The Effects of Mouthwash on Lactoperoxidase and pH in Human Saliva: Helpful or Harmful?

Olivia Lim

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Introduction:

Lactoperoxidase is an enzyme, part of the peroxidase family, that is secreted from the salivary glands as an antibacterial agent. One of four antimicrobial enzymes found in human saliva, it is critical in preventing harmful bacteria growth within the mouth. pH measure of the acidity and basicity of a substance. A healthy mouth's saliva has a pH range between 6.75 and 7.25. Changes to this pH can cause changes in bacterial growth. Mouthwashes are generally more acidic than optimal saliva pH. Mouthwashes are antiseptic solutions designed to reduce the amount of bacteria present in the mouth. If mouthwash disrupts the natural levels of peroxidase or pH, using it might be counterproductive. This experiment aims to determine the effects of mouthwash on lactoperoxidase and pH in saliva. The results concluded that use of mouthwash increased lactoperoxidase levels and decreased pH levels suggesting a positive impact. This research has implications in dental health; providing more confidence in the benefits of mouthwash and its effectiveness at working with natural antibacterial components and pH in the human mouth.

Materials and Methods:

All processes were done under aseptic technique. Collected 1 mL samples of saliva from 6 biological replicates. Three biological replicates then used 1 mL of Colgate Antiseptic mouthwash for 30s and three used 1 mL Listerine Antiseptic Mouthwash for 30s as per manufacturers recommendations. Replicates waited 10min before 1mL sample of saliva was collected. The pH level of each sample was taken using pH strips (pHydrion Spectral 0-14 Plastic pH Indicator Strips) and recorded. Peroxidase levels were measured using an Enzyme Activity kit (AP Biology Investigation #13: Enzyme Activity kit 118-0171) and colorimeter (NeuLog colorimeter logger sensor NUL-219). A guaiacol solution (3.5 mL distilled water, 0.1 mL guaiacol concentrate and 0.15 mL hydrogen peroxide) was mixed with a salivary sample (3 mL distilled water and 0.75 mL saliva sample and placed in the colorimeter measuring percent transmission. Peroxidase levels were recorded at 2,3,4,5, and 6 minutes.

Figures:

Figure 1:

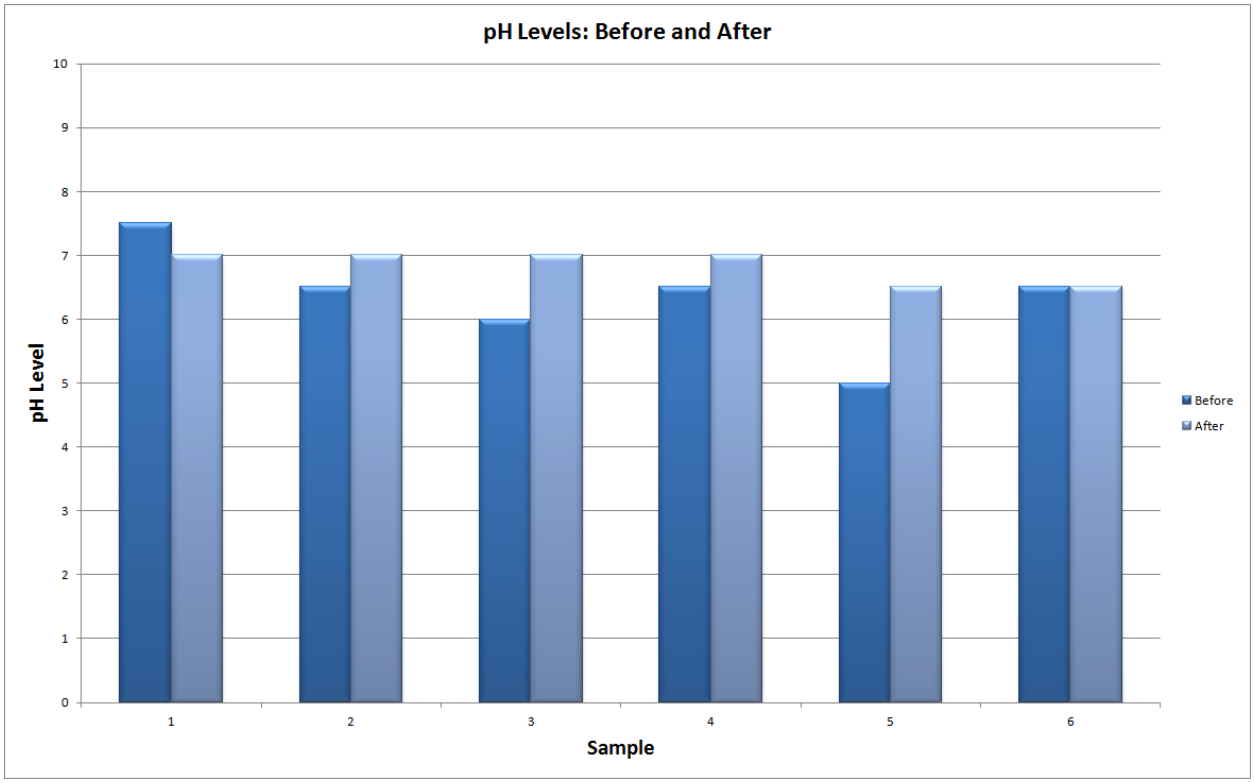

Figure 1: The comparison of average pH levels before and after mouthwash . Samples 1-3 used Colgate Antiseptic mouthwash. Samples 4-6 used Listerine Antiseptic mouthwash.

Figure 2:

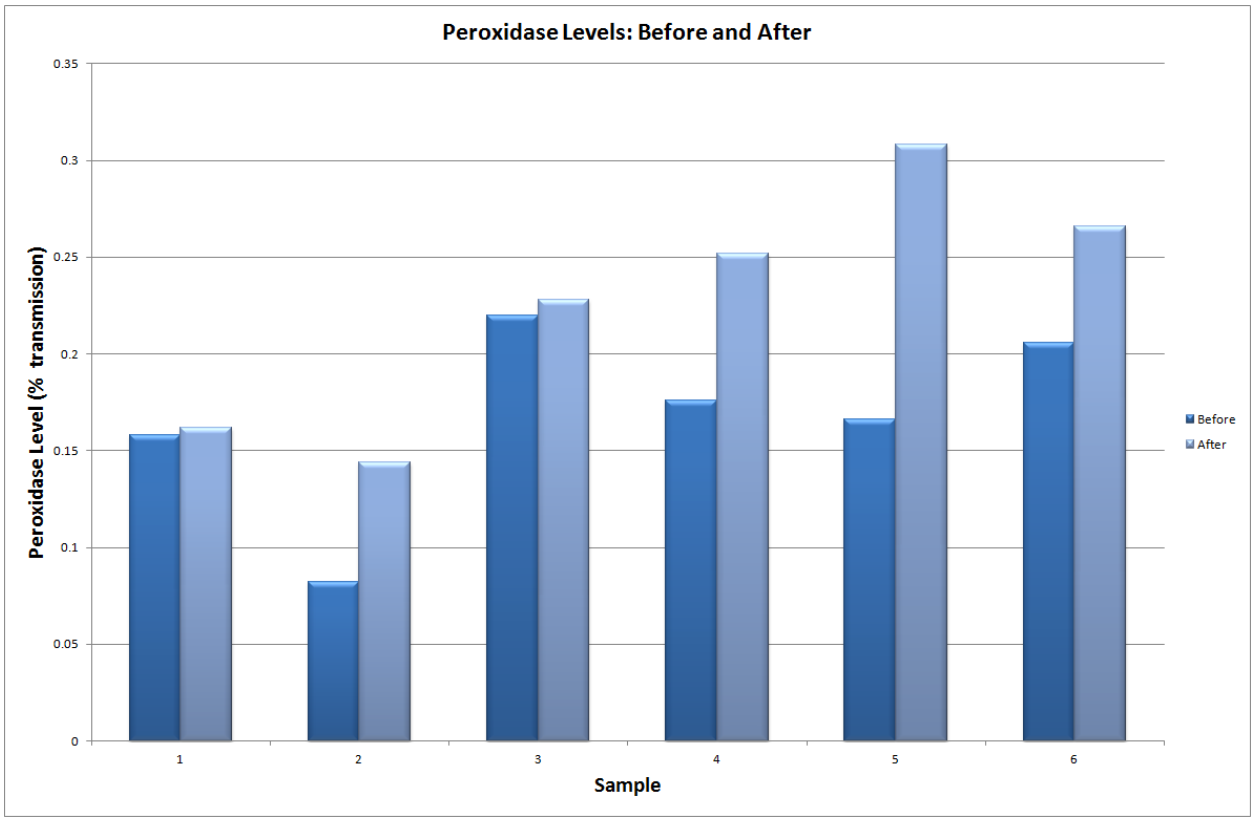

Figure 2: The comparison of average lactoperoxidase levels before and after mouthwash . Samples 1-3 used Colgate Antiseptic mouthwash. Samples 4-6 used Listerine Antiseptic mouthwash.

Figure 3:

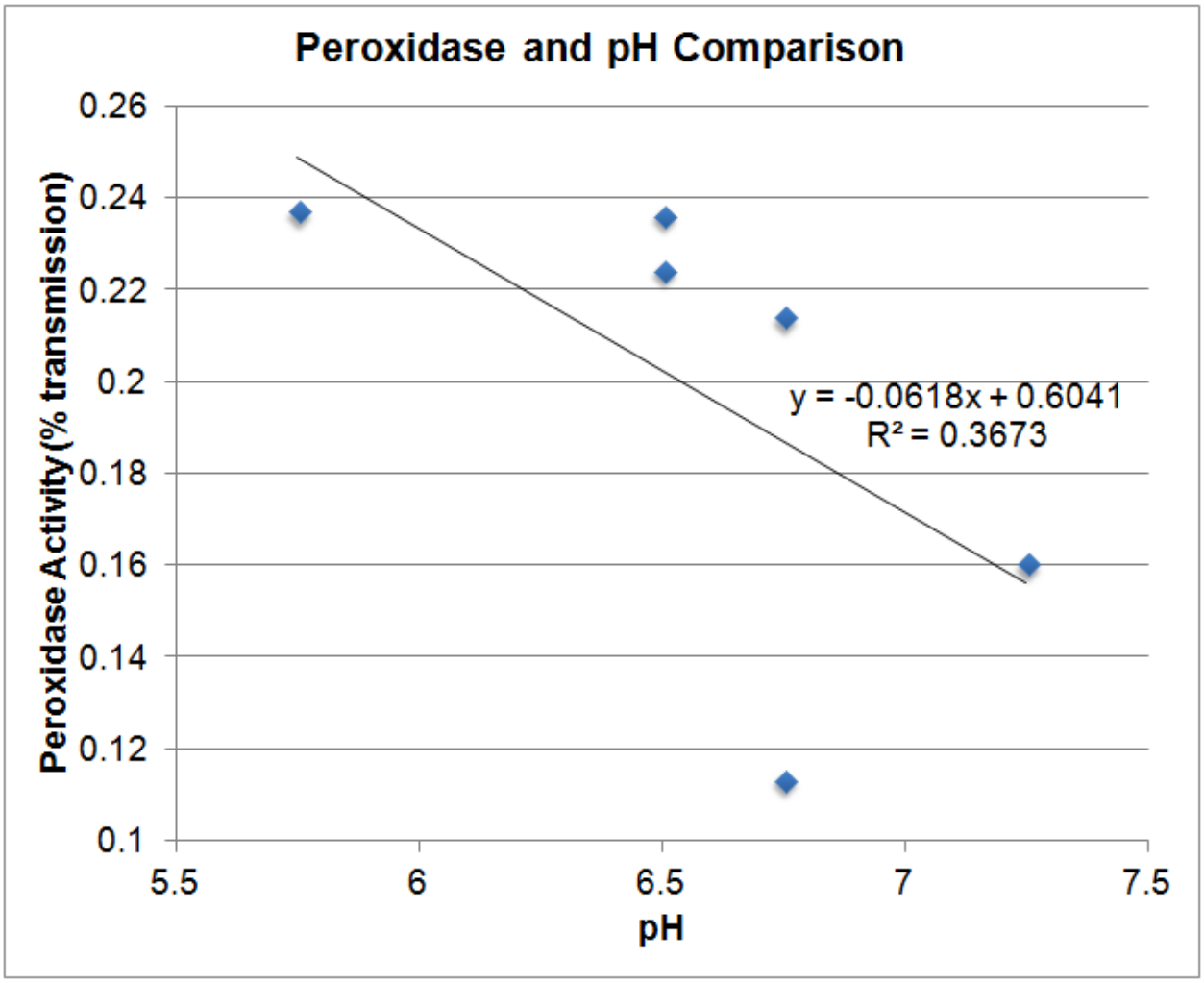

Figure 3: The comparison of average lactoperoxidase and average pH levels.

Results:

The intent of the experiment was to ascertain if mouthwash has an effect on pH and peroxidase levels in human saliva. The lactoperoxidase and pH levels were measured from salivary samples taken before and after mouthwash and recorded. In Figure 1 comparing pH levels before and after mouthwash, 4 out of 6 samples showed a decrease in pH levels. 1 out of 6 showed an increase in pH. 1 out of 6 showed no change in pH. In Figure 2 comparing lactoperoxidase levels before and after mouthwash, 6 out of 6 samples showed an increase in lactoperoxidase levels. In Figure 3 comparing lactoperoxidase and pH levels, the Pearson's correlation of the two values was _____, a strong negative correlation.

Discussion:

Based on the above data, the general trend shown in Figures 1 and 2 suggests that both peroxidase levels and pH levels increase after mouthwash use. This suggests that mouthwash is beneficial, creating higher levels of peroxidase and a more basic mouth. The Pearson's correlation coefficient between the pH and peroxidase levels indicates that there is a strong negative relationship between the two values. As the samples are more acidic the levels of peroxidase are higher. More trials would be needed to confirm these findings. It is possible that human error made pH or peroxidase level readings slightly inaccurate. More biological replicates would also be desirable to strengthen the results. In terms of further research, it would be interesting to test mouthwash's effect on other antibacterial enzymes found within the mouth such as lysozyme, lactoferrin, and Immunoglobulin A. Different mouthwashes could also be tested. The correlation between acidity in the mouth and increased lactoperoxidase levels could also be explored further.

References:

Klaas D. Kussendrager and A. C. M. van Hooijdonk. 2000. Lactoperoxidase: physico-chemical properties, occurrence, mechanism of action and applications. British Journal of Nutrition 2000, 84, Suppl,. 1, S19-S25.

Carlstrom A. 1969. Lactoperoxidase, Identification of multiple molecular forms and their relationships. Acta Chemica Scandinavica 23, 171-184

Paul KG & Ohlsson PI. 1985. The Chemical Structure of Lactoperoxidase. The Lactoperoxidase System, Chemistry and Biological Significance pp. 15-29

Reiter B & HaÈrnulv G. 1984. Lactoperoxidase antibacterial system: natural occurrence, biological functions and practical applications. Journal of Food Protection 47, 724-732.

http://faculty.quinnipiac.edu/libarts/polsci/statistics.html

http://en.wikipedia.org/wiki/Pearson_product-moment_correlation_coefficient