



CALIFORNIA STATE SCIENCE FAIR 2005 PROJECT SUMMARY

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Project Title The Mystery of Stubborn Milk: What Factors Can Inhibit the Fermentation of Milk?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The production of yogurt from milk using live milk-fermenting bacteria as a starter culture does not always give reproducible results. I wanted to find out what factors could inhibit the fermentation of milk. I hypothesized that non-organic milk produced with antibiotics and pesticides may contain traces of these compounds that can inhibit the growth of lactic bacteria and thus prevent milk from fermentation.</p> <p>Methods/Materials In my first experiment I investigated the speed of milk fermentation. 150mL samples of 5 varieties of organic and non-organic milk were inoculated with equal amounts of live milk-fermenting bacteria. The samples were incubated at 37°C. The pH and thickness of milk were checked at 0, 8, 20 and 25 hours of incubation. The time to obtain the final product (yogurt) was also recorded. The experiment was repeated 3 times. In my second and third experiments I studied the inhibition of bacterial growth by milk. Since lactic bacteria required special growth conditions, I used Escherichia coli instead. I inoculated the best and the worst fermenting varieties of milk with 2 strains of E. coli and after incubation I plated the dilutions of milk on a growth agar. The next day I counted the number of colonies.</p> <p>Results After 20 hours of incubation at 37°C only the organic milk samples were fermented. After 25 hours all milk brands were fermented except non-organic Ralphps milk. Organic milk had a quicker and greater decrease in pH (from 6.5 to 4.83) during fermentation than non-organic (from 6.5 to 5.33). The antibiotic-sensitive strain of E. coli grew better in organic (3.9×10^8 bacteria/mL) than in non-organic milk (2.7×10^8 bacteria/mL). The penicillin-resistant E. coli also grew faster in organic milk (9.4×10^7 bacteria/mL) when compared with non-organic (2.8×10^7 bacteria/mL).</p> <p>Conclusions/Discussion These results support my hypothesis. Beneficial lactic bacteria such as Lactobacillus acidophilus ferment organic milk better than non-organic. Non-organic milk inhibits the growth of bacteria including E. coli. This inhibition in case of Ralphps milk can not be explained by the presence of penicillin alone. Organic milk, with its better ability to support the growth of beneficial bacteria, should be used for young children, for people with weak immune system, and for cancer patients who take probiotics (live beneficial microorganisms) to restore their bacterial population after radio- or chemotherapy.</p>	
Summary Statement Brands of organic and non-organic milk were tested for the ability to inhibit bacterial growth and milk-fermenting activity in order to find the brand preferred by beneficial lactic bacteria used in food processing and in medical treatment.	
Help Received Dr. Holcombe from UCI Medical Center let me work in the laboratory and use the lab equipment. Lab personal taught me how to make dilutions. Mother helped to gather all the materials. My science teacher gave support and encouragement.	