The effect of physical and chemical factors on the complement system and the use of the results to diagnose individuals exposed to indoor air damage

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MOLECULAR CELL BIOLOGY

Introduction

Complement system is part of the vertebrate immune system. It is the first defense against microbial infections. Its main functions are pathogen lysis, activation of the leucocyte response and opsonization. The complement system is composed of about 50 proteins. It is activated via three different pathways, which are classical, lectin and alternative pathway.

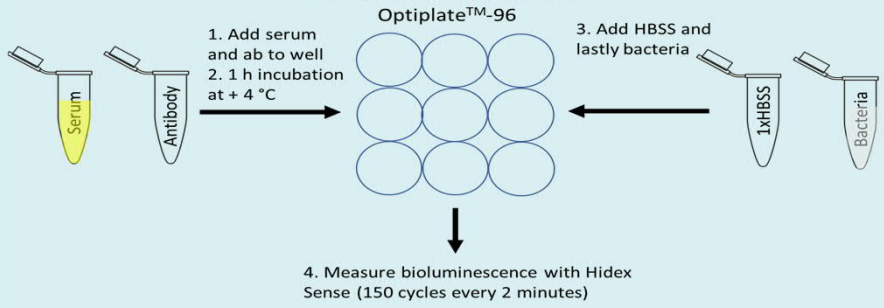
The complement is an evolutionarily old system, and its components have been found in older species, such as crabs, that don't yet have a functioning complement system.

This study is based on *E. coli*-lux bacterial cells, which emit bioluminescence (*Atosuo et al. 2013*). Bioluminescence decreases in proportion to the cells killed by the complement.

Aims of the study

1. The effect of the temperature to the complement activity (Figure 1)
2. Separation of pathways by antibodies (Figure 2)
3. How does the Ca^{2+} affect to the complement activity (Figure 3)
4. Utilize results to diagnose individuals exposed to indoor-related microbe damage

Materials and methods



Results & conclusions

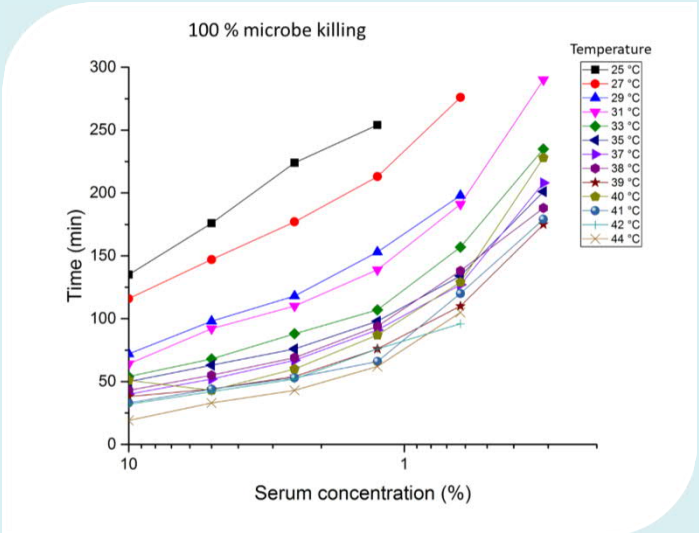


Figure 1. The effect of the temperature (25 – 44 °C) to the antimicrobial effect of the serum (0.31 – 10 %). Result are gained from the *E. coli*-lux bioluminescence kinetics. The higher the temperature the more efficient was the antimicrobial reaction. Fever seems to induce and hypothermia reduce this activity.

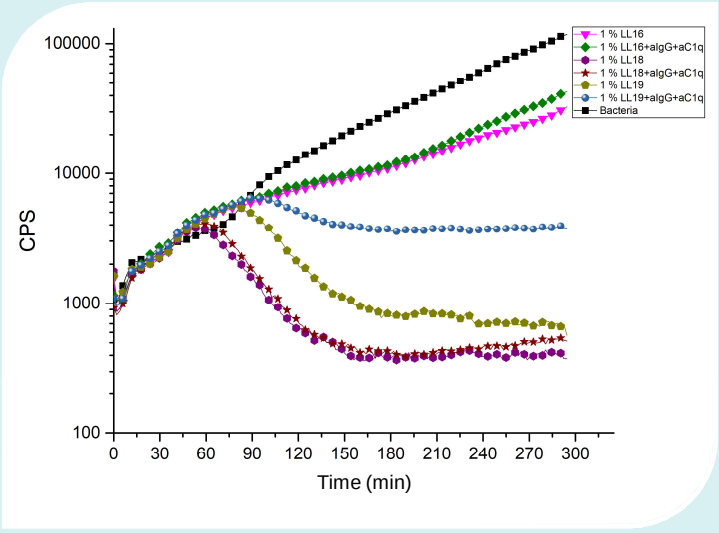


Figure 2. The *E. coli*-lux bioluminescence kinetics, counts per second (CPS) and the effect of antibodies (0.41 mg/ml anti-IgG and 0.8 µg/ml anti-C1q) on patient (LL16, LL18 and LL19) serum samples. Anti-IgG and anti-C1q diminish the complement activity by reducing the classical pathway activation and interindividual differences are observed. LL18 had high activity with or without antibodies, whereas LL16 has low activity. LL19 has quite high activity without antibodies, but with antibodies its activity decreases.

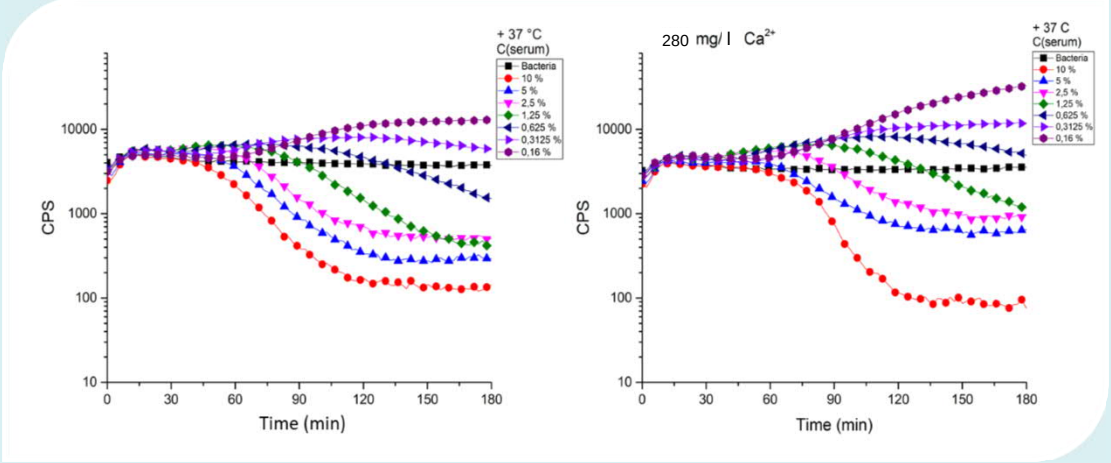


Figure 3. The effect of the double Ca^{2+} concentration (above right) to the antimicrobial activity to the *E. coli*-lux bioluminescence kinetics. The increased Ca^{2+} did not have a substantial effect on the complement activity compared to the normal Ca^{2+} concentration (above left).

TO CONCLUDE

1. Temperature affects on the activity of the complement system. Fever seems to increase antimicrobial activity (figure 1).
2. The three pathways were successfully separated with the antibodies. This method can be used to diagnose persons exposed to indoor-related microbe damages (figure 2) (*Atosuo et al. 2021*).
3. The increased Ca^{2+} concentration did not significantly increase the complement activity (figure 3).