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# NUTRITIONAL STATUS OF PATIENTS RECEIVING CHEMOTHERAPY AT TERTIARY HOSPITAL OF CENTRAL INDIA

Oncology

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## ABSTRACT

**Background:** Cancer patients receiving chemotherapy have a high risk of malnutrition secondary to the disease and treatment, and majority of cancer patients suffer from different degrees of malnutrition, depending on tumour subtype, location, staging and treatment strategy. Early nutritional assessment can identify problems to help patients increase or maintain weight, improve their response to treatment, and reduce complications. This study aimed to determine the nutritional status of patients receiving chemotherapy.

**Methods:** A prospective study was conducted among 447 subjects diagnosed with cancer of various sites and scheduled for three cycles of induction or adjuvant chemotherapy. Nutritional status of each subject was assessed based on nutritional parameters i.e. Anthropometric [BMI, MAMC, TSF, and MAC] and Biochemical [(Haemoglobin, Serum electrolytes and Albumin)] measurements before the initiation of chemotherapy, and follow-up assessment was performed on the completion of third cycle of chemotherapy.

**Results:** In this study it has been found that 95% of subjects suffered from weight loss post chemotherapy. The't' test showed a significant decrease in TSF [t=4.8($p<0.01$)], MAC [t=5.94 ($p<0.01$)] and MAMC, t=5.34($p<0.01$) before and after 3 cycles of chemotherapy.

**Conclusion:** The nutritional status assessment must be carried out on each patient at the beginning and during the treatment. The cancer patients are at high risk of malnutrition and associated comorbidities.

## KEYWORDS

Cancer, chemotherapy, nutrition, nutritional status assessment.

## INTRODUCTION:

Wasting syndrome is very common in cancer due to metabolic, cytokine, and clinical factors and it affects about half of the patients at the time of diagnosis [1, 2] and 80% of patients in advanced stages of diseases[3,4].

Chemotherapy treatment especially is associated with several side effects like nausea, vomiting, oral mucositis, xerostomia, diarrhea, constipation, and food aversion which play an important role in decreased food intake, nutrient loss, energy expenditure alterations and weight loss, particularly lean body mass[5]. Weight loss and malnutrition in these patients increase the risk of infection and associated comorbidities and the cost of health care[6, 7], decrease the quality of life[8], and affect the response to anti-neoplastic treatment and overall survival[9].

Nutritional assessment throughout the course of chemotherapy plays an important role in the early recognition of cancer and its treatment associated malnutrition. Knowledge of changes in nutritional status due to cancer or due to its therapy will not only help in better management of nutritional problems, but will also enable better clinical outcome[10].

This study aimed to measure the nutritional status of patients receiving chemotherapy before the initiation and 3 weeks after the three cycles of chemotherapy.

## MATERIAL AND METHOD:

This was a prospective study, in which the subjects were studied before the initiation and 3 weeks after three cycles of chemotherapy. A total of 447 subjects with cancer of Head and neck, breast and uterine cervix admitted for the first cycle of chemotherapy treatment that fulfilled the inclusion criteria were recruited at Department of Radiotherapy, Gandhi Medical College between May 2015 and December 2016. Data collection tools used were 1) demographic proforma to collect demographic data i.e. age, gender, marital status, education, type of cancer, chemotherapy drugs and 2) Anthropometric Measurements (Height, Weight, BMI, Triceps skinfold thickness, Mid-arm circumference and Mid-arm muscle circumference) and biochemical parameters (Haemoglobin, Serum electrolytes and Serum Albumin).

Data collection was done in two phases: -Phase 1- During the admission for the first cycle of chemotherapy, anthropometric measurements were assessed before the initiation of chemotherapy. Data about biochemical parameters was collected from the medical records, assessed prior to administration of each cycle of chemotherapy and Phase 2- After three weeks of third cycle of chemotherapy (during the response assessment after three cycles of chemotherapy), before the initiation of next cycle or any other adjuvant treatment, anthropometric measurements were reassessed. Data about biomedical parameters was collected from the medical record.

### Estimation of body mass index (BMI):

The current height and weight of all the subjects were measured. Weight was taken to the nearest 0.1 kg. Height was obtained by using stadiometer. The patient's feet were kept together against the measuring board and head was kept right. BMI was Calculated using the formula: weight in kilograms (kg) divided by height in meters (m) squared.

Patients were categorized based on WHO standard range: -
<18.5 kg /m2 (underweight),
18.5-24.9 kg /m2 (acceptable/normal weight),
25-29.9 kg/m2 (overweight),
>30 kg/m2 (obese).

### Estimation of Mid-arm muscle circumference

(MAMC):Mid-arm muscle circumference was estimated by measuring triceps skinfold thickness (TSF) and mid arm circumference (MAC). Measurement of skin fold thickness at the triceps (TSF) provided an estimate of body fat, while mid arm circumference (MAC) and mid arm muscle circumference (MAMC) were used to estimate muscle mass. TSF was measured (to the nearest 0.2mm) using a calibrated skinfold calliper. Measurement of a vertical fold of the right arm was made midway between the tip of the acromion and olecranon process (at the same level as the MAC measurement), by pinching the skin fold with the thumb and index finger at the marked landmark and applying the callipers 1cm below, with the arm hanging vertically and the palm facing up. The average value of three measurements was directly compared to age specific percentile values, with TSF below the 5th age specific percentile considered evidence of moderate/severe fat loss and subsequent moderate malnutrition. Mid-

arm circumference (MAC) was obtained (to the nearest 0.1cm) by a measuring tape placed around the patient's upper arm in the same location where TSF measurement was made with the subjects arm hanging relaxed at their side. Mid-upper arm muscle circumference (MAMC) was calculated by using the formula: - MAC (cm) – [0.314xTSF (mm)]. Average MAC and TSF values were used to calculate mid-arm muscle circumference (MAMC).For descriptive purposes means and standard deviations (±SD) were reported. Changes in the outcome variable between baseline and the end of 3 weeks of the third cycle of chemotherapy were determined using SPSS 16 and results were analysed using paired t-test.

## RESULTS:

### Demographic-socioeconomic characteristics:

38.9 % (174) were male and 61% (273) were female. The average age was 48.7 ± 11.3. 98.3% of them were married, 6.7% of the study subjects were graduates, and 96% of them belong to below poverty line.

### Medical history:

21.7% of subjects were diagnosed with cancer of uterine cervix, 27.2% with cancer of breast and 51% were with cancer of head and neck cancer. Most of the subjects (94%) were disease free and had no other comorbidities. Majority of the subjects (54%) were anaemic before and after the chemotherapy. Only 5% of the subjects needed hospitalisation from complains of post chemotherapy nausea, vomiting and diarrhoea.

### Body Mass Index (BMI):

BMI was calculated using the standard formula: Weight in kilograms (kg) divided by Height in meters (m) squared. The average height was 154.02±8.74 cm. regarding weight, 35.3% of subjects were underweight, 46.8% normal weight, 13.3% overweight and 4.6% obese. After completion of three cycles of chemotherapy, all the subjects had weight loss from 1-3 kg irrespective of the type of cancer, except five subjects with cancer breast, who maintained/gained their weight (1-2 kg) and remained in the same category of BMI. Before initiation of the first cycle of chemotherapy, the mean weight was 52.78±8.92 kg and after 3 cycles of chemotherapy mean weight was 50.36±5.45 kg. The mean BMI before and after chemotherapy cycles was 23.67±6.33 kg/m2 and 22.54±5.42kg/m2 respectively. The t-test showed significant change i.e. decrease in weight before initiation and after three cycles of chemotherapy [t=9.022, p<0.01] Mid-arm Muscle Circumference

### (MAMC): MAMC was calculated using the formula:

MAC (cm) – [0.314xTSF (mm)] where MAC is mid-arm circumference and TSF is triceps skinfold thickness. These anthropometric measurements also showed a decrease before and after the chemotherapy. The mean triceps skinfold thickness (TSF) before and after 3 cycles of chemotherapy was 13.54±3.16 mm and 13.41±2.26 mm respectively, and the mid-arm circumference (MAC) before And after 3 cycles of chemotherapy was 26.14±1.54 cm and 25.77±1.35 cm respectively. The't' test showed a significant decrease in TSF and MAC measurements t=4.8(p<0.01) and t=5.94 (p<0.01) before and after 3 cycles of chemotherapy. The mean mid-arm muscle circumference (21.87±1.15cm And 21.26±1.18 cm respectively) before and after 3 cycles of chemotherapy. The't' test showed a decrease in MAMC, t=5.34(p<0.01) before and after 3 cycles of chemotherapy.

**TABLE1:** Anthropometric characteristics of subjects before initiation andfter three cycles of chemotherapy

n=447

| HEIGHT-154.02±8.74 | PRE-CHEMOTHERAPY Mean± SD | POST CHEMOTHERAPY (3 CYCLES) Mean± SD |
|---|---|---|
| WEIGHT | 52.78±8.92 | 50.36±5.45 |
| BODY MASS INDEX (BMI) | 23.67±6.33 | 22.54±5.42 |
| TRICEPS SKIN-FOLD THICKNESS(TSF) | 13.54±3.16 | 13.41±2.26 |
| MID-ARM CIRCUMOLFERENCE (MAC) | 26.14±1.54 | 25.77±1.35 |
| MID-ARM MUSCLE CIRCUMFERENCE (MAMC) | 21.87±1.15 | 21.26±1.18 |

**TABLE 2:** Biochemical Measurements of subjects before initiation and after three cycles of chemotherapy

n=447

| | PRE-CHEMOTHERAPY Mean± SD | POST CHEMOTHERAPY (3 CYCLES) Mean± SD |
|---|---|---|
| ALBUMIN | 3.29±0.45 | 3.11±0.37 |
| HAEMOGLOBIN | 10.90±1.58 | 9.47±1.64 |
| SERUM SODIUM | 137±4.3 | 137±3.8 |
| SERUM POTASSIUM | 4.5±0.5 | 4.3±0.5 |
| SERUM CALCIUM | 9.5±1.3 | 9.2±2.1 |

### Biochemical Parameters:

The mean serum Albumin level of the patients before and after 3cycles of chemotherapy was 3.29±0.45 g/dl and 3.11±0.37 g/dl respectively. The result on application of't' test showed significant decrease in the albumin levels [t=3.87, p<0.01], before and 3 cycles after chemotherapy. The mean haemoglobin level of the patients before and after 3 cycles of chemotherapy was 10.90±1.58 g/dl and 9.47 ± 1.64 g/dl respectively. Majority of the subjects (54%) were mildly anaemic before and after 3 cycles of chemotherapy. The results show significant decrease in haemoglobin levels (p<0.01) before and after 3cycles of chemotherapy, but remained within the reference limits.

## DISCUSSION:

Nutritional screening should be undertaken immediately following admission to ensure that any nutritional decline due to therapy or disease progression is identified as early as possible and can be dealt with. The implementation of both screening and assessment tools is essential for effective nutritional intervention and management of cancer patients receiving chemotherapy [11].

In the present study, about 95% of patients suffered from weight loss after the three cycles of chemotherapy, irrespective of the type of cancer, except five patients with cancer breast who had a weight gain of 1-2 kg. These changes in weight were not statistically significant. Weight changes are valuable indicators of nutritional risk and associated comorbidities of malnutrition. This observation is also supported by Davies et al [12]

In our study, BMI before chemotherapy and 3cycles after chemotherapy was (23.67 vs. 22.54; P< 0.01). Studies showed that body mass index is positively associated with patients suffering from colon, kidney, oesophagus, and breast cancer which favours the observations of our study [13]. The triceps skinfold thickness, mid arm circumference and mid-arm muscle circumference were also found to have a decrease before and after the chemotherapy treatment, which is consistent with that of [14]. Based on this study, both the anthropometric measurements [(BMI) and (MAMC)] were effective markers for assessing nutritional status.

Biochemical and haematological parameters are subject to homeostatic mechanisms and may be altered by underlying disease and/or treatment. The most common biochemical measurements used to assess nutritional status are blood parameters such as serum albumin and haemoglobin [12]. In our study, all patients had a reduction in serum albumin level before and after chemotherapy, but remained within normal range (3.29±0.45 g/dl and 3.11±0.37 g/dl). This finding is in agreement with the finding of Ushering et al [14, 15] where a significant decrease in albumin before chemotherapy and 3 weeks after chemotherapy (p=0.018) was observed.

Majority (54%) of the subjects were mildly anaemic before and after chemotherapy as observed in other study [14]. Anaemia is the most common haematological abnormality in cancer patients; unfortunately, it is often un-recognized and un-treated which can negatively affect the disease prognosis.

Our study is favoured by Kallajavi et al who had investigated the effect of chemotherapy on various laboratory tests, and found that haemoglobin decreased transiently at 5-8 weeks but remained within the reference limits, and albumin did not change.

The present study has found that cancer patients receiving chemotherapy experienced weight change, and decrease in biochemical parameters before and after chemotherapy.

Therefore, these patients are at risk of malnutrition and if these

parameter of patient's health is not dealt properly and timely interventions are not planned, may severely impair the patient's quality of life (QoL).

## CONCLUSION:

Based on the findings of this study, it is recommended that all cancer patients receiving chemotherapy require a baseline nutritional assessment with the start of the treatment, and should focus on current nutritional status and anticipated nutritional problems related to treatment.

The health care personnel (physicians, nurse and dieticians) must make sure that during active cancer treatment patient should maintain adequate energy intake to prevent weight loss thereby preventing the associated comorbidities of malnutrition and improving the quality of life.

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