1. **Objectives**
   a. To evaluate the effect of nutritional status on chemotherapy related toxicity in patients with gynecologic, breast and lung malignancies
   b. To evaluate the effect of nutritional status on fatigue levels before and during chemotherapy
   c. To evaluate the effect of nutritional status on quality of life outcomes before and during chemotherapy
   d. To evaluate the effect of nutritional status on treatment response before and during chemotherapy

2. **Hypothesis**
   a. Nutritional status may affect chemotherapy related toxicity in patients with gynecologic, breast and lung malignancies
   b. Nutritional status may affect fatigue before and during chemotherapy
   c. Nutritional status may affect quality of life outcomes
   d. Nutritional status may affect treatment response

3. **Methodology**
   This study will recruit 200 subjects with gynecology, breast and lung cancer registered at hospital based cancer registry (Bangalore Institute of Oncology, Bangalore). The subjects will be randomly selected and the nutritional assessment will be done before and after 4 cycles of chemotherapy.

   a. **Study design**: Prospective single arm correlation design

   b. **Subjects**: Patients with lung, cervix, uteri, ovaries or breast cancer registered in hospital based cancer registry of Bangalore Institute of Oncology and Bangalore Institute of Oncology Specialty center planned for receiving adjuvant chemotherapy will be assessed for their nutritional status before starting chemotherapy. They are then followed up
prospectively for chemotherapy related toxicity, treatment response and nutritional status for first 4 cycles of chemotherapy.

c. **Selection criteria:**

**Inclusion Criteria:**

1. Patients diagnosed with breast cancer, lung cancer or gynecologic malignancies (Cervix Uteri, Ovary) planned for adjuvant chemotherapy
2. Written consent to participate in the study

**Exclusion criteria:**

1. Patients who are on enteral tube feeding or have received nutritional support via enteral route in the last one month
2. Uncontrolled diabetes
3. Hepatitis, Cirrhosis of liver
4. Nephrotic syndrome and acute renal failure
5. History of protein losing enteropathies
6. Pregnancy
7. Acute bacterial infection and septicemia at the time of nutritional assessment or within 2 weeks prior to nutritional assessment

**Trial Design:** Prospective longitudinal co relational study

d. **Method:** Subjects included into the study will be assess for their nutritional status, fatigue and quality of life outcomes and treatment response before start of the 4 cycles of adjuvant chemotherapy. They are also assessed for toxicity as per NCI CTCAE criteria after 4 cycles of chemotherapy. Bivariate relationships between Nutritional status, quality of life outcomes, treatment response and treatment toxicity will be determined during chemotherapy.

e. **Sample size:** The mean prevalence of malnutrition in cancer patient is around 16% (Ryu SW, et al. 2010). Therefore we will need 200 subjects in our study to demonstrate any
significant relationship between nutritional status and treatment outcome/toxicity with an error rate of 7.5 % and α of 0.05. This is based on the formula.

\[
\frac{4pq}{n} = \frac{r^2}{X N}
\]

Where, \( p \) = prevalence in %

\( q = 100 − p \)

\( r \) = available error of 7.5 %

\( N \) = Gender as 2 categories, male and female

We will do a random sampling and considering a refusal rate of 20% and a dropout rate of 10% we will screen around 200 subjects with lung and gynecologic malignancies in our study.

f. Outcome measures:

A. Primary outcomes /Dependant variables:
   1. EORTC Quality of life C 30 (Aaronson, et al, 1993)
   2. Fatigue scores on FACT-Fatigue scale and Fatigue symptom inventory (Sawada, et al, 2012)
   3. Treatment toxicity CTCAE criteria (Romero-Ventosa et al, 2012)

B. Predictor outcomes:
   1. SGA (Subjective global assessment) (Detsky, et al, 1987)

7. Anthropometric assessment including BMI, Ht Wt, Mid arm muscle mass, Triceps Skin fold thickness (Hebert, et al. 2006)


Mid-arm circumference (MAC) will be measured using a tailor’s measure. Subjects will be standing with the non-dominant arm exposed. The distance between the acromion and the olecranon process was measured with the elbow in 90° flexion and the midpoint marked. The subject will then be asked to let the arm hang loose and the MAC will be measured at the midpoint. The skin fold at the midpoint on the back of the arm (over the triceps muscle) will be picked up between the thumb and forefinger and the triceps skin fold thickness (TSF) measured using skin fold calipers. Three readings each will be taken and the average of the three calculated. Mid-arm muscle circumference (MAMC) is calculated using the formula:

\[
MAMC \text{ (cm)} = (MAC \text{ mm} - \pi \text{TSF mm})
\]

10. Data analysis: Nutritional status will be categorized as normal or malnourished and outcome variables will be compared using independent samples statistics. Bivariate relationships between predictor and outcome variables will be determined and predictor outcomes that have significant bivariate relationships will be regressed onto the dependant variables and predictors that best describe outcomes will be determined.

5. Scope of the study

The main objective of this study will be to assess the effect of nutritional status on fatigue, quality of life and treatment related toxicity and treatment response in patients with gynecologic, breast and lung cancers in a comprehensive cancer care center in Bangalore. The scope of the study will be limited to observing the effect of nutritional status on study outcomes without any
experimental nutritional intervention. Patients will receive intervention only after the study period is over. This is a prospective co relational study deigned to observe the effect of nutritional status on the above outcomes.

6. **Utility of the study**

This study will throw light on the prevalence of malnutrition in cancer patients using robust assessment measures. This will also offer information on the malnutrition due to disease in terms of systemic inflammatory response. If malnutrition does affect quality of life, treatment related toxicity, treatment response and fatigue then nutritional interventions will gain precedence as an adjunct therapy in conventional chemotherapy. This study might encourage the cancer patients to improve their nutritional status prior to the start of their treatment in an order to tolerate treatment toxicity and to have a better quality of life.

7. **Limitations (restriction) of the study**

This is a correlational study and not an interventional study and hence it would not be possible to minimize effects of any confounding variable as seen in an experimental design. This observational study will help throw light on effect of malnutrition in cancer patients but will not answer if nutritional interventions offer any benefits in terms of reversing the trends due to malnutrition.