Status of hypothyroidism and its impact on molecular level

Tika Ram Lamichhane
Tribhuvan University, Nepal

Statement of the Problem: Routine assessment of thyroid status basically relies on Ultrasonographic (USG) examinations and Thyroid Function Tests (TFT) determining the serum concentrations of FT3, FT4 and TSH. Along with finding the prevalence of hypothyroidism, it is required to explore the biophysical insights in the molecular levels behind such disorders.

Methodology & Theoretical Orientation: USG and TFT measurements of the patients were performed at Tribhuvan University Teaching Hospital (TUTH), Kathmandu, Nepal. The mutational and overt hypothyroidal impacts on Thyroid Hormone Receptors (THRs) were studied by nanoscale molecular dynamics simulations in a high performance computer at Central Department of Physics, TU, Nepal.

Findings: The prevalence of subclinical and overt hypothyroidism are 64.58% and 11.73% of 963 hypothyroid subjects based on TFT results under the study of 4438 subjects. In a total of 140 patients (mean age: 38.94±13.60 years) performing both USG and TFT observations, 22.86% have hypothyroidism (mean TSH: 25.86 mIU/L) with mean size of left and right lobe, 4.92±3.24 mL and 5.66±3.93 mL, respectively finding multinodular goiters, hypoechoic lesions, chronic thyroiditis, benign/malignant nodules and colloid cysts in some patients. Negative correlation between FT3/FT4 and TSH verifies the negative feedback mechanism of thyroid cycle. At overt hypothyroidism, THRs become free of T3 or T4 in their binding sites that reduce the gene transcription rate. By the molecular dynamics study of native state THRs, the heat capacity of T3 liganded THR-β is 9.76±0.38 kcal/mol/K and that of unliganded THR-β is 9.08±0.34 kcal/mol/K at 310 K. It makes change in heat transfer properties.

Conclusion & Significance: In menarche and menopause periods, thyroid size of females is higher than that of males. Females are more vulnerable towards hypothyroidism. The mutated, T3-ligated and unliganded-THRs have the different structural and thermophysical properties like interaction energies, heat capacity, heat conduction and normal modes of vibrations.

Biography
Tika Ram Lamichhane is Assistant Professor at Central Department of Physics (CDP), Tribhuvan University (TU), Kathmandu, Nepal. He has expertise in biomedical applications of physics particularly in medical imaging and protein-hormone systems. His current research is based on ultrasonographic, biochemical and computational study of thyroid disorders.

trlamichhane@tucdp.edu.np

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