Journal of Oncology Research and Treatments

Gebremeskel et al., J Oncol Res Treat 2020, 5:2

Research Article Open Access

Assessment of Malnutrition among Female Breast Cancer Patients using Biochemical Markers

Kibrom Gebremeskel, WondmagegnehuTigeneh and Solomon Genet*

Department of Medical Biochemistry, Addis Ababa University, Addis Ababa, Ethiopia

Abstract

Background: Breast cancer is the most common cancer worldwide and malnutrition commonly occurs during cancer. Malnourished cancer patients respond poorly to therapeutic interventions resulting in increased morbidity and mortality. The aim of the present study was to evaluate malnutrition in breast cancer patients through measurement of biochemical markers.

Methods: Hospital based cross-sectional study was conducted on 50 breast cancer patients and 50 healthy individuals. Blood was collected and analyzed to gather biochemical and hematological data. Demographic and anthropometric data were also collected and data were statistically analyzed.

Results: The mean age of participants was 43.06 years. Patients had decreased albumin, creatinine, body mass index and lymphocyte but increased globulins and urea levels than controls. Prevalence of malnutrition assessed through albumin blood count and body mass index was 32%, 46% and 36% respectively. A positive correlation existed between globulin and total protein levels (r=0.84, P<0 .0001) and negative correlation between albumin and globulin levels (r=-0.48, p<0.0001), and albumin positively correlated with lymphocyte count (r=0.51, p= 0.03) among breast cancer patients.

Conclusion: Measurement of serum albumin, globulin, creatinine, blood count and urea could serve as reliable markers for assessment of malnutrition in breast cancer patients.

Keywords: Breast cancer; Malnutrition; Biochemical markers; Total lymphocyte count

Introduction

Breast cancer is the commonest malignancy of females all over the world [1]. It is the most common cancer in women worldwide, with nearly 1.7 million new cases diagnosed in 2012. This represents about 12% of all new cancer cases and 25% of all cancers in women [2]. Currently Breast cancer is the most commonly diagnosed cancer in women in several sub-Saharan African countries and its burden increases in the coming decades. An age-standardized incidence rate of 19.5 per 100,000 and an estimated age-standardized death rate of 11.8 per 100,000 females are estimated in Ethiopia [3]. The prevalence of malnutrition in people with cancer is estimated up to 30–50% and 85% in long-term care facilities. All women regardless of their racial or ethnic origin or heritage are at risk of developing breast cancer [4]. The development of cancer may be initially slow or rapidly evolving, unavoidably affecting nutritional status [5]. Malnutrition is common in cancer patients [6]. Cancer associated malnutrition can result from local effects of a tumor, the host response to the tumor and due to the effect of antitumor therapies.

Malnutrition has been associated to several clinical consequences, including quality of life impairment, decreased treatment response, increased risk of infections, high risk of chemotherapy induced toxicity, increased length of hospital stay, hospitalization costs and increased morbidity and mortality [7,8]. It may also affect performance of organ systems and even the whole organism [9]. Cancer cell proliferation, survival and metastasis depend on metabolic reprograming of not only dietary nutrients but also systemic metabolic deregulation promoting tissue wasting and metabolites mobilization that ultimately supports tumor growth [10]. Cachexia is a life threatening common cancer metabolism syndrome that affects many organ functions that all together decreases patients' quality of life and worsening their prognosis. Starvation affects mainly the adipose tissue but wasting is a phenomenon particularly of the skeletal muscle. Even though it is the most common cancer in women of high-income countries, there is a trend of increasing incidence and mortality from breast cancer in lower income countries [11]. In addition, therapies also exaggerate the malnutrition resulting in increase in morbidity and mortality of the patients. Hence early assessment of nutritional status is important for nutritional therapy in order to reduce the above complications. Breast cancer is the leading killer cancer disease among female in Ethiopia. Surprisingly it not only women above 50 that manifest the disease but also women at younger age suffer from the disease in this country. This requires an elaborated genetic study of the community. Malnutrition is rampant in Ethiopia and it complicates treatment of cancer patients. This paper is the first of its kind in Ethiopia that attempts to address cancer malnutrition and efficacy of the different treatment strategies by measuring various biochemical markers.

Methods and Patients

Study design

Hospital based cross-sectional study was conducted from January 2016 to April 2017 to evaluate serum biochemical profiles and

***Corresponding author:** Solomon Genet, Department of Medical Biochemistry, Addis Ababa University, Addis Ababa, Ethiopia, Tel: +251 933944457; E-mail: solgen73@yahoo.com

Received January 29, 2020; **Accepted** July 22, 2020; **Published** July 29, 2020

Citation: Gebremeskel K, Tigeneh W, Genet S (2020) Assessment of Malnutrition among Female Breast Cancer Patients using Biochemical Markers. J Oncol Res Treat 5: 148.

anthropometric parameters as cancer malnutrition markers among 50 new breast cancer patients attending Tikur Anbesa Specialized Hospital, Addis Ababa with age and sex matched 50 healthy individuals as controls. Convenient sampling method was used to recruit patients. Patients with renal and liver failure and those who had surgery, those taking chemotherapy, radiotherapy and dialysis, or those using immunosuppressive medication were excluded from the study.

Blood sample and data collection procedures

After the study participants had been asked for their consent, blood (5ml) was withdrawn from the study participants. The sample was collected by qualified professional nurses in the hospital.

In addition, the questionnaire was filled by face to face interview and some anthropometric indicators were also measured following standard procedures. Blood collected in appropriate tubes was allowed to stand for 30 minutes at room temperature to allow complete clotting and clot retraction. Samples were then centrifuged at 4000 rpm for 10 min to extract serum. The serum extracted was used to determine the levels of albumin, total protein, creatinine and urea. About 2ml of the blood was kept in EDTA coated tubes and hematological profiles were determined for all samples using a hematological analyzer. Safety precautions were taken while handling blood and disposing it.

Test procedures of Biochemical markers

Serum albumin level was measured by the method of bromocresol green [12].

Total protein was determined by using an automatic chemistry analyzer. Measurement was performed by a Biuret reaction using a total protein reagent kit. Total serum globulins were determined by subtracting the values of albumin from total protein.

[globulin (g/dl)] = [Total Protein (g/dl)] – [Albumin (g/dl)].

Serum creatinine reacts with picric acid in alkaline solution yielding a yellow- orange colored compound. The intensity of the color is directly proportional to creatinine concentration present in the sample and is measured at an absorbance between 490 nm-500nm.

The enzyme urease converts urea to ammonia and carbonic acid. Glutamate dehydrogenase catalyzes the reaction of ammonia with α-ketoglutarate and oxidizes NADH in to NAD+.

Automated hematology analyzer, was used to accurately count and size cells by detecting and measuring changes in electrical resistance when a particle such as a cell in a conductive liquid passes through a small aperture.

Anthropometrical measurement procedure

The weights of the breast cancer patients and the control were measured using a standard balance, and the height was measured by using a height measuring device attached to the balance. Body Mass Index was then calculated from the body weight (kg) and height (meter) as BMI=Weight (kg)/Height $(m)^2$. According to Norte et al., 2015, four categories of BMI were identified: <18.5 kg/m^2 (underweight); 18.5 to 24.9 kg/m2 (normal); 25 to 29.9 kg/m^2 (overweight); and ≥ 30 kg/ m^2 (obese). The participants' ages were also recorded.

Data quality control and management

The data collection questionnaire was well prepared and all variables were filled on the data extraction format daily. All the laboratory procedures were handled by professional laboratory technologists. All the tests were standardized and automated.

Data processing and analysis

After checking for completeness and cleaning, processing and analysis of the data obtained from laboratory analyses of the blood samples and questionnaires was performed by coding and entering the data into Epi Data statistical software version 3.1 and then to SPSS software version 23 package and the different variables were tested and analyzed. Simple descriptive statistics was used to present the socio demographic and clinical characteristics of the study subjects. Continuous variables were presented as mean ± standard error and compared using the student t tests and one way analysis of variance (ANOVA). Other associations were performed with Pearson's correlation coefficient. A P-value of <0.05 at 95% confidence level was considered to be statistically significant in all the analyses.

Ethical consideration

Before starting data collection and preliminary study, ethical clearance letter with reference number SOM/DRERC/BCHM060/2009 was obtained from the Department Research and Ethics Review Committee, Department of Biochemistry, College of Health Sciences, Addis Ababa University. The objective of the study was briefly clarified and explained for each participant, before enrolling any of the eligible study participants. Samples and data were collected after informed consent had been obtained from the study participants.

Results

This study enrolled 50 female breast cancer patients and 50 healthy female as controls which meet the inclusion and exclusion criteria. The average age of the breast cancer patients and control groups were 43.06 ages ranging from 21 to 56 years. Most of the breast cancer patients in the study were of middle economic status (58%), rural resident (58%), married (74%), with moderate loss of appetite (48%), self-feed without difficulty (70%). In addition only 12 % of the breast cancer patients drink alcohol, and 2% did smoke cigarette. The control groups were of middle economic status (72%), urban (84%), married (72%), and with good appetite. They had no habit of smoking and alcohol consumption (Table 1).

With regards to cancer stage, stage III amounted the highest proportion (36%) whereas stage I had least proportion of the breast cancer patients (18%) (Figure 1).

Assessment of malnutrition among the breast cancer patients and control groups was performed using anthropometric techniques and biochemical tests using standard kits. The age group ranged between 21 and 56 years. There was a good matching with regards to age between the control and study groups. There was no statistically significant difference between the mean ages of patient and the control groups.

Serum albumin level was measured for controls and study subjects and the results showed that there was a statistically significant difference between the two groups. The study group had lower mean albumin level (3.89 ± 0.04 g/dl) than the control group (4.34 ± 0.17 g/dl) with P<0.0001. Serum total protein level was also measured for the two groups and the results showed that there was no significant difference between them. The study group had almost similar mean average total protein level (7.81 ± 0.07 g/dl) to the control group (7.7 ± 0.05 g/dl) with a P< 0.19. Serum globulin was calculated from the total protein for the breast cancer patient & control groups. The patient group had higher mean globulin level (3.92 ± 0.08 g/dl) than the control group (3.35 ± 0.04 g/dl) with P< 0.0001.

Variable		Patients N (%)	Controls N (%)
Age[a]	1.72	43.06 ± 1.72	43.06 ±
Socioeconomic status[b]	Low	20 (40)	6 (12)
	Middle	29 (58)	36 (72)
	High	1 (2)	8 (16)
Residence	Rural	29 (58)	8 (16)
	Urban	21 (42)	42 (84)
Marital status	Married	37(74)	36 (72)
	Single	2 (4)	12 (24)
	Widow	7 (14)	0 (0)
	Divorced	4 (8)	2 (4)
Appetite status	No loss of appetite	21 (42)	50 (100)
	Moderate Loss of appetite	24(48)	0 (0)
	Severe loss of appetite	5(10)	0(0)
Mode of feeding	Self-feed without difficulty	35 (70)	50 (100)
	Self-feed with difficulty	15 (30)	15 (30)
Alcohol taking	Yes	6 (12)	0(0)
	No	44 (88)	50(100)
Smoking status	Yes	1(2)	0(0)
	No	49(98)	50(100)

[a]Age, continuous variable, is expressed as mean ± standard error; [b] for the rest of the variables, qualitative, the numbers are in percent out of the total 50 patients and 50 controls.

Table 1: Socio demographic characteristics of the breast cancer patients and control groups.

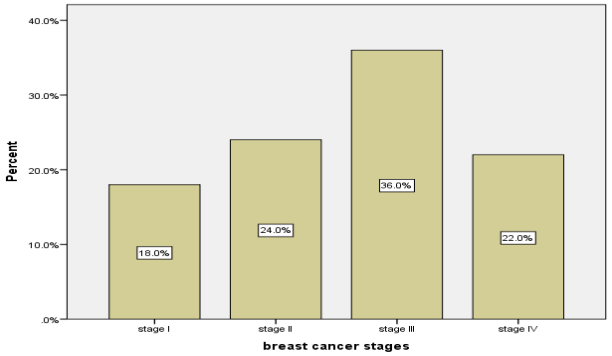

Figure 1: Proportion of breast cancer patients' enrolled in the study.

The patient's mean value of serum creatinine level was (0.72 ± 0.03 mg/l) and the control mean was (0.96 ± 0.03 mg/l) P< 0.0001. This shows that the creatinine level had really gone down for the breast cancer patients than control groups. Urea mean value level for study group was (25.19 ± 1.22 mg/l) and for control group (21.62 ± 1.01 mg/l) with a P< 0.033. In addition total lymphocytes count (TLC) was determined for both groups and its mean value for the patient group (1.73 x 103 ± 0.29 cells/mm^3) & the control group (2.35 x 103 ± 0.15 cells/mm3) with P< 0.0001. Anthropometric parameter such as body mass index was determined by measuring weight and height of both groups. The mean body mass index value was 17.97 ± 0.6 kg/m2 for study group and 20.43 ± 0.64 kg/m2 for control group. The results of the two groups are shown in (Table 2).

Serum albumin, total lymphocyte count, total protein, creatinine and body mass index were measured to see the prevalence of malnutrition between control group and study subjects. The results obtained are shown below (Table 3). The overall prevalence of malnutrition was 32%, with 12% and 20% cases of moderate and mild malnutrition, respectively according to serum albumin. According to total lymphocyte count prevalence of malnutrition were 46%; with 4%, sever; 4%, moderate and 38% mild malnutrition in the patient group. In addition 2% were, severely; 34%, mildly malnourished; 14% were overweight and 12% obese based on body mass index. There was no statistically significant prevalence of malnutrition using serum total protein and creatinine level in the study group. There was almost no prevalence of malnutrition in the control group through all biochemical nutritional markers assessed in the study.

Pearson correlation analysis for anthropometric and biochemical measurements for the patient and control group were done and are

Parameters	Breast Cancer (n=50) Mean ± SE	Control (n=50) Mean ± SE	P-Value
Age	43.06 ± 1.72	43.06 ± 1.72	1.000
Albumin[a]	3.89 ± 0.04	4.34 ± 0.17	<0.0001
Globulin[a]	3.92 ± 0.08	3.35 ± 0.04	<0.0001
Total protein[a]	7.81 ± 0.07	7.7 ± 0.05	0.190
T. lymphocyte count[b]	1.73 ± 0.29	2.35 ± 1.12	<0.0001
Creatinine[c]	0.72 ± 0.03	0.96 ± 0.03	<0.0001
Urea[c]	25.19 ± 1.22	21.62 ± 1.01	0.033
Body mass index[d]	17.97 ± 0.6	20.43 ± 0.64	0.069

Values bearing different superscripts a, b, c, d; represents units, [a]g/dl, [b]10^3 x cells/mm^3, [c]mg/dl, [d]kg/m^2

Table 2: Comparison of mean value of anthropometric and biochemical measurements of the breast cancer patients and control groups.

Variables	Breast cancer (50) N (%)	Control (50) N (%)	P –value
Albumin			
Severely malnourished	0 (0)	0 (0)	0.03*
Moderately malnourished	6 (12)	0 (0)	
Mildly malnourished	10 (20)	0 (0)	
Normal	34 (68)	50 (100)	
Total lymphocyte count			
Severely malnourished	2 (4)	0 (0)	0.01*
Moderately malnourished	2 (4)	0 (0)	
Mildly malnourished	19 (38)	3 (6)	
Normal	27 (54)	47 (94)	
BMI			
Sever malnourished	1(2)	0(0)	0.01*
Mild malnourished	17(34)	2(4)	
Normal	19(38)	34(68)	
Overweight	7(14)	14(28)	
Obese	6(12)	0(0)	
Total protein			
Malnourished	1(2)	0(0)	0.99
Normal	49(98)	50(100)	
Creatinine			
Malnourished	11(22)	0(0)	0.07
Normal	39(78)	50(100)	
*P value < 0.05 is statistically significant			

Table 3: Prevalence of malnutrition in breast cancer patients and control individuals.

			AGE	GLOB	TPRO	TLYMC	CRE	UREA	BMI
Albumin	Breast Cancer	R	-0.21	-.48**	0.06	0.51*	0.02	0.05	0.1
		P	0.14	<0.0001	0.65	0.03	0.88	0.73	0.48
	Control groups	R	-0.11	.05	.56**	0.02	0.26	0.02	0.05
		P	0.45	0.71	<0.0001	0.16	0.06	0.89	0.74
** Correlation is significant at the 0.01 level (2-tailed),* Correlation is significant at the 0.05 level (2-tailed).TPRO; total protein, GLOB; globulin, TLYMC; total lymphocyte count, CRE; creatinine, BMI; body mass index									
			AGE	ALB	TPRO	TLYMC	CRE	UREA	BMI
Globulin	Breast Cancer	R	0.21	-.48**	.84**	0.04	-0.2	0.01	0.07
		P	0.15	<0.0001	<0.0001	0.78	0.33	0.9	0.59
	Control groups	R	0.12	0.05	.86**	-0.15	0.15	0.07	0.06
		P	0.42	0.71	<0.0001	0.3	0.3	0.65	0.68
** Correlation is significant at the 0.01 level (2-tailed).ALB; albumin, TPRO; total protein, TLYMC; total lymphocyte count, CRE; creatinine, BMI; body mass index									
			AGE	ALB	TPRO	CRE	UREA	BMI	GLOB
TLYMC	Breast Cancer	R	-0.14	0.08	-0.09	0.26	0.19	0.47*	0.04
		P	0.35	0.56	0.52	0.07	0.18	0.04	0.78
	Control groups	R	-0.13	0.2	0.04	0.06	0.67	0.04	0.17
		P	0.35	0.16	0.79	0.64	0.64	0.77	0.23
* Correlation is significant at the 0.05 level (2-tailed).ALB; albumin, TPRO; total protein, GLOB; globulin, TLYMC; total lymphocyte count, CRE; creatinine, BMI; body mass index									

Table 4: Pearson correlation co-efficient between anthropometric and biochemical indices for breast cancer patient and control groups.

Parameters	No appetite loss (n=21) value	Moderate appetite (n=21) value	Severe appetite (n=21) value	P
Albumin	0.027*	4.01 ± 0.09	3.98 ± 0 .05	3.67 ± .05
Total protein	0.643	7.67 ± 0.1	7.89 ± 0.1	7.89 ± 0.1
Globulin[a]	0.891	3.76 ± 0.1	3.87 ± 0.1	3.98 ± 0.1
Creatinine[b]	0.57	0.77 ± 0.04	0.70 ± 0.03	0.61 ± .06
Urea[b]	0.135	28 ± 1.92	23.5 ± 1.86	22.2 ± 2.96
TLC[c]	0.135	1.83 ± 2.1	1.67 ± .28	1.67 ± .33
BMI[d]	0.786	18.49 ± 1.06	17.79 ± .88	17.14 ± 1.36
*P value < 0.05 is statistically significant, data are expressed as Mean ±SE; values bearing different superscripts a, b, c, d, represents units, ag/dl, bmg/dl, c10^3 x cells/ mm^3, dkg/m^2				

Table 5: One-way ANOVA of appetite status effect on biochemical, TLC and BMI, in breast cancer patients.

shown in Table 4. Albumin positively correlated with TLC (r=0.51, P=0.03) in patient group and serum total protein (r=0.56, P<0.0001) in the control group. Albumin also negatively correlated with nutritional indicators of serum globulin (r=-0.48, P<0.0001) in study group. Globulin showed a statically significant positive correlation with total protein in both study (r = 0.84, P<0.0001) and control groups (r=0.86, P<0.0001). Creatinine positively correlated with urea (r=0.33, P=0.02) and body mass index (r=0.43, P< 0.0001) in the study group. But there was no correlation in the control group. Total lymphocyte count positively correlated with body mass index (r=0.47, P=0.04) in patient group.

Bivariate, Pearson correlation analysis, showed that age negatively correlated with all biochemical and body mass index in both study and control groups (P>0.05). In addition appetite status was also assessed in the study groups. There was significant difference in mean value of serum albumin (P=0.027), with appetite status of breast cancer patients but non-statistical significant difference in total protein (P=0.643), globulin (p=0.891), Creatinine (P=0.570), urea (P=0.135), TLC (P=0.179) and body mass index (P=0.786) (Table 5).

Effect of cancer stage on biochemical nutritional parameters was assessed through one way ANOVA. There was significant difference in mean value of serum albumin (P=0.001), Creatinine (P=0.001) and TLC (P=0.010) with clinical stage of breast cancer but non-statistical significant difference in total protein (P=0.922), globulin (P= 0.963), urea (P=0.088) and body mass index (P=0.144) (Table 6).

Parameters	Stage I (n = 9)	Stage II (n=12)	Stage III (n=18)	Stage IV (n=11)	P-value
Albumin[a]	4.16 ± 0.08	4.01 ± 0.06	3.85 ± 0.05	3.55 ± 0.17	0.001**
Total protein[a]	7.71 ± 0.16	7.83 ± 0.10	7.85 ± 0.18	7.79 ± 0.14	0.922
Globulin[a]	3.75 ± 0.24	3.94 ± 0.10	3.99 ± 0.17	3.91 ± 0.20	0.963
Creatinine[b]	0.80 ± 0.05	0.86 ± 0.03	0.70 ± 0.05	0.55 ± 0.06	0.001**
Urea[b]	20.22 ± 1.75	23.53 ± 2.23	25.6 ± 2.92	30.8 ± 2.58	0.088
T. Lymph. Count[c]	1.95 ± 0.11	1.70 ± 0.06	1.77 ± 0.08	1.52 ± 0.02	0.010**
BMI[d]	19.66 ± 1.20	17.98 ± 0.92	17.17 ± 1.36	16.77 ± 0.6	0.144
**P value ≤ 0.01 is statistically significant, data are expressed as Mean ±SE; values bearing different superscripts a, b, c, d represent units, [a]g/dl, [b]mg/dl, [c]10^3 x cells/ mm^3, [d]kg/m^2					

Table 6: One-way ANOVA test showing cancer stage effect on biochemical, TLC and BMI parameters, in breast cancer patients.

Discussion

Breast cancer patients were found to have elevated levels of globulin and urea, lower level of albumin and ceatinine than the control group. Total lymphocyte count was significantly lower in the patients. Anthropometric indicator like BMI was also lower than the control subjects. Non-significant increase in the mean value of serum total protein was obtained in breast cancer patients, similar to several other reports [13-14]. This increase in serum total protein level is because cancer patients synthesize different kinds of proteins such as globulins, immunoglobulin, enzymes and positive acute phase proteins. Lymphocytes produce globulins to the levels that are high enough to compensate for the lowered albumin levels in the serum. Another reason for increase in total serum protein could be that as plasma circulates through the tissues, it collects proteins that are released from their original locations due to certain physiological events, such as tissue remodeling, trauma and cell death. That there is no change in total protein may be due to compensation of negative acute phase protein by positive acute phase protein. So for assessment of malnutrition, it is better to assess the fraction of total protein rather than total protein.

There was significant decrease in mean value of albumin in breast cancer patients compared to controls; similar to other findings [15,16]. The reduction in serum albumin concentration could be because, during malignancy condition, liver synthesizes large amount of positive acute phase reactant proteins than the synthesis of negative acute phase reactant proteins. A report showed that synthesis of inflammatory cytokines such as TNF-α and IL and C-reactive protein also reduces serum albumin concentration [17]. These inflammatory mediators are produced by tumor and host cells in malignancies. Another cause for the observed reduced albumin level in serum of breast cancer patients may be due to the role of albumin as extracellular antioxidant scavenger [18]. There was 32% prevalence of malnutrition in breast cancer patients with 12% and 20% of moderate and mild malnutrition, respectively taking albumin as marker. Albumin positively correlated to TLC in study group. The low albumin level in patients may increase susceptibility to infection, reduce quality of life and increase mortality. In addition albumin negatively correlated with globulins i.e. low albumin to globulin ratio. The low albumin to globulin ratio was predicting long term mortality in breast cancer patients. Moreover, the

low plasma albumin concentration is a reflection of poor diet or poor appetite that minimizes amino acids availability for plasma protein biosynthesis.

There was significant higher serum globulin in the patient than the control group, which agrees with other works. In response to reduced levels of serum albumin in breast cancer patients, albumin to globulin ratio is lowered due to an increase in globulins; mainly immunoglobulin's synthesized by lymphocytes to compensate for the reduced serum albumin. Failure of lymphocytes to raise globulins to levels that is high enough to compensate for the reduced albumin may indicate advanced disease, where protein synthesis is reduced but protein catabolism is accelerated.

Significantly lower serum creatinine level was observed in the study group than the control group, which may be attributable to muscle mass wasting of breast cancer patients. A large proportion of the breast cancer patients in this study were stage III and above, which may have lost muscle mass as a result of increased breakdown of muscle protein to provide the essential amino acids required for protein synthesis and energy metabolism gluconeogenesis for the tumor cells [19,20]. In contrast to decreased protein synthesis in muscle cells, tumor cells exhibit increased protein synthesis in liver. Removal of specific amino acids by the tumor leads to a depression of host protein synthesis [21]. The condition of sarcopenia in an individual with otherwise normal body weight would result in a disproportionately low contribution of muscle derived metabolites. It is estimated that 20% or more of patients with cancer may have sarcopenia, i.e. significant loss of muscle mass, and thus lower than expected serum creatinine levels [22,23]. Muscle catabolic rate increase in the presence of tumor, results in a negative nitrogen balance on the muscle due to translocation of nitrogen from host to the tumor. Statistically significant elevated mean urea value in breast cancer was also found as compared to healthy subjects. The elevated serum urea level in our study probably arises from an increased mobilization of body proteins for the production of glucose for use by the tumor. In the presence of cancer the ability of an organism to regulate the synthetic and catabolic processes involving numerous and different proteins with the goal of maintaining relatively constant bodies are disturbed. The malignant tumor seems to inappropriately metabolize both dietary and host proteins, resulting in the wasting of lean body mass. It is estimated that 30 – 100% of all patients with advanced cancer have negative nitrogen balance [24].

A significant decrease in mean value of total lymphocyte count in breast cancer patients as compared to normal subjects was also noted , which is in line with other works [25,26]. Reduction may be due to cancer directed depletion of albumin or malnutrition that contributes to compromised immunity/immune-suppression. Other investigators reported significant reduction in the number of helper CD4+ cells and depressed natural killer cell activity [27]. Total lymphocyte count positively correlated with body mass index. Skeletal muscle, which accounts for 40% of body weight and 50% of body protein, plays a vital role in regulating immune function and its loss predispose impaired tissue healing and poor immune function. The mean values of body mass index showed that the breast cancer patients were underweight but the control group had normal value. This is in line with the work of [28]. Assessment of prevalence of malnutrition in patient group through BMI showed that 2% were severely and 34% mildly malnourished but 14% were overweight and 12% were obese. There was significant difference in mean value of serum albumin level in breast cancer patients in relation to pathological stages and the value decreased as the stage becomes advanced, which is in line with other studies [29-30]. This may be due to increased degradation and decreased synthesis of albumin with increasing cancer stages. Decrease in total lymphocyte count level with increase in stage of breast cancer in our study agrees with another study [31]. In addition, mean value of serum creatinine also showed statistically significant reduction with advanced clinical stages. There were no differences in mean serum total protein level among breast cancer patients at different cancer stages.

Conclusion

Breast cancer patients present with different stages of malnutrition. The consequences of malnutrition include impairment of immune functions, poor quality of life, low response to chemotherapy, chemotherapy-induced toxicity and complications. The low albumin concentration was indicative of the malnutrition and unavailability of amino acids for protein synthesis. The high urea level obtained in breast cancer patients is indicative of increased muscle wasting and catabolism of proteins. These patients are in a state of negative nitrogen balance and this has to be considered during treatment through diet supplementation or nutritional therapy has to be considered as a treatment strategy. There is a rampant nutritional deficiency in this country that can compound the problem of cancer treatment. Since biochemical markers have their own limitations and their level is affected by different disease, it is advisable to use combination of biochemical markers and lymphocyte count to get feasible assessment strategy of malnutrition during cancer.

Conflict of Interest

The authors of this research article do not have any type of conflict of interest what so ever.

Acknowledgements

We acknowledge the financial support of Addis Ababa University. We also thank the patients that were willing to participate in the study. We thank TASH for allowing us to use the space available and also for the clinical access to patients.

References

1. Liu X, Meng QH, Ye Y, Hildebrandt MA, Gu J, et al. (2015) Prognostic significance of pretreatment serum levels of albumin, LDH and total bilirubin in patients with non-metastatic breast cancer. Carcinogenesis 36: 243-248.
2. World cancer research fund international Breast cancer statistics. WCRF International web site visited
3. Kantelhardt EJ, Zerche P, Mathewos A, Trocchi P, Addissie A, et al. (2014) Breast cancer survival in Ethiopia: A cohort study of 1,070 women. Int J cancer 135: 702-709.
4. Fatima T, Roohi N, Abid R (2013) Circulatory proteins in women with breast cancer and their chemotherapeutic responses. Pak J Zool 45: 1207-1213.
5. Santarpia L, Contaldo F, Pasanisi F (2011) Nutritional screening and early treatment of malnutrition in cancer patients. J CSM 2: 27-35.
6. Righini, CA Timi N, June P, Bertolo A, Reyt E, et al. (2013) Assessment of nutritional status at the time of diagnosis in patients treated for head and neck cancer. Eur Ann Otorhinolaryngol Head Neck Dis 130: 8-14.
7. Beghetto MG, Luft VC, Mello EDD, Polanczyk CA (2009) Accuracy of nutritional assessment tools for predicting adverse hospital outcomes. Nutr Hosp 24: 56-62.
8. Kuzuya M, Kanda S, Koike T, Suzuki Y, Iguchi A, et al. (2005) Lack of correlation between total lymphocyte count and nutritional status in the elderly. Clin Nutr 24: 427-432.
9. Andreoli A, De Lorenzo A, Cadeddu F, Iacopino L, Grande M, et al. (2013) New trends in nutritional status assessment of cancer patients. Eur Rev Med Pharmacol Sci 15: 469-480.
10. Porporato PE (2016) Understanding cachexia as a cancer metabolism syndrome. Oncogenesis 5: e200
11. Romieu I (2011) Diet and breast cancer. Saludpublica de Mexico 53: 430-439.

12. Doumas BT, Watson WA, Biggs HG (1971) Albumin standards and the measurement of serum albumin with bromcresol green. Clinica chimica acta 31: 87-96.

13. Dhakar N, Asteka M, Jain M, Saawarn S, Saawarn N, et al. (2003) Total sialic acid, total proteinand total sugar levels in serum and saliva of oral squamous cell carcinoma patients: A case control study. Dent Res J 10: 343.

14. Gao WM, Kuick R, Orchekowski RP, Misek DE, Qiu J, et al. (2005) Distinctive serum protein profiles involving abundant proteins in lung cancer patients based upon antibody microarray analysis. BMC cancer 2005;5:110.

15. Muhtaseb SI (2014) Serum and saliva protein levels in females with breast cancer. Oncology letters 8: 2752-2756.

16. Joudi FS (2005) Prognostic value of an index for serum globulin compensation in colon and breast cancers. Singapore Med J 2005;46: 710.

17. Dawood RM, Hasan HR (2013) Assessment of salivary and serum proteins in patients with oral Tumors J Baghdad Sci 10: 934-944.

18. Roche M, Rondeau P, Singh NR, Tarnus E, Bourdon E, et al. (2008) The antioxidant properties of serum albumin. FEBS letters 582: 1783-1787.

19. Giltay EJ, van Schaardenburg D, Gooren LJ, Kostense PJ, Dijkmans BA, et al. (1999) Decreased serum biochemical markers of muscle origin in patients with ankylosing spondylitis. Ann Rheum Dis 58: 541-45.

20. Lecker SH, Solomon V, Mitch WE, Goldberg AL (1999) Muscle protein breakdown and the critical role of the ubiquitin-proteasome pathway in normal and disease states. J Nutr 129: 227S-37S.

21. Smith KL, Tisdale MJ (1993) Mechanism of muscle protein degradation in cancer cachexia. Br J cancer 68:314.

22. Stretch C, Eastman T, Mandal R, Eisne R, Wishart DS, et al. (2012) Prediction of skeletal muscle and fat mass in patients with advanced cancer using a metabolomic approach. J Nutr 142: 14-21.

23. Cohen E, Krzesinski JM, Launay-Vacher V, Sprangers B (2015) Onco-nephrology: core curriculum. Am J Kidney Dis 66: 869-83.

24. Blackburn GL, Maini BS, Bistrian BR, McDermott WV (1997) The effect of cancer on nitrogen, electrolyte, and mineral metabolism. Cancer Res 37: 2348-2353.

25. Shrivastava S, Singh N, Nigam AK, Chandel SS (2017) Comparative study of hematological parameters along with effect of chemotherapy and radiotherapy in different stages of breast cancer. Int. J. Res Med Sci 5: 311-15.

26. Ruffell B, Au A, Rugo HS, Esserman LJ (2012) Leukocyte composition of human breast cancer. Proc Natl Acad Sci USA 109: 2796-2801.

27. Lawal AO, Kolude B, Adeyemi BF, Lawoyin JO, Akang EEU, et al. (2010) Relationship between serum albumin and oral epithelial cancers in patients seen at a Nigerian tertiary hospital. Afr J Biomed Res 13: 225-29.

28. Martins KA, Freitas-Junior R, Monego ET, Paulinelli RR (2012) Anthropometry and lipid profile in women with breast cancer: a case-control study. Revista do ColégioBrasileiro de Cirurgiões 39: 358-63.

29. Irungu CW, Oburra HO, Ochola B (2015) Prevalence and Predictors of malnutrition in nasopharyngeal carcinoma. Clin Med Insights Ear Nose Throat 8: 19.

30. Pan Yi-Ping, Pei-Hung Chang, Chung-Wei Fan, Wen-Ko Tseng, Jen-Seng Huang, et al. (2015) Relationship between pre-treatment nutritional status, serum glutamine, arginine levels and clinicopathological features in Taiwan colorectal cancer patients. Asia Pac J Clin Nutr 24: 598-604.

31. Rana APS, Kaur M, Zonunsanga B, Puri A, Kuka AS, et al. (2015) Preoperative peripheral blood count in breast carcinoma: predictor of prognosis or a routine test. Int J Breast Cancer.