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SUMMARY

Biophotons in Milk: The effect of biophoton intervention on the pH level of aging milk

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Introduction

Milk quality and shelf life have been the subject of a variety of research approaches. However, not much research has been put into the relation between quality of milk and the more recent developments in the field of biophotons. One unpublished study in the past has focused on detecting changes after intervention, presumably on a biophoton level, with a specific biophoton device used by therapists. This text elaborates on that with research into biophoton intervention by means of a simple measurement, pH level.

State of knowledge on biophotons

Biophotons are weak emissions of light radiated from the cells of all living systems. A photon is a single particle of light. Plants, animals and humans have an intensity of their emission from some hundreds up to one thousand photons/second/cm², and an almost continuous spectrum within the optical range of at least 200 - 800 nm (Bischof, 1995).

State of knowledge on milk quality

Milk quality is of great concern to the agricultural community and is stricly monitored by the Dutch government. The most commonly used method of monitoring the quality level of milk in The Netherlands is monitoring the bacterial levels that are caused by udder and/or teat infection with mastitis, and quality of milk has an influence on the shelf life of milk. This monitoring is done through a test which measures the Somatic Cell Count (SCC). SCC is commonly used with cutoff points, where certain levels above the cutoff are considered no longer acceptable, in which case the farmer is not allowed to distribute the milk to either factory or customer. There is a relation between SCC and the occurrence of mastitis, as well as a relation between SCC and the Acid Degree Value (ADV) of milk. (Ogola H., Shitandi A., Nanua J., 2007) The ADV is a potential indicator of the rancid flavor of milk, which would influence the quality perception of the customer, and shows an estimate of the level of Free Fatty Acids (FFA). (Cornell University, 2004) Acidity of milk is therefore related to different factors.

Another means of measuring acidity is pH level. The pH level shows the hydrogen ion concentration, which is different from the FFA the ADV test measures. Because of multiple factors influencing the

acidity of milk, among which lactic acid, the possibility exists of measuring an apparent acidity of milk when using titrable acidity to determine the acidity level. (Dahle Budge Keith, 1930) This can also be viewed as titration primarily describing the buffer action of milk and the developed acidity describing the result of bacterial activity producing lactic acid in the milk. (Gea Niro website, 2010)

Altough pH and ADV both measure acidic levels and are therefore theoretically related, the author has not found any experimental or other research to specifically illustrate the relationship between these two variables. A study on cows milk in New York does however lead to the tentative conclusion that there is a correlation between pH level, titrable acidity and ADV. (Herrington, Sherbon, Ledford, Houghton, 1972)

The basic pH level of milk is around 6.63, with a range of deviation of ± 0.08 without differences between lactation stages of cows. (Tsioulpas, A., Lewis, M. J., Grandison, A. S., 2007) Factors of influence on the pH level are the concentration of lactic acid and the presence of mastitis in the cows among others like food- and other regional influences.

No direct relation between SCC and pH level exists as far as the author has been able to determine, so pH is not a valid means to determine the SCC levels of raw milk, despite the fact that an indirect link exists through the coagulation properties of milk. (Ikonen T., Morri S., Tyriseva A.-M., Ruottinen O., Ojala M, 2004) There is, however, an inverse link between higher SCC and higher pH, since the presence of mastitis will cause a raise in the pH level of milk. Apart from a higher pH level, an elevated SCC count is also related to changes in fatty acid composition and ion and mineral concentration. (Atasever S., Erdem H., Altop A., 2010) Other than for quality testing, pH value is a determining aspect for other aspects of testing of cow milk, as seen in the research focused at developing a single-use phosphorimetric sensor for field use. The focus is on phosphorescent intensity and it shows that pH is a valid variable to be used for certain applications. (Capitan-Vallvey L.F., Al-Barbarawi O.M.A., Fernandez-Ramos M.D., Avidad R., 2002)

In 2002 and 2003, experimental research has been done by Van Wijk and Boswinkel into the aging process of milk after biophoton intervention by treatment with a specific biophoton device used by therapists. The results were measured with laboratory equipment including a photon multiplier tube and photon counter. The conclusion of Van Wijk was that additional research would be advisable, since a noticable difference was measured between the treated samples and the control group for the biophoton emissions. Whether there was statistical significance of these noticable differences is unknown. The results show that the device had an impact on the biophoton characteristics as present in the milk samples. The research included both raw and pasteurized samples of milk, and both showed noticable changes after treatment. (Van Wijk, 2003)

Research Question

Is aging of milk as measured by pH level affected by intervention through treatment with a specific biophoton device used by therapists?

Methods

This section details the methods used in the research, including research design, participants, materials and research execution design.

Design

For this research, 50 milk samples were used for each group according to treatment. This sample size is small, but statistical significance would in any case be of secondary importance, since the purpose was first to see whether there would be any noticable differences between treated samples and the control samples. In order to determine whether a sample treated with added information in the form of a homeopathic remedy would perform differently from a sample without such additions, two treated groups were used, and one control group.

In order for the study to be as objective as possible, blinding has been done by first treating the respective groups, and then shuffling their physical position respective to each other by a different person than the author, so that the pH testing would be done by the author on samples for which the author did not know whether the samples were treated or not with the BT device.

Data collection has been done at the start of the study for each sample, and on two more specific days after the start of the study. Raw milk will usually only be consumable within 3 days even when kept refrigerated, therefore three samples of each group were tested daily to assess the pH level of that group. The pH level was chosen as a variable because it is a cost effective means of determining the acitidy of the milk samples. Because of the short shelf life of raw milk, the dates of measuring were initially set at 2 days after the start and 4 days after the start, to achieve a situation where usable test results could be obtained before the pH level would reach its lowest value of around pH 4.5, at which point any differences could be obscured by the milk aging process.

Participants

The author, and one additional person.

Materials

A selection of the materials used is:

- Biophoton device: The biophoton device (device according to J. Boswinkel) consists of one main electronic component with operating buttons, several connectors for attachments and one connection for the electric supply. For this research, two glass rods were attached with fiberoptic cables to the biophoton device, as per instruction by the inventor.
- Raw milk: The raw milk was gotten from the collection tank of a dairy farm (‘t Oortjeshek, Oortjespad 2, Kamerik, The Netherlands) right after milking on the day after the tank had been emptied, thus ensuring the relative freshness of the raw milk. Using raw milk was necessary since pasteurized milk does not exhibit the property of a lowering pH level when it agess. There are no specifics known as to the medication, food or SCC levels of the milk.
- Petri dishes: The petri dishes were bought from the firm Greiner Bio One and were 94/16 mm dishes, catalog number 632180.
- pH meter: Voltcraft PHT-01 ATC
- Measurement syringe: The syringe used to transfer equal amounts of milk into the petri dishes from the bulk transport container was a standard disposable plastic sterilized syringe of 100 ml as bought at an apothecary.
- pH calibration fluid: With the pH meter, a calibration fluid was delivered with an included table for compensation of temperature differences.

Execution of the Study

The milk was divided into samples of 55 ml of milk each and put in disposable one-time use petri dishes of 16 mm height and 94 mm diameter with a sterilized and disposable syringe of 100 ml. The study comprised three sample groups: one control group, one group treated without any additional information and one group treated with the same program as the previous group but with information of Rescue Remedy (RR) added to it in the biophoton device.

The samples were placed in petri dishes after treatment of an amount of milk sufficient for 50 samples, and were numbered before blinding in random sets of 10 so as to spread the numbering among the groups as well and to avoid any easy deduction of which group was which.To avoid any material contamination, the control group was placed into the dishes first. The treatment group without the additional Rescue Remedy followed, and the treatment group with Rescue Remedy followed last. The blinding process involved moving an entire group to a new location by sliding them over the counter on which the samples had been placed. The overall treatment time was neglectably short in comparison to the milk aging time.

The samples were each measured at the start and each measuring point with the pH meter by stirring the sample before measurement, by inserting the pH meter into the fluid, then waiting until the pH meter had settled enough for the value to remain unchanged during a period of 10 seconds. When a value would remain unchanged for 10 seconds, that value was noted down. All samples were measured at each sitting.

Statistical Analysis

The pH levels of the milk samples are documented and analyzed for differences in terms of mean, group to group correlation and the possibility of chance occurrance of results in terms of p level significance in a pairwise comparison (group * factor1) test performed by a College-appointed statistician.

Results

This section details the results of the research. First the actual pH values from the samples are presented, followed by the results from the statistical analysis.

The results show a clear distinction between the pH levels of the groups that were treated with the biophoton device and the control group, as illustrated by the following graph:

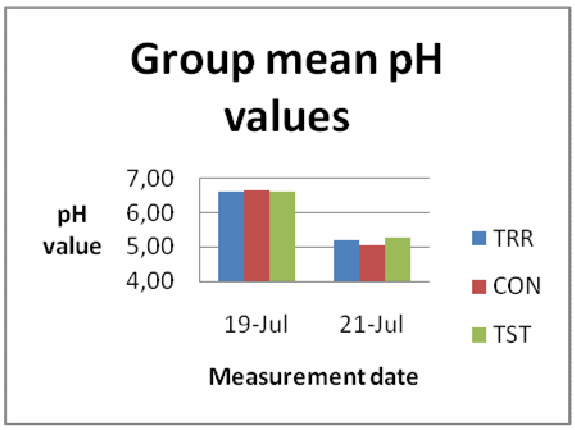
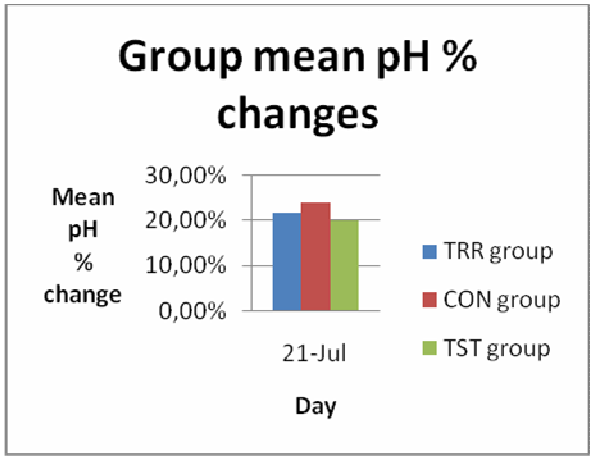


Figure 1: Group mean pH values

While a small difference in pH values on the 19th of July can be observed, the control group CON's mean pH value is noticably lower than both treatment groups TRR and TST, with group TST showing the highest mean pH value. TRR represents the group of samples treated with the biophoton device with added non-physical information called Rescue Remedy, CON represents the control group without any treatment and TST represents the group of samples treated with the BT device without added non-physical information.

In other words, there is a larger difference in mean pH values between the sample groups when measured after two days of aging when compared to the difference in mean pH level at the first measurement directly after treatment of the sample groups.



As can be seen in figure 2, the percentual changes on the control group CON were largest of all groups. The percentual changes in the TRR group are less than the control group, but larger than the relative pH changes in the TST group.

The statistical analyses show statistical significance, as quoted: "... shows results for comparison between t1 and t2 and for interaction between group and time. Both are significant, that means that there is a difference between t1 and t2."

Figure 2: Group mean pH percentage changes

Discussion

In this section, an interpretation of the results and the author's conclusions will be presented. This section will finish with the author's suggestions for further research to answer questions that have come up as a result of this study.

Interpretation of Results

The research results show a clear difference between the pH levels of the treatment groups TRR and TST and the control group during aging of the milk samples, with a statistically significant difference as computed through p value. As such, the working hypothesis can only be accepted as valid, and the counter hypothesis will be rejected.

The results show that treatment with the biophoton device has worked a change in the behavior of the milk aging characteristics when compared to the control group. Although the author has found no specific research linking pH levels of aging milk to biophoton delayed luminescence, the results seem to suggest that changes in the pH of milk could correspond on a certain level to delayed luminescence. The research by Van Wijk concludes that the milk samples after treatment show more coherence, which is linked to higher internal quality of the milk. Other publications from the Louis Bolk institute have shown that physical and sensory differences in organic milk when compared to non-organic milk shows a higher level of quality. This is explained in both biophoton delayed luminescence as well as computated and observed biocrystallisations. With the hypothesis that milk of a higher quality could show slower degradation, the differences in pH level during aging seem to correlate with both the findings of Van Wijk as well as the publications referenced from the Louis Bolk institute. This is further strengthened by the findings of Bajpaj, where the storage life of milk does have a relation to the biophoton delayed luminescence, since storage life of milk depends on bacterial activity and pH levels among other variables. This, however, remains an indirect link between pH level and biophoton delayed luminescence for now.

Conclusions with regard to the resarch problem and the state of knowledge

From the research, it can be concluded that intervention with the biophoton device has a significant influence on the pH level of aging milk. The changes in mean pH level were 23.98% for the control group CON, 19.96% for the treatment group TST and 21.75% for the treatment group TRR. It can be concluded that adding the Rescue Remedy information to the treatment has caused a different effect on the pH level of the milk samples when compared to the TST group. The significance in p value was 0,044 between groups CON and TRR and 0,001 between CON and TST, showing that the significance for the treatment group TST was greater because of the difference in percentage difference.

Self-Critical Remarks

There are several self-critical remarks to be made about this research, mainly about the potential theoretical effect some variables may have had on the results. One of those variables is that the research has taken place in a home lab. Performing this study in a home lab was done for reasons of practicality.

Although the goal of the research has been achieved in terms of showing that pH level is a possible means of measuring changes in milk due to treatment with the biophoton device, this research has not yielded any insight into the specific relations of characteristics of milk, and as such does not yet provide a complete fundamental base on which to comfortably base other work.

Suggestions for Further Research

The fundamental suggestions revolve around the relationships between characteristics of variables tied to milk and biophoton behavior and reproducibility. The relation between SCC level and biophoton emission is one such relation, and research into this relation could help build a more firm foundation on which to base other research. Reproducibility and a scale up in number of samples would help achieve the same goal.

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