EFFECT OF SOCIAL DEMOGRAPHY AND MEDICAL NUTRITION THERAPY ON CANCER PATIENTS UNDERGOING CHEMOTHERAPY IN AGA KHAN HOSPITAL, MOMBASA KENYA
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ABSTRACT

Background: **Cancer has become a global public health concern with an estimated incidence 12.7 million in 2008 and a million deaths from cancer in 2012. Previous studies have indicated that malnutrition was associated with a higher mortality rate of cancer patients, on contrary, nutritional therapy has been associated with higher chances of survival.**

*Methods***: This study was conducted at Aga Khan Hospital, Mombasa using a case-control research design. Information was sought through patients' health records involving cancer patients undergoing chemotherapy alone and those undergoing both chemotherapy and medical nutrition therapy. Collected data was analyzed using SPSS version 22.0. This study sought the impact medical nutritional therapy and social demography on cancer patients.**

*Results***: The results recorded highest cases breast followed by ovarian cancer. Patients above 55 years recorded higher cases of cancer. More cases were recorded in urban compared to rural. The overall mean tumor shrinkage during and after treatment was from 2.5 to 1.67 cm in the case-study compared to increase from 2.30 to 2.62 cm in control. BMI for case-study increased from an overall mean of 19.92 ± 2.1 to 21.10 ± 1.9 Kg/M^2 while for control it reduced from 22.40 ± 1.6 to 20.90 ± 1.6 Kg/M^2. *p*-value < 0.05 showed significant difference in mean BMI among patients suffering from all the cancer types apart from lungs and colon.**

*Conclusion***: There is a positive correlation between medical nutritional therapy and cancer treatment by chemotherapy. There is need for further research covering more hospitals before making conclusive recommendation.**

INTRODUCTION

Medical nutrition therapy is complementary to other modalities in cancer management approaches. Indeed, nutrition is part of a holistic management for these patients. It is a team effort consisting of physician, oncologists, registered dietitian, or professional nutritionist. Every case requires specifically tailored diet devised and monitoring. Cancer has become a global public health concern, because there was an estimated incidences of 12.7million in 2008 and a million deaths from cancer in 2012 [1]. In 2008, Africa alone had approximately 715,000 new cases were diagnosed out of which 542,000 deaths were reported [2]. According to World Health Organization [3], types of common cancer-causing death include lung, liver, colorectal, stomach, and breast cancer.

Cancer burden in Kenya is projected to continue rising in the near future [4]. However, cancer morbidity and mortality can be reduced if cases are detected and managed promptly including provision of relevant nutritional programme [5]. .

In a study to evaluate the role of malnutrition and mortality in patients undergoing surgery for renal cell carcinoma, it emerged that depression, fatigue, and malaise associated with malnutrition significantly impacts on patient's well-being [5]. In addition, cancer-related malnutrition was associated with significant health-care-related costs [6]. It has been reported that malnutrition was associated with a higher mortality, independent of key clinical and pathological factors.

Appetite and taste are closely related. The taste of food makes eating an enjoyable experience. When taste is diminished, the pleasure of eating and one's appetite is often also reduced. Taste and smell interact with one another. The smell of food enhances one's sensation of taste [7]. Taste and appetite can be affected by cancer treatments in different ways. Chemotherapy treatment, for example affects all dividing tissues of the body including the taste buds. Chemotherapy can lead to a temporary decrease in the number and activity of the taste buds resulting in altered or decreased taste sensation [8]. Chemotherapy and radiotherapy to the head can affect the salivary glands causing decreased saliva (spit) production [8]. A dry mouth decreases taste sensation and can make chewing and swallowing difficult.

During chemotherapy, patients are advised on the kind of diet they will be eating, and how they are going to eat during the chemotherapy treatment. Some of the advice include sucking on a mint, lemon drop, or other hard candy during chemotherapy treatment to help relieve unpleasant tastes in the mouth. Platinum-based chemotherapy drugs such as carboplatin (Paraplatin) and cisplatin (Platinol) and some other chemotherapy drugs used to treat some form of cancer can cause an unpleasant taste in the mouth. The memory of this taste can interfere with appetite and eating [9].

Medical nutrition therapy includes six small meals throughout the day instead of 3 large meals, targeting the calorie goal with these smaller meals. Despite the significance of nutrition in cancer management, there is limited research which has been carried out to document this empirical evidence. It's against this background that this study was commissioned to establish the role of medical nutrition therapy on cancer patients undergoing chemotherapy treatment. This is expected to enhance knowledge of healthcare workers on nutritional management of cancer patients.

MATERIALS AND METHODS

Location and Study Population
The study was conducted at Aga Khan Hospital, Mombasa County. The hospital offers different kind of services including Computerized Tomography scan (CT scan), Magnetic Resonance Imaging (MRI) in addition to being a cancer treatment center. The Chemotherapy center was opened 27th May 2014.

The case study population was made up of the cancer patients above the age of 18 years at the Aga Khan Hospital cancer center from August 2017 to February 2018. The control study population was a retrospective study of patients above the age of 18 years at the Aga Khan Hospital Centre from June 2014 to June 2015.

Research design
The study applied a case-control design. In the study 'control 'was the cancer patients at Aga Khan Hospital, Mombasa who underwent cancer chemotherapy but did not undergo medical nutrition therapy. A 'case' was the cancer patients from the same hospital who had already undergone both chemotherapy and medical nutrition therapy. Both control and case groups were accessed from medical records in the hospital using the Demidenko's formula [10]. Quantitative information obtained through the use of structured questionnaires and health records.

Sample Size Determination
Purposive sampling procedure was employed to select study participants for both 'controls' controls and 'cases' study. The sample size was calculated using the formula by Demidenko [10] described as follows;

$$n = \frac{r+1}{r} \frac{(\overline{p})(1-\overline{p})(Z_\beta + Z_{\alpha/2})^2}{(p_1 - p_2)^2}$$

Where:
n is the sample size in each group.
r is the ratio of cases to controls (1:1), r =1.
$\overline{p}$ Measure of variability (similar to standard deviation) is the estimated cancer prevalence in Kenya (7%).
P_1-P_2 is the expected differences in effect, which is 20%.
Z_β is the Z score for power, at 80% $Z\beta$ =0.84.
$Z_{\alpha/2}$ is the Z score for normal distribution at 1% margin of error, Z=2.58.
n= (1+1)/1) ((0.07) (1-0.07) $(0.84+2.58)^2/0.2^2$) = 39

Table 1 shows selection of participants for both controls, and cases study.

Table 1
Selection of Cases and Controls

No. Infected			Cases Studied
Type of Cancer	Total No. infected	No. infected selected for control	No. of cases selected for study
Breast cancer	84	40	40
Ovary cancer	46	22	22
Lungs	30	13	13
Pancreas	28	12	12
Colon	24	10	10
Endometrium	3		
Lymphoma	7		
Esophagus	1		
Carcinoma	6		
Total	229	97	97

Data management
Data collected was coded as per the thematic areas in the questionnaire before it was entered and analyzed using a Statistical Package for the Social Sciences (SPSS) version 22.0. All categorical variables were analyzed using frequencies and proportions while measures of central tendency and dispersion were used to obtain their descriptive statistics. For hypothesis testing the 5% level of significance was used. A p-value of 0.05 or less was considered to be statistically significant, and all tests were 2-sided. Tables and graphs were used to present the findings of the research.

Ethical Considerations
Approval and permission to conduct the research was sought from Department of Environment and Health Sciences of the Technical University of Mombasa and the Aga Khan Hospital management. Ethical approval was sought from Pwani University Ethics and Research Committee. All respondents provided written consent. Lastly, participant's confidentiality was observed by concealing their identity. The respondents were given the choice to participate on voluntary basis.

Consenting process
Prior to any interview the researcher approached the respondents and made a formal introduction stating the reasons, rational and potential utility of the study before consent was granted by the respondent.

RESULTS

Socio-demographic Characteristics of Study Participants
Comparison of socio-demographic characteristics of cancer patients who received against those who did not receive medical nutrition therapy while undergoing chemotherapy treatment are in Figures 1 to 5.
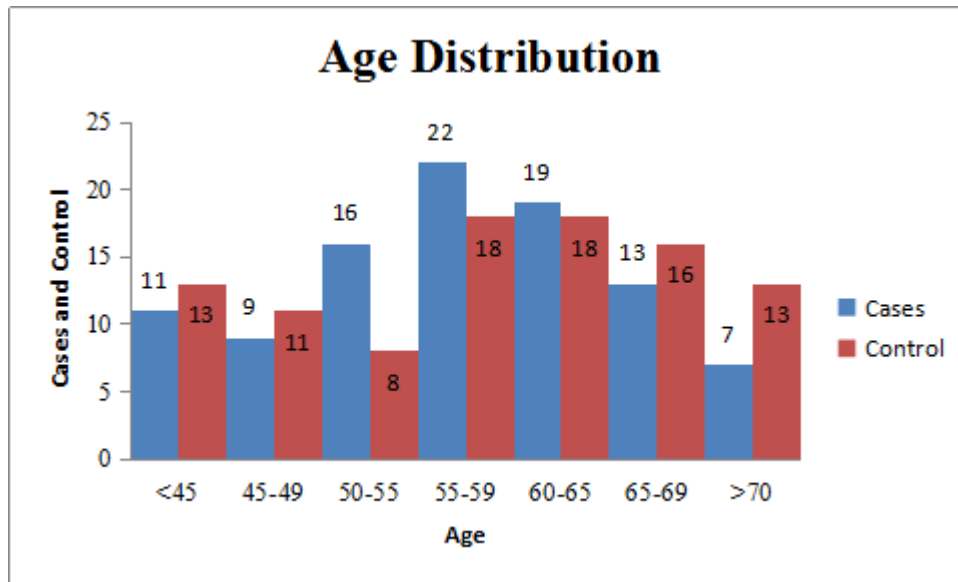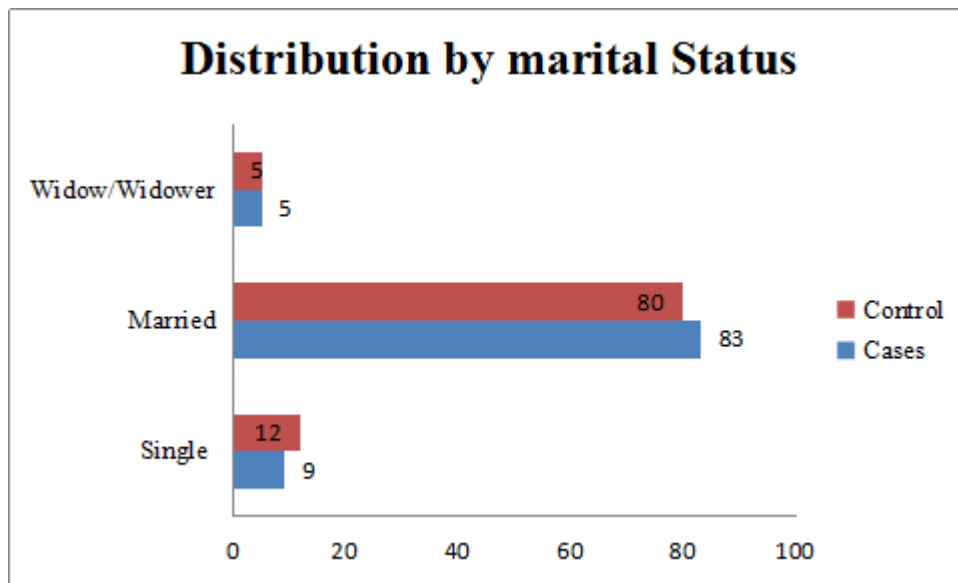
Figure 1 Age distribution of patients

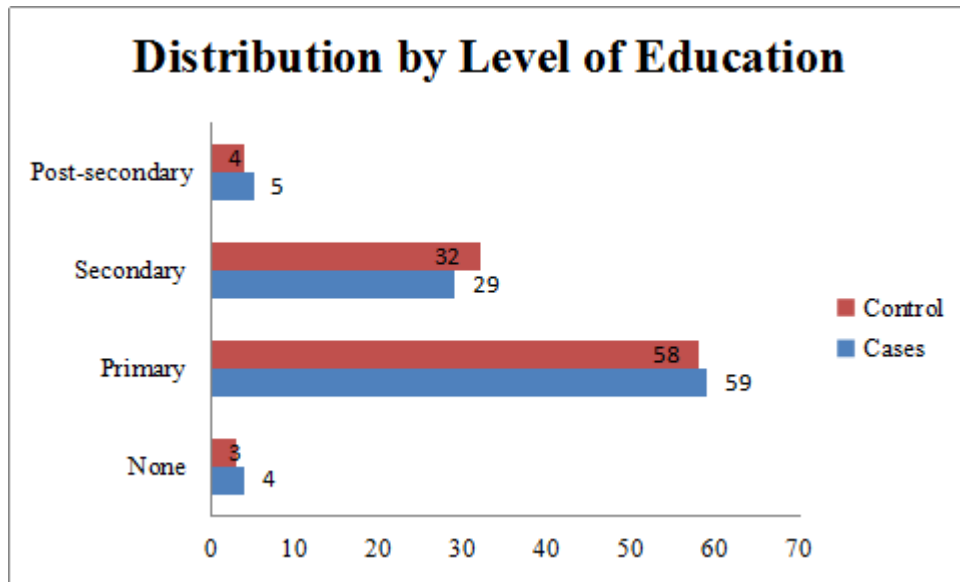*Figure 2 Marital status of the patients*

Distribution by Level of Education

Post-secondary: Control 4, Cases 5
Secondary: Control 32, Cases 29
Primary: Control 58, Cases 59
None: Control 3, Cases 4

Figure 3: Formal education level attained by patients

Type of Cancer Distribution

pacrease: Control 12, Cases 12
Ovary: Control 22, Cases 22
Colon: Control 1, Cases 10
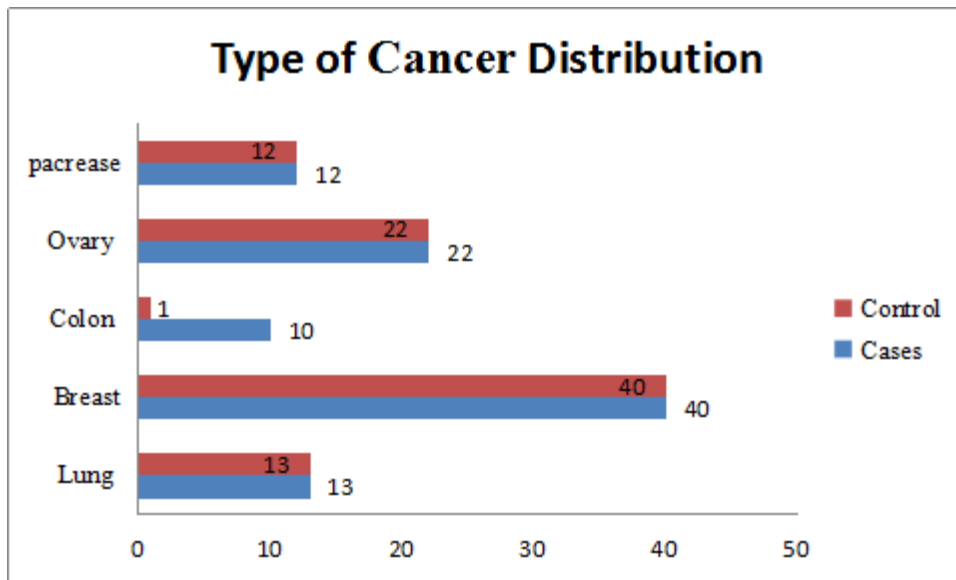**Breast:** Control 40, Cases 40
Lung: Control 13, Cases 13

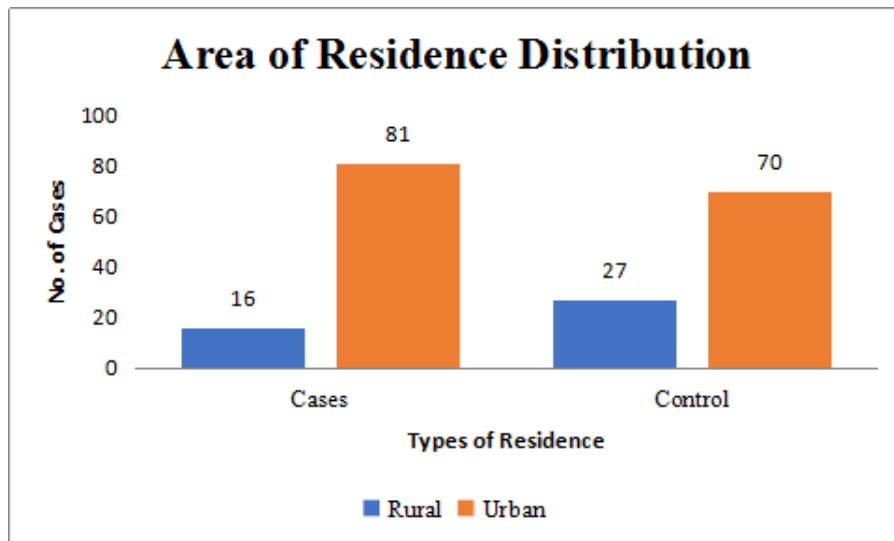Figure 4: Types of cancer among the patients

Figure 5: Residential areas among the cancer patients

Nutritional Status of Study Participants

Nutrition outcome of patients who underwent chemotherapy and were on medical nutrition therapy were compared against those who did not undergo the medical nutrition therapy. The data was recorded both before and after treatment in each category and it was analyzed using T-test in order to compare the nutrition outcome in both groups. The patients' height and weight measurement were recorded to determine Body Mass Index (BMI) and hip and waist measurements were also recorded in order to determine the Hip-Waist Ratio (WHR). The summary of analysis comparing BMI and WHR of patients as an indicator of nutritional status before and after chemotherapy treatment is as shown in Tables 2 and 3.

Table 2

Comparison of BMI of patients as an indicator of nutritional status before and after chemotherapy treatment

Cancer Type	Treatment	Mean BMI (Kg/M²)		t value	p Value
		Before	After		
Breast (N= 40)	Case	19.93 ± 2.6	21.03 ± 2.3	-2.0	0.045
	Control	22.39 ± 1.5	21.00 ± 1.7	3.9	0.000
Ovary (N= 22)	Case	19.87 ± 1.7	20.98 ± 1.3	-2.5	0.018
	Control	22.78 ± 1.7	21.02 ± 1.7	3.4	0.001
Lungs (N= 13)	Case	19.87 ± 2.1	21.02 ± 2.1	-1.4	0.175
	Control	22.39 ± 1.9	20.98 ± 1.6	2.1	0.051
Pancreas (N= 12)	Case	20.24 ± 1.5	21.94 ± 1.8	-2.5	0.021
	Control	22.07 ± 1.3	20.43 ± 1.1	3.3	0.003
Colon (N=10)	Case	19.69 ± 1.5	20.75 ± 1.5	-1.6	0.125
	Control	22.03 ± 1.8	20.68 ± 1.4	1.9	0.077
Overall (N=97)	Case	19.92 ± 2.1	21.10 ± 1.9	-11.7	0.000
	Control	22.40 ± 1.6	20.90 ± 1.6	17.6	0.000

Values are given as Mean ± SD; Case, chemotherapy + medical nutrition therapy; Control, chemotherapy alone; P< 0.05 represents significant difference.

Table 3

Comparison of WHR of patients as an indicator of nutritional status before and after chemotherapy treatment

Cancer Type	Treatment	Mean WHR (cm)		t-value	p-Value
		Before	After		
Breast (N= 40)	Case	0.88 ± 0.06	0.90 ± 0.05	-1.7	0.100
	Control	0.94 ± 0.10	0.97 ± 0.10	-1.3	0.195
Ovary (N= 22)	Case	0.89 ± 0.05	0.89 ± 0.05	0.0	1.000
	Control	0.89 ± 0.06	0.91 ± 0.08	-1.0	0.317
Lungs (N= 13)	Case	0.88 ± 0.06	0.88 ± 0.06	0.0	1.000
	Control	0.88 ± 0.07	0.91 ± 0.07	-1.3	0.201
Pancreas (N= 12)	Case	0.87 ± 0.04	0.89 ± 0.05	-0.8	0.412
	Control	0.89 ± 0.04	0.95 ± 0.08	-2.4	0.023
Colon (N=10)	Case	0.86 ± 0.05	0.90 ± 0.07	-1.7	0.110
	Control	0.91 ± 0.05	0.94 ± 0.05	-1.3	0.222
Overall (N=97)	Case	0.88 ± 0.05	0.89 ± 0.05	-4.8	0.000
	Control	0.91 ± 0.08	0.94 ± 0.09	-5.3	0.000

Values are given as Mean ± SD; Case, chemotherapy + medical nutrition therapy; Control, chemotherapy alone; P< 0.05 represents significant difference.

Treatment Outcomes in Study Participants

Comparison of treatment outcomes between cancer patients who received and those who did not receive medical nutrition therapy during chemotherapy treatment was done. Besides BMI and WHR, other treatment outcomes included tumor size, tumor markers, CT scan, X-ray, MRI, full Haemogram, biopsy, liver function, kidney function, appetite, immunity, hair loss and physical examination were analyzed. Tumor size was measured in cm whereas the other outcomes were determined and recorded as % normal or abnormal.

t-test was used to analyze outcome results for tumor size while *Chi*-square test was used to test the hypothesis of no association for the rest of the outcomes in all types of cancer patients in the two groupings. Tables 4 and 5 below summarize the treatments outcome of the study participants before and after they underwent chemotherapy, in addition to medical nutrition therapy for the case group.

Table 4

Tumor size change after chemotherapy in control and case groups

Cancer Type	Treatment	Mean Tumor Change (cm)			*t* value	*p*-Value
		Before	After	Difference		
Breast (N= 40)	Case	2.42 ± 0.88	1.58 ± 0.54	0.85	5.2	0.000
	Control	2.63 ± 0.82	2.76 ± 0.83	+0.13	-0.7	0.475
Ovary (N= 22)	Case	2.01 ± 0.52	1.16 ± 0.35	0.86	6.4	0.000
	Control	1.74 ± 0.50	2.39 ± 0.57	0.65	-4.0	0.000
Lungs (N= 13)	Case	2.53 ± 0.92	1.29 ± 0.52	1.24	4.2	0.000
	Control	1.88 ± 0.47	2.56 ± 0.76	+0.67	-2.7	0.012
Pancreas (N= 12)	Case	3.21 ± 0.81	2.28 ± 0.71	0.93	3.0	0.007
	Control	2.36 ± 0.62	2.47 ± 0.74	+0.11	-4.0	0.701
Colon (N=10)	Case	2.98 ± 0.49	2.94 ± 0.67	0.05	0.2	0.860
	Control	2.74 ± 0.62	2.87 ± 0.66	+0.13	-0.5	0.651
Overall (N=97)	Case	2.5 ± 0.85	1.67 ± 0.76	0.83	11.9	0.000
	Control	2.30 ± 0.77	2.62 ± 0.75	+0.32	-5.2	0.000

Values are given as Mean ± SD; Case, chemotherapy + medical nutrition therapy; Control, chemotherapy alone; P< 0.05 represents significance difference

Table 5

Number of normal treatment outcome in patients after chemotherapy

Outcome	Breast cancer (N=80)		Lung cancer (N=26)		Ovary cancer (N=44)		Pancreas cancer (N=24)		Colon cancer (N=20)	
	Control	Case	Control	Case	Control	Case	Control	Case	Control	Case
CT Scan (%)	28	33	38.5	35	23	25	16.7	8	20	11
X ray (%)	28	33	19	35	21	25	16.7	33	20	40
MRI (%)	28	34	19	27	36	25	16.7	8	25	20
Liver function (%)	26	38	39	27	27	36	0	38	45	5
Kidney Function (%)	15	38	0	23	0	27	50	46	0	25
Full Haemogram (%)	40	39	0	50	5	53	0	0	0	30
Biopsy (%)	0	43	39	30	16	27	33	29	20	25
Appetite (%)	14	11	23	35	23	27	21	29	30	30
Immunity (%)	23	16	15	39	36	39	21	38	35	20
Loss of Hair (%)	23	43	23	0	33	0	21	0	10	0
Physical Examination (%)	14	18	23	30	33	27	29	25	35	25

DISCUSSION

Socio-demographic Characteristics of Study Participants
Data analyzed on socio-demographic characteristics of cancer patients is shown in Figures 1 to 5. As shown in Figure 1 patients aged 55 years and above recorded more cases. According to WHO [11], approximately 70% of cancer cases occur in patients aged over 50 years. The findings of this study therefore are in concurrence with the WHO report of 2018.

As shown in Figure 5, there were more cancer patients' cases in urban compared to rural.   These results are in concurrence with [12], which reported that there were more cancer cases in urban than rural areas. This trend could have been contributed by lifestyle factors like smoking, chewing of raw tobacco and drinking [13].

As shown in Figure 4, cases breast were the highest followed by ovarian cancer. Given that these two types of cancer affected exclusively female, the higher prevalence of breast and ovarian could have been attributed by the fact that there were more females who had cancer in the study than males.

As shown in Figure 3, the lowest number of cancer cases were reported in patients with no education followed by those with tertiary level of education. This could have been attributed to the nature of hospital under study, which is private and expensive. The scenario could be a different in a public hospital. In contrast, the low number of cases in tertiary level could be due to awareness and prevention measures.

There were more cancer cases in urban compared to rural (Figure 5). This could be due to urban population being exposed to environmental pollution and people's habit of eating fast foods. This is in agreement with the International Agency for Research on Cancer [14].

Nutritional Status of Study Participants
Radiation and chemotherapy often cause a decrease in appetite, nausea, vomiting and mouth sores which can affect your ability to eat normally, further contributing to weight and muscle loss. BMI of over 24.9 cm is associated with the risk of developing cancer. Excess body weight is known to correlate with cancers in certain populations, especially colon and pancreatic cancer.

P-values of less than 0.05 shows there is significant differences between any two groups. Table 2 shows that there was significant difference in mean BMI among patients suffering from all the cancer types apart from those suffering from lungs and colon. Overall, there was significant difference in mean BMI after the treatment in both the control and case groups. The total mean BMI was relatively higher after treatment in the case subjects while lower in the control subjects.

The participants in the study were low on body weight. Using BMI as an indicator of nutrition status, shows there was significant difference among patients who received against those who did not receive medical nutrition therapy (Table 2).

The study showed that patients in the case group were enrolled when they were having low BMI but after chemotherapy treatment, there was an increase in BMI, it was opposite with the control group. Introduction of the medical nutrition therapy could have improved the appetite of the patients and probably aided in repairing the worn-out cells. When comparing the total mean BMI of the case and the control it was found that the control group was losing weight as they progressed with treatment (from normal BMI mean of 22.40 kg/m^2 to deteriorating BMI mean of 20.90 kg/m^2), whereas the case group gained weight from 19.92 to 21.10 kg/m^2. This

implies that the patients were responding well to the medical nutrition therapy. According to the National Cancer Institute [15], medical nutrition therapy supports the cancer patients during and after treatment by keeping a healthy body weight, maintaining strength, keeping body tissue healthy and decreasing side effects.

The study, showed no significant differences in mean Hip-Waist Ratio (HWR) between the groups among different cancer types apart from pancreas within the control group. However, there was significant differences across the two groups when the cancer type is not put under consideration. In both groups the total mean HWR increased significantly (Table 3).

Generally, HWR either increased or remained the same in the case group, but it increased in all control groups. Total mean HWR increase in the control group had a wider margin of 0.91 to 0.94 cm compared to the case group (0.88 to 0.89 cm). This was in tandem with the views of Desantis *et al*. [16].

Treatment Outcomes in Study Participants

Data on treatment outcomes of cancer patients revealed significant changes in the tumor size (Table 4). There was significant difference across all the cases groups apart from colon cancer patients. For control group, significant differences were noticed among the ovary and lung cancer patients only. Generally, there was significant differences in mean tumor size before and after treatment for cases and the controls without considering cancer type.

There was a total mean tumor reduction (shrink) during the treatment and after the treatment from 2.5 to 1.67 cm (0.83 difference) in the case group compared to the control group which had increase tumor size from 2.30 to 2.62 cm (+0.32 difference). The results show that after treatment, all the control groups had increased the size of the tumor whereas there was reduction in tumor size in the case groups. This could be due to the fact that the control group did not undergo medical nutrition therapy which could have played a significant role in reducing the tumor in the case group.

Chemotherapy drugs can cause damage to healthy cells. In addition, combining medical nutrition therapy with chemotherapy could prevent the killing of the healthy cells thus making the patients more resistant to opportunistic diseases [9].

The analysis of the rest of the treatment outcomes (Table 5) was conducted using CT scan, X-ray, MRI, full Haemogram, biopsy and physical examination before treatment. Out of these outcomes, biopsy and X-ray were normal after treatment while the rest varied. Liver and kidney function varied both before and after treatment in both control and case groups. Immunity was close to normal before treatment, but it varied after treatment.

CONCLUSION AND RECOMMENDATIONS

Medical nutrition therapy plays a significant role in cancer management. It determines a patient's functional status and tolerance to therapeutic interventions.

The authors of this study are recommending further research that will include more hospitals in Mombasa County (both private and public) so as to validate the findings.

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