pressure processing, a sealed container of juice is placed under high pressure without the application of heat in order to inactivate certain microorganisms and degradative enzymes. It has been scientifically demonstrated that high pressure processing preserves more vitamins and nutrients in fruit and vegetable juices better than traditional pasteurization. In one study, high pressure processed orange juice processed under 350 MPa at a mild temperature of 30°C for 2.5 minutes had the same level of ascorbic acid and vitamin C after treatment as untreated orange juice (3).

Interestingly, the total carotenoid content increased in high pressure processed orange juices after treatment compared to untreated orange juice, with the greatest increase occurring in the higher range of pressures that was applied, 350 MPa or 400 MPa, suggesting that high pressure induces better release of carotenoids (3). This may be due to the disruption of the chromoplasts where the carotenoids in the orange juice are present and the denaturation of the carotenoid-binding protein. As a result of the better release of carotenoids, the bioavailability of antioxidant carotenoids is possibly higher in high pressure processed orange juice, similarly to how the bioavailability of lycopene is higher in thermally treated tomato juice.

In plant-based foods such as fruit and vegetable juices, vitamin A is present in the diet as carotenoid precursors that can be biologically converted to vitamin A (3). Potential precursors of vitamin A include β -carotene, α -cryptoxanthin, β -cryptoxanthin, and α -carotene (3). High pressure processed orange juices showed an increase in these vitamin A precursors compared to untreated orange juices (3).

Current use in juice companies

According to Zoë Sakoutis, one of the creators of BluePrint, another producer of cold-pressed, unpasteurized juice, high pressure processing was a “game-changer” (1). Because high pressure processing kills pathogenic and spoilage microorganisms and inactivates degradative enzymes, it extends the shelf life of the juice without the use of pasteurization or food additives, meaning that it can still be marketed as raw and charge a premium price. The extended shelf life of the juice allows more of it to be sold and shipped nationwide. Numerous cold-pressed juice companies utilize high pressure processing, including BluePrint, Suja, Juice So Good, Forager Project, and Starbucks’ Evolution Fresh (6).

Controversy: Is HPP just another form of pasteurization?

However, some cold-pressed juice producers frown upon the use of high pressure processing, sometimes referring to it as “high pressure pasteurization” due to the belief that the process heats the vitamins and enzymes. Several other raw juice companies, such as Zula Juice, echo that sentiment and use the fact that they don’t use high pressure processing as a selling point. On the website for Zula Juice, it claims that the result of purchasing high-pressure processed juice is “paying a premium for juice that may or may not be organic... and certainly isn’t fresh” (6).

While the FDA agrees that high-pressure processed juice cannot be called “fresh” and has regulations in place that prevent companies that use the technology from doing so, there is no specific regulation with respect to the word “raw,” sparking a legal debate about whether or not high-pressure processed juice can be considered raw (7).

In a class action lawsuit filed in December 2013 against Hain Celestial, which owns the BluePrint brand, plaintiff Samuel F. Alamilla argued that the company falsely advertised its high-pressure processed juices as “unpasteurized” and “100% Raw” (7). Alamilla also alleged that the effects of high pressure processing were identical to those of conventional pasteurization, including inactivation of beneficial enzymes and probiotic microorganisms (7). However, in an order that dismissed the case with prejudice, U.S. district judge Vince Chhabria pointed out that the academic papers Alamilla submitted to support his arguments instead undermined his own case because the papers repeatedly made the point that pasteurization had less impact on nutritional value than pasteurization (7).

Still, Chhabria did not directly address whether high-pressure processed products should be considered “raw,” which was the main issue in a February 2014 lawsuit against Suja Life LLC. Like in the case against Hain Celestial, Suja was accused of deceiving consumers into paying a premium price for high-pressure processed juices by labeling them as “organic, raw and cold pressed” (8). The plaintiff argued that the artificially extended lifespan of high pressure processed juice products undermines the fundamental principles of the raw food movement and therefore consumer expectation. The package on Suja products has since been updated to say “organic and cold-pressured” (8).

Some proponents of completely unprocessed juice argue that in addition to killing the pathogenic and spoilage microorganisms, high pressure processing also kills probiotic bacteria such as *Lactobacilli*. However, in order for the presence of probiotic organisms to have an impact on human health, the level of probiotics in food products needs to be high in order for enough probiotic organisms to confer a benefit unto the host survive the environment of the gut. The minimum level of live probiotic cells in a food product should be at least 10^6 – 10^7 CFU/ml before consumption, and fruit and vegetable juices do not meet this minimum without fermentation (9).

Community Action: Bringing awareness to the risks of unpasteurized juice

In order to raise awareness about the risk of unpasteurized juice and the viability of high pressure processed juice as a more nutritious alternative to conventionally pasteurized juice, an editorial piece on the topic was written and submitted to *Food & Nutrition* magazine to target health-conscious consumers likely to drink cold-pressed unpasteurized juice. The editorial is as follows:

Though you were most likely to hear about cold-pressed juice from the “juice cleanses” of Hollywood celebrities and raw foodies half a decade ago, in the past few years, cold-pressed juice has become increasingly popular. Large companies such as Starbucks have invested in their own cold-pressed juice store chains and numerous smaller stores, such as Juice Press and Liquiteria in New York City have popped up.

Cold-pressing is a process that involves placing a pouch of ground fruits and vegetables under enormous pressure until all the juice is squeezed out of the pulp. Though the vast majority of juice sold in the United States is pasteurized in order to inactivate degradative enzymes and kill pathogenic and spoilage microorganisms, most cold-pressed juice is unpasteurized. Most cold-pressed juice is also sold at a premium price of \$10-12 a bottle at most stores, which claim that the price is worth it because the nutritional quality of the juice is better maintained than in

pasteurized juice because the juice is kept in its natural state as much as possible. However, before you spend your hard-earned cash on this trend, it is important to learn more about these claims and the possible risks.

Juice companies that choose not to pasteurize their juice argue that the process makes the juice more nutritionally dead. Pasteurization of juice involves temperatures around 100°C, and these extremely high temperatures have the unfortunate side effect of destroying heat-sensitive vitamins such as vitamin C and deactivating possibly beneficial enzymes such as digestive enzymes. However, whether these supposed nutritional benefits are worth the premium price of cold-pressed juice is up for debate. It is difficult to predict how or even *if* the additional vitamins and nutrients found in unpasteurized juice would benefit each individual person due to differences in their gut ecosystems, and some vitamins only become bioavailable when subjected to heat, such as lycopene in tomato juice.

In addition, unpasteurized juice has a greater risk of contamination by pathogenic microorganisms such as several species of *Salmonella* and *E. coli* O157:H7, both of which are able to survive in the acidic environment of most fruit and vegetable juices. Unpasteurized juice has been linked to several outbreaks, including salmonellosis among 152 people across six U.S. states in 2009. It is for this reason that the FDA requires that a warning label be displayed on unpasteurized juice and advises that people with compromised immune systems, such as pregnant women and young children, avoid unpasteurized juice.

While some cold-pressed juice companies elect to not process their juice at all, one method that other juice companies have employed to increase the shelf life and microbiological safety of their products without significantly reducing their nutritional quality is high pressure processing, or HPP. HPP utilizes high pressure rather than heat to kill pathogenic and spoilage microorganisms, and studies have shown that the process leaves most heat-sensitive vitamins and nutrients intact. I believe that it is important for health-conscious consumers to be informed about how their juice is processed, if at all, and the risks of that process, so that they could make the purchase decision that is best for them. For someone who wants to ensure the microbiological safety of their juice while preserving as much of its nutritional value as possible, HPP juice provides a viable alternative to conventional pasteurized juice or unprocessed juice. If you want to consume entirely unprocessed fruits and vegetable, simply buying intact fruits and vegetables may be the cheaper option.

In addition to the editorial piece, a letter was written to Cocobeet and Zula Juice, two cold-pressed juice companies that choose not to use high pressure processing, urging them to consider using the technology in order to guarantee the safety of their juice. The letter is as follows:

To the Manager of _____,

Due to the degradative effects of pasteurization, such as the destruction of heat-sensitive vitamins and inactivation of beneficial digestive enzymes, an increasing number of Americans and I have become interested in cold-pressed unpasteurized fruit and vegetable juice such as the juice sold by your company. However, I have noticed that you choose not to use high pressure processing (HPP), and I would like to ask you to reconsider.

Unpasteurized juice is vulnerable to contamination by pathogenic microorganisms such as several species of *Salmonella* and *E. coli* O157:H7, both of which are able to survive in the acidic environment of most fruit and vegetable juices, and there have been outbreaks in the past related to unpasteurized juice. For example, in 2005, unpasteurized orange juice was attributed to salmonellosis in 152 people across six states in the United States. Though the FDA officially recommends that immunocompromised people such as pregnant women, young children, and the elderly not drink unpasteurized juice due to the microbiological risks, I believe that these people should be able to benefit from the increased nutrition of unpasteurized juice without needing to worry about their safety.

For them, HPP juice is a viable alternative to conventionally pasteurized juice. Numerous studies have shown that HPP is effective in ensuring the microbiological safety of the juice while keeping most vitamins intact because unlike conventional pasteurization, HPP does not involve the application of heat. By offering HPP juice, your store would expand its consumer base to more immunocompromised people, who may need nutritionally dense juice the most, and to those who are otherwise weary about the safety of your juice. Another thing to consider is that in the event that illness or death is attributed to your product, the need to respond financially to a lawsuit, for example, could be fatal to your business and shut your production down. For these reasons, I believe that it is in the best interest of your company to be proactive and invest in HPP.

Sincerely,
Diane Sapit

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Letter to the Editor (*Jersey Journal*):

Dear Editor,

In the past few years, cold-pressed fruit and vegetable juice has grown in popularity, with large companies such as Starbucks investing in their own cold-pressed juice lines and the establishment of numerous smaller stores such as Juice Press and Liquiteria in New York City. Before choosing to partake in the trend, however, it is important for consumers the first educate them about how the juice was processed for microbiological safety prior to being sold. While most juice sold in the United States is pasteurized in order to kill pathogenic and spoilage microorganisms and deactivate degradative enzymes, some cold-pressed juice companies have chosen not to pasteurize their products. The primary reason is that the extremely high temperatures involved in pasteurization have the unfortunate side effects of destroying heat-sensitive vitamins and nutrients and deactivating possibly beneficial enzymes such as digestive enzymes, making the juice more nutritionally dead. However, leaving juice entirely unprocessed increases the risk of contamination by pathogenic microorganisms such as several species of *Salmonella* and *E. coli* O157:H7, which survive in the acidic environment of most fruit and vegetable juices. Unpasteurized juice has been the cause of several outbreaks, including one in 2009, in which unpasteurized orange juice was attributed to salmonellosis in 152 people across six U.S. states. It is for this reason that the FDA has advised that people with compromised immune systems, such as pregnant women and young children, avoid unpasteurized juice.

While some cold-pressed juice companies elect to not process their juice at all, one method that other juice companies have employed to increase the shelf life and microbiological safety of their products without significantly reducing their nutritional quality is high pressure processing, or HPP. HPP utilizes high pressure rather than heat to kill pathogenic and spoilage microorganisms, and studies have shown that the process leaves most heat-sensitive vitamins and nutrients in the juice intact and in some cases even increases the bioavailability of certain vitamins. I believe that it is important for health-conscious consumers to be informed about how their juice is processed, if at all, and the risks of that process, so that they could make the purchase decision that is best for them. For someone who wants to ensure the microbiological safety of their juice while preserving as much of its nutritional value as possible, HPP juice provides a viable alternative to conventional pasteurized juice or unprocessed juice. Some juice companies that use HPP are BluePrint, Suja, and Evolution Fresh, and it is usually stated on the company's website if their products use HPP.

Sincerely,
Diane Sapit