Recent phytochemical researches have directed attention that mostly single phytochemicals based therapy lacks bioefficacy and highlight the role of combination therapy as new treatment modalities for breast cancer. The developments in combination therapies involving nanosize enhanced therapeutic activities have shown scope of applications in medical sciences. The bioactive phytochemical embedded with nano particles, particularly; gold nanoparticles have an emerging interdisciplinary area with potential applications of nano composites in therapeutic applications. The versatile phytochemicals mediated Green Nano Technological processes have been shown to be effective in both the generation and stabilization of non toxic nanoparticles for direct application in diagnostic and therapeutic applications.

**Pharmacological Studies (In vitro)**

- Assessment of antioxidant (DPPH, FENTON, \( \text{H}_2\text{O}_2 \) and NO assay) and anticancer (MTT, TBE and SRB assay in MCF-7 and MDA-MB-468 breast cancer cell line) bioefficacy of 3,6-dihydroxyflavone its gold nanoparticle with lutein and selenium methyl selenocysteine (single and combination).

**Synthesis and Characterization of gold nanoparticle embedded 3,6 dihydroxyflavone**

- Synthesis of gold nanoparticle embedded 3,6-dihydroxy flavone by standard protocol and characterization by SEM, TEM, AFM, XRD and UV analyzing techniques.

**Pharmacological Studies (In vivo)**

- Assessment of antioxidant (in terms of reduced glutathione and lipid peroxidation), anticancer and antimutagenic activities of most potent combination of gold nanoparticle embedded 3,6-dihydroxy flavone with selenium methyl selenocysteine and lutein in sarcoma 180 cancer cell induced female Balb/c mice.

Gold nanoparticle embedded 3,6-dihydroxyflavone was synthesized using chemical reduction method and was subjected for following steps of characterization.

- UV spectra: a broad peak: 425-520 nm indicates mono dispersed particles.
- XRD analysis: crystalline phase and average particle size 12 nm.
- SEM analysis: uniform needle type morphology in contrast of rhombic crystal of native 3,6-dihydroxyflavone.
- TEM micrograph: nucleated cell type of morphology: particle size 6-12 nm.
- AFM image: uniform distribution of small sized particles in contrast of rough surface with large sized particle of native 3,6-dihydroxyflavone.

**Antioxidant activity**

**In vitro** Combination study: GNDHF+LUT+MSC (1:1:1) at 100 µg/ml by DPPH (87.13±1.43) %, Fenton (85.11±1.31) %, \( \text{H}_2\text{O}_2 \) (83.10±1.51) % and NO (84.02±1.13) % shows enhancement [10%] in antioxidant activity in combination with LUT and MSC and further enhancement [28%] in antioxidant activity in combination with GNDHF. **In vivo** combination study: [GNDHF+LUT+MSC (8/1.5/10 µM) at 5 mg/Kg b.w.], Glutathione contents (0.15 µM) increases compared to tumor control (0.07 µM) this relates increased development of antioxidant potential in Balb/C mice. Lipid peroxidation (0.18 nM) decreases compared to tumor control (0.47 nM) shows decrease in free radical production and subsequent reduction in oxidative stress.

**Anticancer activity**

**In vitro** combination study: [GNDHF+LUT+MSC (8/1.5/10 µM) gives enhancement in percent inhibition (90.27 - 91.57 %) in MCF-7 cell lines exhibits significant potential of anticancer bioefficacy. **In vivo** combination study: [GNDHF+LUT+MSC (8/1.5/10 µM) at 5 mg/Kg b.w.] using balb/c mice shows no change in body weight, depicts
non toxicity of the test compound, reduction in tumor volume (091.0 -126.9 mm$^3$) and delay in tumor growth (0-5 days) exhibit effectiveness of the test compound. Antimutagenic activity: [GNDHF+LUT+MSC (8/1.5/10 µM) at 5 mg/Kg b.w.] gives reduction in chromosomal aberrations: (17 %) and reduction in micronucleus formation (5.1- 87 %). Histopathological study exhibit triggering of apoptosis, decreased angiogenesis of cancerous cells without any major toxicity.