Telomere length shortening in early childhood in the Democratic Republic of Congo

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Introduction

Telomeres are sequences of DNA at the end of your chromosomes. They do not code for proteins like the rest of your DNA, but instead, protect the regions that do. However, every time a cell replicates, a little bit of the telomere is cut off due to the mechanism of the replication process. Although areas of the telomere are removed through the natural aging process, there appears to be mechanisms in place in early life to combat that. One such mechanism is an enzyme called telomerase that works to add nucleotides to the ends of telomere to increase their length.

Hypothesis/Approach

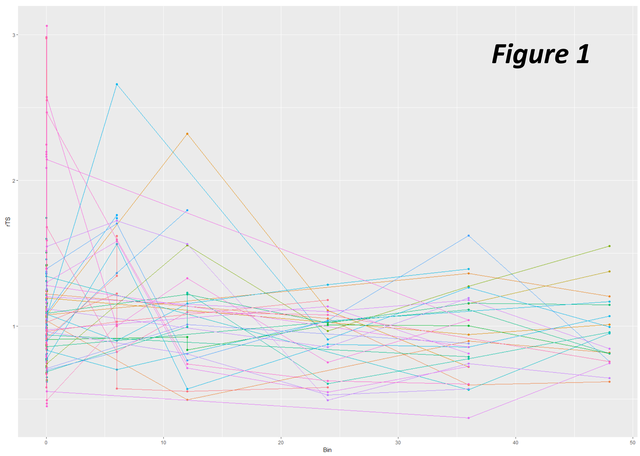
Based on relatively few longitudinal studies and comparison of single time point studies, it appears that telomere shortening occurs most rapidly during the first four years of life. However, there are no longitudinal studies of telomere length during this period of early childhood starting at birth. Our study works to characterize telomere shortening in a population of children, exposed to extreme prenatal maternal stress, starting at birth and continuing until four years of age.

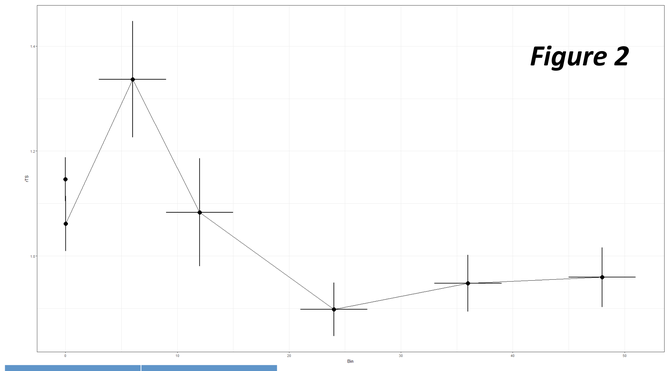
Methodology

Study Participants and Sample Collection- Blood samples from 101 babies were collected shortly after delivery. Blood samples were them collected from 38 of those babies up to 4 years of age.

Relative Telomere Length (rTS) value – Quantitative polymerase chain reaction (qPCR) multiplex reaction that produces a value proportional to the average telomere length of DNA.

Results





Age (months)	Average rTS Value
At Birth	1.14621
Day 1	1.061737
6	1.336882
12	1.083232
24	0.898139
36	0.947864
48	0.959301

Table 1

Figure 1 illustrates a raw spaghetti plot of the data from the 100 participants birth to 48 months.

Figure 2 illustrates the average rTS for each age group from birth to 48 months.

Table 1 shows the average rTS value at each time point studied from birth to 48 months.

Conclusions

Many studies have shown that rTS value will decrease over time in individuals as cells divide and the ends of chromosomes are removed. However, the four year timeframe of my study is just too short of a time to see significant shortening. From my data, it can be concluded that there is more than just the theory of telomere aging at play during the first few years of life. Not only is telomere length variable among individuals, but it seems to fluctuate greatly during this time.

Future Work

The enzyme telomerase has been shown to be present in the germ line of humans and rapidly decrease activity after birth to basically zero. This could explain the large increase in telomere length at 6 and 12 months and the subsequent decrease at 24, 36, and 48 months as telomerase activity levels drop. An interesting study would quantify telomerase activity combined with telomere length during this critical period of life.

References

1. Cawthon, R. M. (2009). Telomere length measurement by a novel monochrome multiplex quantitative PCR method.
2. Tackney, J. (2014) Blood Cell telomere lengths and shortening rates of chimpanzee and human females.

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