

CURD CLINIC: CHEESE SAFETY/STORAGE

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Question

How do I know if I can safely hold a cheese outside of temperature control/refrigeration?

Answer

First of all, you need to ensure that your cheese is being produced safely. The dairy plant must be following Good Manufacturing Practices (GMP) and have a food safety plan in place. Using high quality milk from a trusted source also goes a long way in producing safe, quality cheese. The Pasteurized Milk Ordinance (PMO) directs how milk is to be handled at all stages from the farm to the plant but, still, dairy plant operators need to be vigilant and practice good hygiene and ensure that the proper environmental controls are in place in order to produce a safe product.

FDA/USDA Risk Categories	
HIGH →	Soft unripened cheeses (>50% H ₂ O i.e. Cottage, Cream cheese, Ricotta)
MODERATE →	Fresh soft cheeses, Soft ripened cheeses, Semi-soft cheeses (>39-50% H ₂ O i.e. Brie, Camembert, Feta, Mozzarella)
VERY LOW →	Hard cheeses, Pasteurized process cheeses (<39% H ₂ O i.e. Cheddar, Colby, Parmesan)

That said, many cheeses are generally considered to be an inherently safe food: if they have reduced moisture, a significant salt content, a higher acidity and contain an active starter culture. These characteristics help keep pathogens from growing. The dairy industry is also highly regulated with strict food safety and environmental controls in place. Considering the high volume of cheese that is produced across the globe, there are not many outbreaks or food safety issues with cheese. Therefore, some cheeses, produced under good hygienic and manufacturing process, may be safely held outside of temperature control if they meet certain requirements. So, how do you determine if a cheese qualifies?

Two measurements help us determine if a cheese can be safely held outside of temperature control: water activity and pH.

Water activity (a_w) is the measurement of free or unbound water available in a food for microbial growth. It utilizes a scale of 0 to 1.0 where pure water equals 1.0.

A cheese with a high water activity (i.e. 0.99 a_w) has a lot of water available to be used by microorganisms and therefore is at a greater risk for growth of bacteria, yeast and molds. Conversely, a cheese with a low water activity (0.92 a_w or less) would preclude the growth of some types of microorganisms yet allow the growth of the more tolerant. In short, the higher the water activity, the more potential there is for biological growth to occur.

Different styles of cheese have different water activity values. For instance, Cottage cheese, which has a high moisture content, is typically around 0.99 a_w , while Parmesan, an aged cheese with a lower moisture content, can have a water activity as low as 0.67 a_w . Based on this data, we know that Cottage cheese has a much higher risk of microbiological growth than Parmesan because more water is available for microorganisms to grow.

The other important factor to consider when evaluating whether a cheese can be held out of temperature control is the pH of the cheese. Generally, the lower the pH (higher acidity) of the cheese, the more likely it will qualify to be held out of refrigeration. A high-acid environment is more hostile to pathogens. Cheese pH is achieved using an active starter culture that produces lactic acid and brings down the pH of the cheese. The use of an active starter culture is a requirement for cheese to be safely held out of temperature control.

Figure 1. Interaction Table From 2017 Food Code			
Interaction of pH and a_w for control of spores in food heat-treated to destroy vegetative cells and is subsequently packaged.			
a_w Values	pH Values		
	4.6 or less	> 4.6-5.6	>5.6
0.92 or less	Non-PHF/non-TCS	Non-PHF/non-TCS	Non-PHF/non-TCS
>0.92 – 0.95	Non-PHF/non-TCS	Non-PHF/non-TCS	PA
>0.92	Non-PHF/non-TCS	PA	PA

PHF – "Potentially Hazardous Food"
TCS – "Time/Temperature Control for Safety Food"
PA – "Product Assessment Required"
Source: FDA

Thus, the interaction of low pH and low water activity can be used to determine if a cheese can be safely held out of refrigeration. The Food and Drug Administration (FDA) includes a table (see Figure 1) in the Food Code that lays out the parameters of when a food product can be safely held out of refrigeration. Essentially, those cheeses with a lower water activity and a lower pH are more likely to be a non-potentially hazardous food (non-PHF) and thus don't require temperature control. →

A couple of important caveats should be mentioned before we go into determining what cheeses are safe to hold outside of refrigeration.

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| 1. As mentioned at the beginning of the article, these guidelines are for cheeses that are assumed to have been produced safely (GMP, food safety plan, heat treated milk). |
| 2. This applies only to cheese that has been uncut, has no cracks, breaks or punctures and/or retains the original, undisturbed wax or cloth packaging. |
| 3. The maximum storage/display temperature can't exceed 86°F (30°C). |
| 4. Finally, storing a cheese out of temperature control is not ideal for the quality of the cheese. |

With that said, let's use the Interaction Table (Figure 1) to determine if a cheese can be safely held out of refrigeration. Let's say that we have a Parmesan with a water activity in the range of 0.68 - 0.76 a_w and a pH of 6.5. The cheese milk was heat treated and the cheese was cured for 2-3 years and then packaged. Can this cheese be safely held out of refrigeration? First, we would locate the cheese's water activity (0.68 - 0.76 a_w) in the correct line and then locate the pH (6.5) in the correct column. You will see that they intersect at "Non-PHF/Non-TCS," which tells us that no temperature control is required.

Additionally, there is a list of cheeses that, when produced to the Code of Federal Regulations (CFR) standards, should be considered exempt from refrigeration requirements during aging, storing, shipping and display (maximum temperature of 86°F). The list includes:

Asiago (medium and old)
Aged Cheddar
Colby
Feta
Monterey Jack
Muenster
Parmesan
Pasteurized Process Cheese
Provolone
Romano
Swiss/Emmentaler

In Wisconsin there are also special considerations for cheese curds. With the popularity and prevalence of cheese curds in the state, a special dairy inspection policy was drafted. The policy states that cheese curds must be refrigerated at all times with one exception. Cheese curds

can be offered for sale outside of refrigeration only on the day they are manufactured. Any cheese curds that are not sold must be disposed of at the end of the day.

As mentioned at the beginning of the article, cheese is an inherently safe product. Cheese is a fermented product and fermentation is an age-old preservation method that is antagonistic to foodborne pathogens and will inhibit their growth or inactivate them. Research has also shown that active starter cultures are detrimental to pathogens. Given these characteristics of cheese, some cheeses can be safely held out of temperature control.

Sources:

Bishop, Jay Russell and Marianne Smukowski. 2006. *Storage Temperatures Necessary to Maintain Cheese Safety*. *Food Protection Trends*: Vol. 26, No. 10, Pages 714–724.

Johnson, Mark, D. Sommer. 2014. *Curd Clinic: The significance of water activity in cheese varieties*. *Dairy Pipeline*: Vol. 26, No. 2.

US Food and Drug Administration, Food Code, 2017, [fda.gov/media/110822/download](https://www.fda.gov/media/110822/download). 🌻

