DEFINING THE MECHANISMS UNDERLYING REDUCED IMMUNITY TO *STREPTOCOCCUS PNEUMONIAE* WITH AGE

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INTRODUCTION

According to the United Nations (2013),

the older population (over 60 years old) will **DOUBLE** by 2050, reaching *2 billion* people.

The incidence of **age-related diseases** is also increasing.

Among those, **Pneumonia** is a major cause of infection related **deaths in older adults,** accounting for 1.6 million deaths per year (WHO 2005).

The main pathogen to cause pneumonia is the bacterium ***Streptococcus pneumoniae***, and older adults are particularly **susceptible** to this disease, that affects both the extremes of age.

One of the reasons for this is because **the immune system changes with age**. It undergoes a process called **immunosenescence**, in which the cells undergo loss of function.

Among these cells, the **neutrophils**, which are central for achieving immunity against *S. pneumoniae*, show decreased function in old adults.

Therefore**, our aim** is to understand how and why neutrophil response to *S. pneumoniae* differs between healthy young and older adults.

METHODS

After collecting peripheral blood from healthy young adults (HY) (< 30 years) and from older adults (HE) (>65 years), neutrophil functions in response to *S. pneumoniae*, serotype 4 (TIGR4 strain) were analysed by measuring 3 different killing actions of neutrophils:

- **Phagocytosis and Respiratory Burst in whole blood**

S. pneumoniae was opsonized with antibody or complement, as these molecules can **enhance** neutrophil functions. Serum from HY or HE were used as a source of complement.

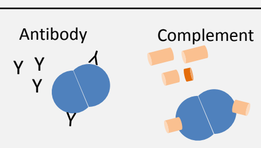


Fig. 1. *Opsonins binding to* S. pneumoniae *(in blue)*

- **Neutrophil extracellular trap (NET) formation**

Neutrophils from HY and HE were incubated for 1 hour with live *S. pneumoniae* with a multiplicity of infection (MOI) of 1 and 10, and after, extracellular DNA released was stained for measurement.

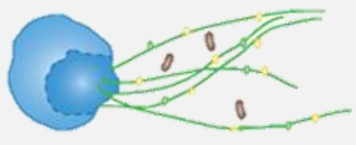
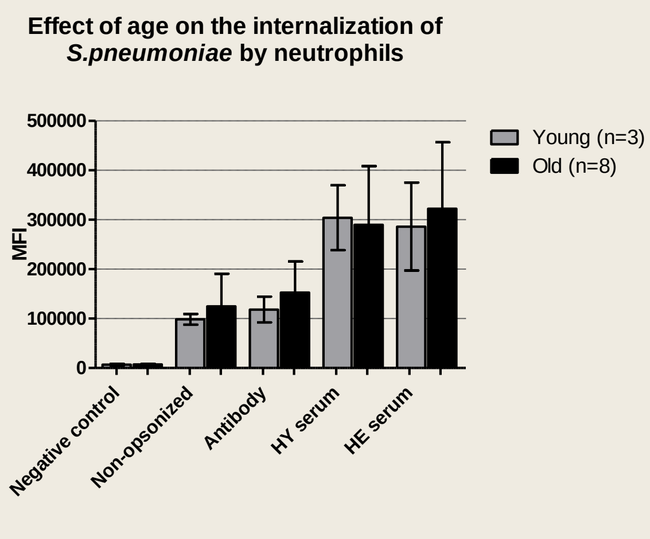


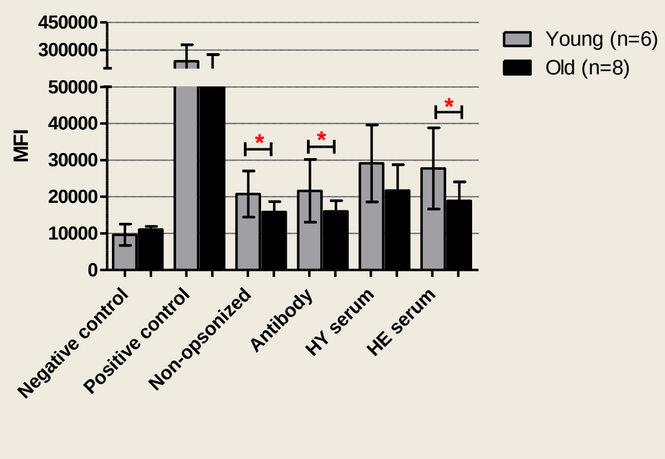
Fig. 2. *NET (in green), release by neutrophil (in blue).*
Adapted from Phillipson & Kubes (2011). Nature Medicine 17, 1381–1390

RESULTS

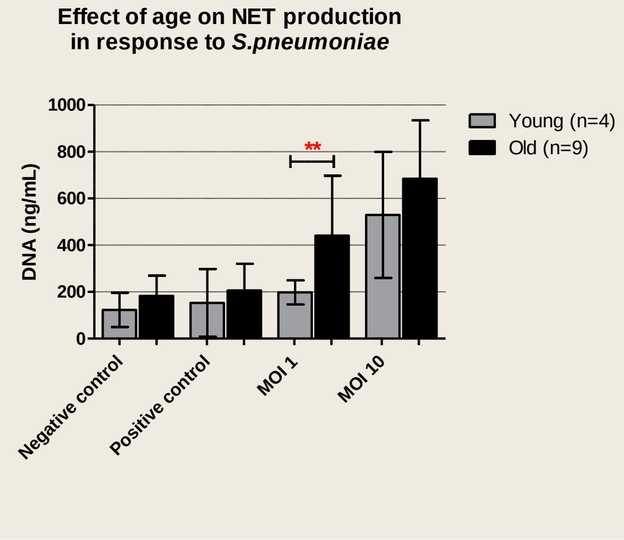
We found that neutrophils from older adults were internalizing (phagocytosing) the same quantity of *S. pneumoniae* as neutrophils from young adults.



However, neutrophils from the old produced less killing molecules, called reactive oxygen species, than neutrophils from young adults, after incubation with S*. pneumoniae*.



Analysis of NET production, which kills bacteria outside the cell, showed that neutrophils from the old produced more NETs than the young when less bacteria were present (MOI 1).



Data is expressed as mean ± standard deviation. Statistical significance was determined by Unpaired T test, (indicates p<0.05 and ** indicates p<0.01)*

CONCLUSIONS

Our results indicate that neutrophils from older adults are capable of generating NETs and internalizing *S. pneumoniae*, but their killing function is impaired. This could help to understand better the origin of susceptibility of elders to pneumonia.

WHAT IS NEXT

Compare how neutrophil response to *S. pneumoniae* differ between healthy older adults and older adults with pneumonia.

DO YOU WANT TO BE A VOLUNTEER?

You can be a volunteer to our study by donating **blood**. If you are interested, please contact me:

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