# Impact of Cancer on Nutrition in the Geriatric Cancer Population

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## ABSTRACT

Malnutrition in geriatric cancer patients is a leading cause of morbidity and mortality. A nutrition risk assessment should be done early to identify and treat those at risk for cancer-related malnutrition. The goal of this study was to assess nutritional status in geriatric patients diagnosed with all cause cancer. We conducted a single institutional prospective cohort study of geriatric patients with cancer from 2013–2018. Patients 65 years old and above had undergone a comprehensive geriatric assessment before starting treatment (day 0), post-treatment (day 30), and post-post treatment (day 90). Body Mass Index (BMI) and the Mini Nutritional Assessment (MNA) were used to assess nutrition status. Results showed an increase in nutrition status from pretreatment (day = 0) to treatment (day =30), followed by a decrease in MNA scores at day 90. Results showed a decrease in BMI across all time points. This study supports that cancer and anti-cancer therapy in geriatric patients cause malnutrition, indicating the importance of early nutritional evaluation and intervention.

**KEYWORDS:** nutrition, cancer, geriatric population

## INTRODUCTION

The U.S. population aged 65 years and older is expected to grow from 54.1 million in 2019 to nearly 81 million in 2040.[1,2] 80 % of cancer diagnoses occur among those who are 55 or older, with 57 % of diagnoses occurring among those 65 and older.[1,3]

Cancer-related malnutrition is defined as a continual loss of skeletal muscle associated with loss of appetite and alteration in absorption and metabolism of nutrients.[4,5,6,7] This is typically caused by cancer-induced metabolic changes or response to anti-cancer treatment side effects. Cancer treatment options include immunotherapy, chemotherapy, radiation, hormone therapy, surgical intervention, or most often, a combination of these. Common side effects of these treatments include anosmia, dysgeusia, stomatitis, gastric and duodenal ulcers, persistent nausea, vomiting and constipation, all contributing to net low-caloric intake despite the higher caloric need necessitated by cancer pathology and treatment. If surgery is part of the treatment plan, it can contribute even further to higher metabolic demands, leaving the cancer patient with a hefty caloric deficit.[8]

Approximately, 15–40% of cancer patients report weight loss at the time of diagnosis and 40–80% of all cancer patients will meet malnourishment status during the disease and treatment phase.[9] Geriatric syndromes, defined as an accumulated effect of impairment, increase the vulnerability of the older adult to situational challenges. A study published in 2011 cited that 60.3% of older adults with cancer reported one or more geriatric syndromes as compared to 53.2% of those without cancer.[10] Given that almost 50% of the geriatric population is malnourished at baseline,[11] it should come as no surprise that cancer-associated malnutrition is very common in geriatric cancer patients. This is especially concerning as malnutrition may increase the chance of side effects, including mortality in this patient population. Malnutrition is associated with increased rates of infections, poor wound healing, prolonged hospital stays and increased mortality.[11] Geriatric patients with solid tumors who were malnourished had an 87% higher risk of all-cause mortality than those who were well-nourished.[12]

Conventional nutritional therapy, such as oral nutritional supplements, can partially reverse cancer-related malnutrition, making nutritional status assessment imperative for the identification and treatment of high-risk individuals. Examinations of involuntary weight loss, low body mass index (BMI) and Mini Nutritional Assessment (MNA) are among the screening techniques validated for use in geriatric oncology patients.[6,13]

The goal of this study was to assess the impact of cancer and malnutrition among geriatric patients diagnosed with all cause cancer with surgically resectable disease, using validated noninvasive screening assessment tools, BMI and MNA, across 3 time points from diagnosis and treatment.

## METHODS

This was a cohort study conducted at Roger Williams Medical Center (RWMC), a community teaching hospital located in Rhode Island. Institutional review board (IRB) waiver was obtained, and research meets requirements for protection of human subjects. Inclusion criteria for this study were patients 65 years of age or older with a new cancer diagnosis and surgically resectable disease. The patients included did not receive chemotherapy or radiation therapy. Eligible patients were further assessed for nutritional status using MNA and BMI between January 1, 2013 and December 31, 2018. Assessments occurred at day 0 ($t=1$), day 30 ($t=2$), and day 90 ($t=3$), day 0 being at the time of diagnosis. Data for this study was obtained from the RWMC electronic medical record system, Meditech.

### Mini Nutritional Assessment (MNA)

MNA is a rapid, non-invasive and inexpensive method for assessing nutritional deficiency and malnutrition in these patients.[13] The MNA assessment is composed of simple measurements of height, weight, weight loss, lifestyle, medication, mobility, nutritional adequacy, food and fluid intake, and self-perception of health and nutrition.[14] Nutrition status is indicated by scores obtained by the MNA assessment. A score of 0–7 indicates malnutrition, 8–11 a risk for malnutrition and a score of 12–14 indicates well nourishment.

### Body Mass Index (BMI)

Weight loss and BMI are also valuable in clinical practice for assessing malnutrition in geriatric cancer patients.[15] They are strongly predictive of patient survival across all stages and types of cancer.[16] A BMI of 20–25 kg/m2 represents healthy nutrition, whereas less than 20 kg/m2 represents malnutrition. Previous studies have reported that low BMI is a significant risk factor for increased mortality in certain cancers, such as lung cancer and colorectal cancer.[17,18,19]

## RESULTS

All statistical analyses were performed using SPSS, version 28.0. All analyses were conducted separately on MNA and BMI results. Descriptive statistics, including mean, standard deviation, standard error and confidence intervals were calculated, respectively. Repeated measure analysis of variance (ANOVA) test was used to investigate the changes in mean scores over three points day 0, 30, and 90 (t=1,2,3), a $p$ value of less than 0.05 indicated statistical significance. Furthermore, a post-hoc pairwise comparison using the Bonferroni correction was used to compare difference among the means between the different time points. MNA and BMI values were evaluated across all time points for significance.

We assessed 311 geriatric patients with a new cancer diagnosis who were undergoing active treatment, including surgery, chemotherapy, radiation, or any combination of the same. 65 of the 311 participants had complete records across all time points observed and were included in our final analysis. All results were evaluated for significance across time points observed. On day 0, 48 (74%) participants were malnourished according to MNA and BMI values respectively. At day 30, 42 (65 %) of participants were malnourished, and at day 90 this increased to 52 (80 %) of participants were malnourished according to MNA and BMI values. Descriptive statistics of MNA and BMI values for 65 participants at day 0, day 30, day 90. (see **Table 1**). Mauchly's Test of Sphericity indicated that the assumption of sphericity had not been violated, $\chi^2(2) = 4.917$, $p = 0.086$. Therefore, a repeated-measures ANOVA was used and determined that mean MNA scores differed significantly across the 3 time points (see **Tables 2,3**). A post-hoc pairwise comparison using the Bonferroni correction showed an increase in MNA scores between day 0 and day 30, 5.4 vs. 6.5 respectively, with a statistically significant $p$-value of 0.02 (see **Table 4**). Although, the MNA scores decreased between day 30 and day 90 from 6.5 to 5.7. $P$-value of 0.067 and was not statistically significant. Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated

**Table 1.** Descriptive statistics for MNA and BMI values at pre- and post-treatment days.

| | Source | | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|---|---|
| MNA | Time | Sphericity Assumed | 46.779 | 2 | 23.390 | 4.140 | 0.018 | 0.061 |
| | Error (Time) | Sphericity Assumed | 723.221 | 128 | 5.650 | | | |
| BMI | Time | Greenhouse-Geisser | 36.856 | 1.518 | 24.277 | 7.069 | 0.003 | 0.099 |
| | Error (Time) | Greenhouse-Geisser | 333.677 | 97.160 | 3.434 | | | |

**Table 2.** Mauchly's Test of Sphericity

| | t | Mean | Std. Deviation | N | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower Bound | Upper Bound |
| MNA | 1 | 5.3692 | 3.67665 | 65 | 0.456 | 4.458 | 6.280 |
| | 2 | 6.5231 | 3.53159 | 65 | 0.438 | 5.648 | 7.398 |
| | 3 | 5.6615 | 2.98055 | 65 | 0.370 | 4.923 | 6.400 |
| BMI | 1 | 26.4723 | 6.74172 | 65 | 0.836 | 24.802 | 28.143 |
| | 2 | 25.8538 | 5.96665 | 65 | 0.740 | 24.375 | 27.332 |
| | 3 | 25.4123 | 5.81664 | 65 | 0.721 | 23.971 | 26.854 |

**Table 3.** Tests of Within-Subjects Effects for MNA and BMI.

| | Measure | MEASURE_1 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Within Subjects Effect | Mauchly's W | Approx. Chi-Square | df | Sig. | Epsilon[b] | | |
| | | | | | | Greenhouse-Geisser | Huynh-Feldt | Lower-bound |
| MNA | Time | 0.925 | 4.917 | 2 | 0.086 | 0.930 | 0.957 | 0.500 |
| BMI | | 0.683 | 24.057 | 2 | 0.000 | 0.759 | 0.774 | 0.500 |

**Table 4.** Pairwise Comparisons between different time periods for MNA Scores.

| | Measure | MEASURE_1 | | | | | |
|---|---|---|---|---|---|---|---|
| | (I) Time | (J) Time | Mean Difference (I–J) | Std. Error | Sig.[b] | 95% Confidence Interval for Difference[b] | |
| | | | | | | Lower Bound | Upper Bound |
| MNA | 1 | 2 | –1.154* | 0.412 | 0.020 | –2.166 | –0.142 |
| | | 3 | –0.292 | 0.466 | 1.000 | –1.438 | 0.853 |
| | 2 | 1 | 1.154* | 0.412 | 0.020 | 0.142 | 2.166 |
| | | 3 | 0.862 | 0.367 | 0.067 | –0.042 | 1.765 |
| | 3 | 1 | 0.292 | 0.466 | 1.000 | –0.853 | 1.438 |
| | | 2 | –0.862 | 0.367 | 0.067 | –1.765 | 0.042 |
| BMI | 1 | 2 | 0.618 | 0.280 | 0.093 | –0.071 | 1.308 |
| | | 3 | 1.060* | 0.347 | 0.010 | 0.208 | 1.912 |
| | 2 | 1 | –0.618 | 0.280 | 0.093 | –1.308 | 0.071 |
| | | 3 | 0.442 | 0.205 | 0.104 | –0.062 | 0.945 |
| | 3 | 1 | –1.060* | 0.347 | 0.010 | –1.912 | –0.208 |
| | | 2 | –0.442 | 0.205 | 0.104 | –0.945 | 0.062 |

Based on estimated marginal means (**1= Pretreatment, 2 = 30 days, 3= 90)**
* The mean difference is significant at the .05 level.
b Adjustment for multiple comparisons: Bonferroni.

$\chi^2(2) = 24.057$, $p = 0.000$. Therefore, Greenhouse-Geisser method was used. Corrected results showed significant differences among the means across all time points ($p$ =0 .003) (**Table 3**). A post-hoc pairwise comparison using the Bonferroni correction showed a continuous decrease in BMI values across all time points, 26.5, 25.9, 25.4 (shown in **Table 4**). However, the difference among the means was only statistically significant between day 0 and day 90, p =0.01 (**Table 4**).

## DISCUSSION

America's population of older adults is expected to double by 2030. It is expected that the rate of cancer diagnoses in the geriatric population will rise accordingly.

Natural aging changes, as well as the presence of geriatric syndromes, make geriatric patients more vulnerable to acute events such as cancer diagnoses and demanding treatment regimens. A decrease in basal metabolism occurs which causes metabolic rate decline and muscle atrophy. There are changes at the level of the digestive system as well, namely diminished digestive secretions which impair digestion and absorption of nutrients.[20] As such, frailty, sarcopenia, and weight loss, are highly prevalent in geriatric population, with 50 % of the population being malnourished at baseline.

Malignancy and associated anti-cancer treatment led to additional metabolic derangements such as elevated energy expenditure, increased catabolism, and chronic inflammation, further undermining this patient population's nutritional status. The results from this study demonstrate that as patients are diagnosed and continue with their respective anti-cancer treatment, MNA and BMI scores decline, indicating higher rates of malnourishment at day 30 and day 90.

### Limitations

The study is a pilot project. The power of the study needs to be improved to identify the interventions required. The interventions need to be standardized so that the outcomes can be appropriately measured. Multi-institutional studies are required in the future to increase more patients within the study.

## CONCLUSION

Geriatric cancer patients are vulnerable to malnutrition, not only as a response to cancer and associated treatment regimens, but also due to natural aging and the high prevalence of geriatric syndromes. This study, which used MNA and BMI assessments to evaluate the nutritional status of newly diagnosed cancer patients undergoing active treatment, showed decreasing values for both assessments across all time points observed.

Malnutrition alone carries increased risk of negative outcomes such as infections, poor wound healing, and prolonged hospital stay. Malnutrition in the geriatric patient, particularly in patients with solid tumors, is even more detrimental, carrying a significant mortality risk of 87 %.[12] This suggests that proactive rather than reactive nutritional interventions should always be considered an integral part of cancer care in geriatric patients to improve clinical outcomes and quality of life. Assessment and intervention should start at the time of diagnoses and be re-evaluated at each touch point with the patient by all care team members, despite individuals having normal BMI and or MNA values, due to the demonstrated high risk of becoming malnourished quickly after diagnosis (day=0) and at 30 to 90 days thereafter. Interventions can be multifaceted; for example, nutrition referral, dietary consultations, high protein nutritional education, simple encouragement, daily weights, and food diaries may all be beneficial. Repeated screening with MNA and careful monitoring of BMI will help with early identification and offer the possibility of early intervention.

Malnutrition in geriatric cancer patients poses increased risk of impairing patient's chances of endurance, treatment, and recovery, along with carrying an increased risk of morbidity and mortality. More studies are needed to explore this notion and provide more information on the types of intervention that are most efficacious and if early identification and preemptive treatment for malnutrition is as effective as this study seems to suggest it has the potential to be.

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## Disclosure

The authors do not have any conflicts of interest or disclosures to disclose.

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