

# Low Level Radiation Research Section

(LLRRS, Mumbai and LLRRL, Kollam, Kerala)

## Objectives/Mandates:

- ❖ Biological and Health effect of chronic low dose/ low dose rate ionizing radiation on human population living in high level natural background radiation areas of Kerala coast in South west India.
- ❖ Understanding the molecular effect of low dose /low dose rate ionizing radiation in human cells.
- ❖ Effect of acute low dose ionizing radiation in human cells.

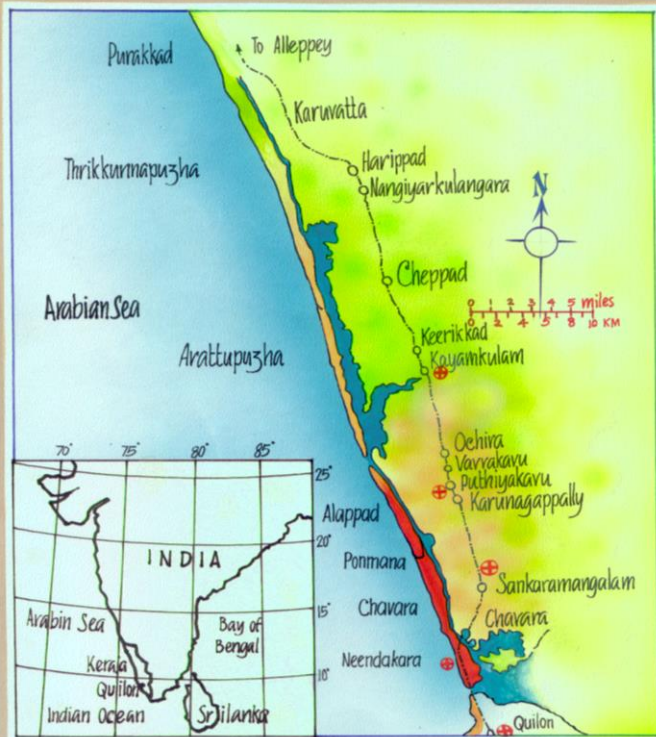
**Highlights:** So far, Our results do not reveal any significant differences in any of the parameters in HLNRA as compared to NLNRA.

## High Level Natural Background Radiation has no effect on:

- ❖ Congenital malformations (birth defects), Still Birth , Karyotype anomalies.
- ❖ Chromosome aberrations, micronuclei, heritable DNA Mutation rate, Telomere length and DNA Strand Breaks.
- ❖ Interestingly, gene expression analysis (transcriptome) revealed background dose dependent increase in number of differentially expressed genes in HLNRA and majority of these genes are involved in DNA repair, methylation and chromatin modification.

# HIGH LEVEL NATURAL RADIATION AREAS OF KERALA COAST

## Study Area



## KERALA HLNRA STUDIES

Epidemiology

Biological

**NEWBORN SURVEY**  
(congenital malformations)

**CYTOGENETICS**  
(Adults and newborns)



**HEALTH AUDIT SURVEY**  
(Non cancer Diseases)



**Heritable DNA Mutation analysis**

**DNA damage and repair**

**Case Control Study**

**Transcriptome analysis and miRNA profiling and sequencing**



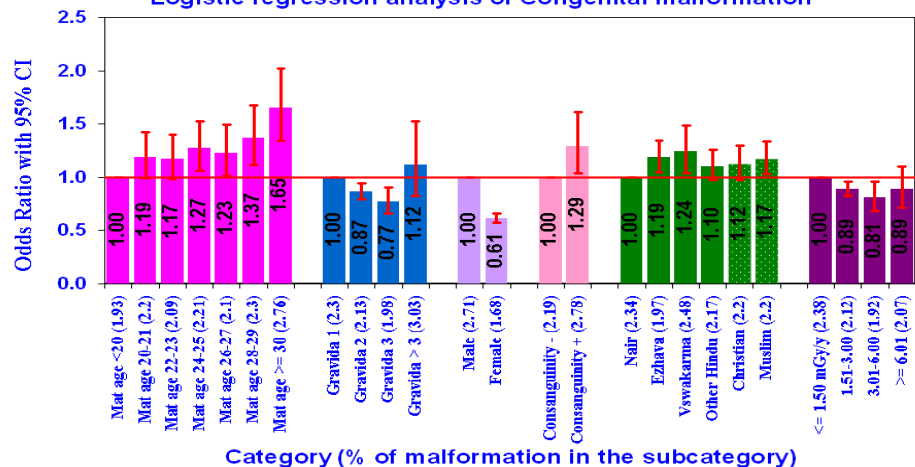
- ❖ Approx. 55x0.5 sq km strip along the south-west coast of India.
- ❖ Thickly populated (~400,000 population)
- ❖ Inhabited for generations.
- ❖ study the effects of radiation directly on humans.
- ❖ Ideal for dose-response studies.

- ❖ Radiation source - Thorium (and its decay products) containing monazite sand.
- ❖ Radiation dose rates ranges from <1 to 45 mGy/yr
- ❖ NLNRA: Normal Level Natural Radiation Area ( $\leq 1.5$  mGy/year)
- ❖ HLNRA: High Level Natural Radiation Area ( $> 1.5$  mGy/year)



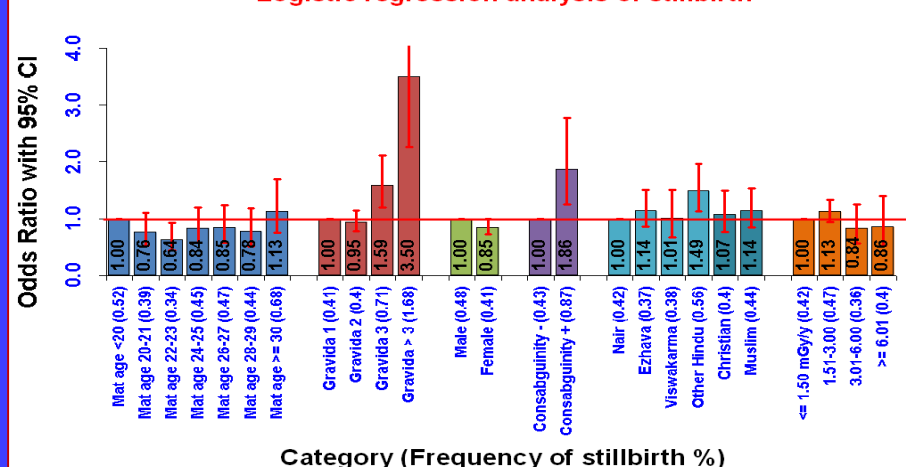
# HIGH LEVEL NATURAL RADIATION AREAS OF KERALA COAST

Logistic regression analysis of Congenital malformation



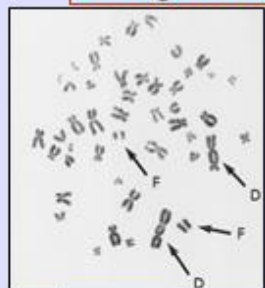
Category (% of malformation in the subcategory)

Logistic regression analysis of stillbirth

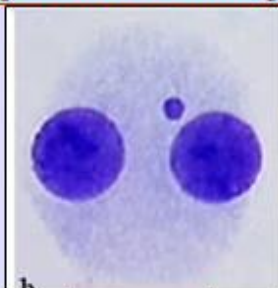


Category (Frequency of stillbirth %)

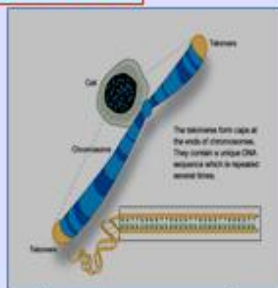
## Biological End points: DNA damage markers



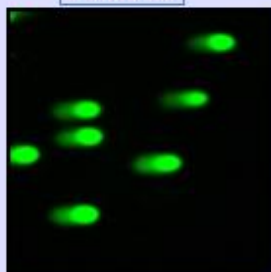
Dicentrics



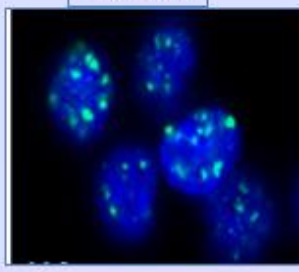
Micronuclei



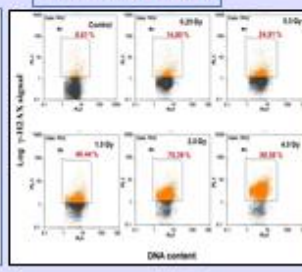
Telomere length



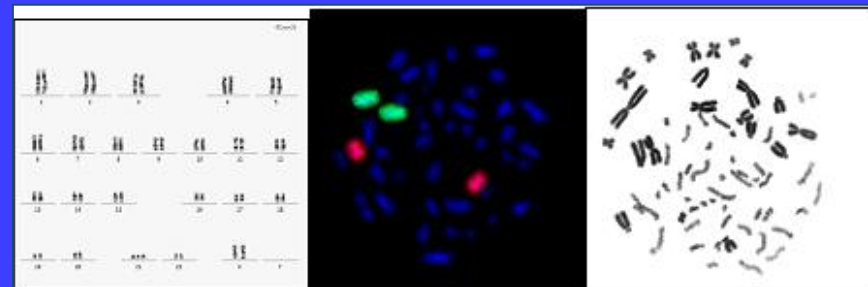
DNA strand breaks



Gamma-H2AX foci



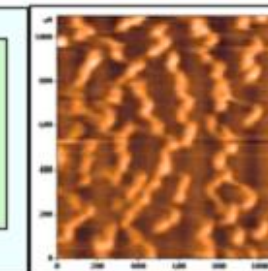
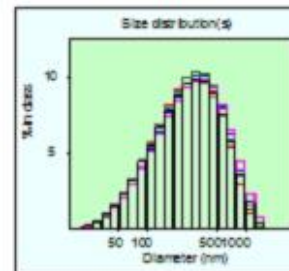
Gamma-H2AX positive cells



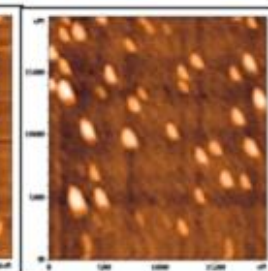
Karyotype 47 XX+21

Whole chromosome painting

Premature chromosome condensation



Control

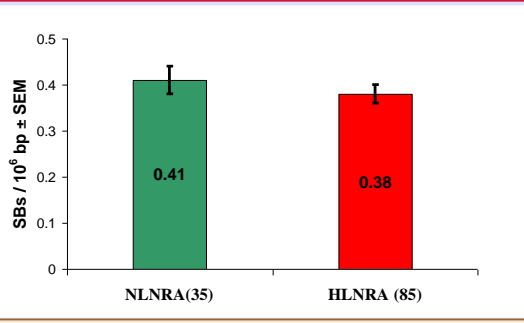


Irradiated

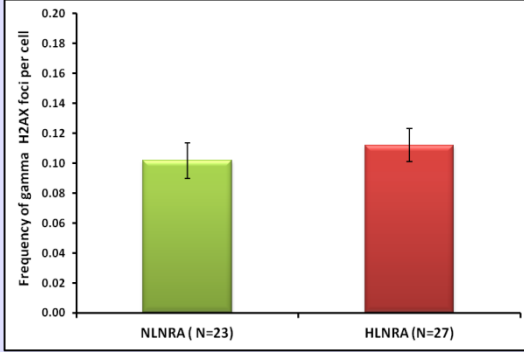
Chromatin dynamics



# HIGH LEVEL NATURAL RADIATION AREAS OF KERALA COAST



No significant difference in DNA strand breaks between HLNRA and NLNRA individuals.



No significant difference in DNA Double Strand Breaks between HLNRA and NLNRA individuals.

