

Evaluation of the Nutritional Status among Patients with Leukemia During Induction Chemotherapy: Using PG-SGA

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Abstract: Prevalence of malnutrition is seen at higher percentage in adult patients having leukemia, which is increased during the course of induction chemotherapy. The aim of the current study was to evaluate the nutritional status among patients with leukemia during induction chemotherapy: using PG-SGA. Descriptive design was utilized in the current study. Research question: What is the nutritional status among patients with leukemia during induction chemotherapy? A convenient sample of 100 adult male and female patients had leukemia receiving induction chemotherapy at oncology department, Cairo University, Egypt was taken. Tools of the study included Socio-demographic data sheet and Patient generated-subjective global assessment (PG-SGA) to evaluate nutritional status. Results showed that there were statistically significant differences between anthropometric measurements as TSF, MAC, MAMC and body mass index. The highest value of physical signs of nutritional deficiency were related to mouth problems as pale tongue, lips, cracks at the sides of lips and bleeding per gums. The most common nutritional risk factors were anorexia, taste alteration, difficulty in swallowing and vomiting. It can be concluded that the majority of the study subjects with leukemia are at risk for developing malnutrition based on nutritional assessment data. The majority of the patients were obese or had different degree of obesity. The study recommended that health care team of the hospital should formulate PG-SGA sheet to be suitable for Egyptian patients had cancer in the hospitals, have an equipment for evaluating nutritional status of the patients as skin fold calipers, tape measure and body weight scale and identify how to use it correctly.

Key words: Nutritional Status • Leukemia • Induction Chemotherapy & PG-SGA

INTRODUCTION

Cancer is the second cause of death in the most developed countries of the world and the most complicated and multifactorial diseases nowadays [1]. Leukemia is a clonal hematopoietic disorder characterized by aggressive proliferation of immature hematopoietic cells arrested at an early stage of differentiation [2]. In United States, there were an estimated number 387, 728 individuals living with leukemia, the number of patients with leukemia is 13.7 per 100, 000 each year. The number of deaths was 6.8 per 100, 000 each year from 2010 to 2014 [3]. Leukaemia is ranked the fifth most common cancer in men and sixth in women [4].

Leukemia is categorized into two types: acute and chronic leukemia that may be classified into acute & chronic myeloid leukemia and acute or chronic lymphocytic leukemia, the initial differences between the

four kinds of leukemia refers to their rates of progression and wherever the cancer develops [5]. Acute myeloid leukemia (AML) is one of the most common myeloid malignancies in adults. There are several symptoms related to leukemia as fatigue, insomnia, irritability, anorexia, joint pain, mild fever, bleeding from the nose or gums or per rectum, pallor, anemia, malnutrition, thrombocytopenia, neutropenia and skin rash [6]. The study of [7] showed that protein energy malnutrition is a common complication of leukemia and its medical treatment as induction chemotherapy which is defined as the delivery of chemotherapy before definitive surgery or radiation therapy, it is an approach based on the recognition that systemic chemotherapy is most active in previously untreated patients.

Chemotherapy treatment may have an influence on the energy requirements of the patients and put them in a catabolic state and also impair their dietary intake as a

result of chemotherapy-related side effects such as nausea, vomiting, loss of appetite and taste changes which are considered as predisposing factors for malnutrition [8]. Malnutrition can be defined as a state of altered nutritional status that is associated with increased risk of adverse clinical events such as complications or death. Malnutrition specific to cancer patients has been observed to negatively impact patient's response to therapy, increase the incidence of treatment-related side effects, interrupt serial treatment regimens, extend hospital stay, impair muscle function, performance status, immune function and quality of life; and ultimately affect survive [9].

World Health Organization (2014) estimated that there were 1.9 billion adults overweight or obese, while 462 million were underweight. A malnourished patient is thus more likely to be at higher risk of death than a well-nourished patient with the same diagnosis; it is also associated with a prolonged hospital stay [10]. A high prevalence of malnutrition has been found in patients with cancer, present in 40% to 80% of cases. It has been suggested that malnutrition is one of the main causes of medical complications and even death [11]. Nutritional assessment is performed on adult patients with Leukemia by Brinksma *et al.* [12], their results indicated that 65 % of them showed signs of protein calorie malnutrition as indicated by low body cell mass, reduced serum albumin concentrations or abnormal skin fold thickness. They also reported that malnutrition was observed at all clinical stages but was more frequently seen at advanced stages of cancer. Lnuarn and Sories [11] found that impaired nutritional status is common among patients with Leukemia even in a stable clinical condition.

Brinksma *et al.* [12] added according to his study on patients with Leukemia, body fat and muscle mass were evaluated by triceps skin fold thickness and mid arm muscle circumference, their study showed that 40% of patients had severe malnutrition, 30 % had moderate malnutrition, 26 % of patients were over nourished. The same authors commented that severely and moderately malnourished patients had lower survival rates than normal and over nourished patients. In addition; these data demonstrates that malnutrition is an independent predictor of survival in patients with Leukemia. So nutritional assessment and nutritional care are fundamental to cancer patients to evaluate their nutritional status and to identify who are nutritionally at risk. Patient generated-subjective global assessment (PG-SGA) is a widely used nutritional screening tool used especially for patients have cancer, it defined as a systematic tool used for obtaining, verifying and

interpreting data in order to make decision about the nature and cause of nutrition- related problems for cancer patients. The specific types of data gathered for the assessment would vary depending on practice setting, patients, present and previous health status [13]. Several measurements should be looked at when assessing nutritional status of patients have leukemia by using (PG-SGA), often these parameters include anthropometric measurements, biochemical tests, clinical observations, dietary intake and also activities of the patients [14]. Anthropometric Measurements are physical measurements of the body such as height, weight, triceps skin fold thickness (TSF), mid upper arm circumference (MAC), mid arm muscle circumference (MAMC), body mass index. Biochemical tests are hemoglobin, hematocrite, serum albumin. The clinical observation includes examination of the hair, nails, skin, eyes, lips, mouth, bones, muscles and joints. Furthermore; dietary intake can be collected by diet history, food record, food frequency questionnaire and 24-hour recall [14, 15].

Weight is a critical measure in nutrition assessment, it should be obtained by using a balance beam scale, it should be placed on a flat, hard surface, the zero weight on the scale's horizontal beam should be checked periodically, the patient should use the same scale, at the same time of the day and wearing the same kind of clothes. Weight can be measured by kilograms or pounds, [16]. The standing of height of adult can be determined with a tape measure fixed to a wall and a sliding right- angle head board for reading the measurement, height may be measured in inches or centimeters, to convert inches to centimeters; the number of inches should be multiplied by 2.54 [17].

Skin fold thickness (TSF) It is a measurement of a double layer of skin and subcutaneous fat that accounts for about half the fat in the body, TSF is more accurate estimate of fatness than body weight because weight includes not only fat but also muscle mass, water and bone components [18]. The width of the fat layer is measured by a skin fold caliper, usual measures are 10 to 12 mm for males; and 21 to 25 mm for females, levels below 3 mm indicate severe fat depletion. TSF alone isn't a sensitive indicator of malnutrition because many normal adults have less than 5 % body fat, so mid upper arm circumference (MAC) and mid arm muscle circumference (MAMC) should be also used [19].

The mid upper arm circumference measures muscle mass and subcutaneous fat, it is measured with a flexible, non stretchable tape, MAC is not a reliable indicator of nutritional status when used alone, it is needed to calculate the mid arm muscle circumference, its usual

measures are 31.9-32.2 cm for males and 27.7-29.9 cm for females. Mid arm muscle circumference is calculated from TSF and the MAC by using this formula, MAMC (cm) = MAC (cm) - [0.314 x TSF (mm)]. MAMC is used to estimate the amount of skeletal muscles that decreases in protein malnutrition. Its usual measures are 27.9-28.1cm for males and 21.2-29.0 cm for females [20].

Body mass index is the ratio of weight in kilograms and height in square meters, The normal range of body mass index is 20 to 25; 16 is severe malnutrition, 16-17 is moderate malnutrition, 17 - 18.5 is mild malnutrition, more than 27.5 is classified as obesity, 27.5 to 30 is mild obesity, 30 - 40 is moderate obesity, more than 40 indicated severe obesity [21]. Patients are considered to be nutritionally at risk if they have one or more of the following factors: Body weight $\leq 80\%$ or $\geq 120\%$ of ideal body weight, unintentional weight loss of $\geq 10\%$ of usual body weight, serum albumin ≤ 3.5 gm /dl, total lymphocyte count $\leq 1500/\text{mm}^3$, three or more reported risk factors mentioned in the health and illness history as decreased appetite, vomiting, diarrhea, & constipation [15].

The characteristics of health that can be seen in physical exams can help in completion of the picture of nutritional health; therefore hair, nails, skin, eyes, lips, mouth, bones, muscles and joints should be examined [22]. Signs of nutritional deficiency are most frequently evident in the skin, eyes, mouth, bones, muscles, joints and nervous system such as muscle wasting, skin rashes, hair thinning, edema, ascites, glossitis, mucosal lesions and finger nails abnormalities. So, close look at these areas is important for a thorough assessment [23]. The picture of nutritional health wouldn't be complete without information about dietary intake, because dietary information may confirm the lack or excess of dietary components which is suggested by anthropometric, biochemical, or clinical evaluation. There are numbers of ways to collect data about dietary intake as diet history, food record, food frequency questionnaire and 24-hour recall [24].

Nursing care of patient with leukemia presents many challenges because the leukemia affects a multitude of body systems. The nurse is responsible for both the biophysical and psychosocial coordination of the patient's care which is carried out through assessment, nursing diagnosis, planning, nursing intervention and evaluation. Nursing assessment of patient having leukemia should focus on the onset of symptoms and the history of precipitating factors as well as dietary intake and changes in the patient's physical and mental status [25].

Furthermore; the nurse should help the patient to understand the importance of the diet, monitor and record body weight, record intake and output, observe and report clinical signs of malnutrition; as well as serve a communication link between patient, dietitian, physician or other members of health care team [26]. The nurse should also develop, support and carry out the plan of nutritional care on individualized basis according to the patient's needs and condition; she should act as a coordinator, advocate, interpreter, teacher, or counselor to promote nutritional care. The nurse also should be familiar with the cultural dimensions of a patient's dietary practice and support the spiritual needs of patients by helping them to fulfill their religious dietary practices. So the aim of the current study was to evaluate the nutritional status among patients with leukemia during induction chemotherapy.

Significance of the Study: A high prevalence of malnutrition has been found in patients with cancer, present in 40 to 80% of patients. It has been suggested that malnutrition is one of the main causes of medical complications and even death [27]. Malnutrition frequently occurs in patients with leukemia and may represent a risk factor influencing both short & long term survival in these patients. High percentage of patients with leukemia is malnourished and those who were malnourished has higher incidence of chemotherapy-induced toxicity compared with well-nourished patients. Moreover, malnutrition is a frequent complication of leukemia. Hospitalized patients with leukemia have a high prevalence rate of malnutrition and most don't satisfy their nutritional requirements, decrease in caloric intake is an independent risk factor of short-term mortality.

So proper nutritional assessment and dietary interventions are essential to identify who are nutritionally at risk and to reduce morbid- mortality rate for those patients. Therefore, data that may be derived from this study would be value to nursing practice. It meant to provide enlightenment to the nutritional aspect of care of patients with leukemia through continuous assessment and monitory of nutritional status as an integral aspect of nursing care that may positively affect patient's outcomes.

MATERIALS AND METHODS

Aim of the Study: This study was carried out to evaluate the nutritional status among patients with leukemia during induction chemotherapy.

Research Question: To fulfill the aim of this study the following research question was formulated: What is the nutritional status of patients with leukemia receiving induction chemotherapy?

Research Design: Descriptive research design was utilized in the current study.

Sample: A sample of convenience of 100 adult male and female patients with leukemia was taken. Data collection started from (May, 2015 to October, 2015). All the patients were admitted to the oncology department, Cairo University hospitals. The criteria of patients inclusion were that each patient shouldn't have any co morbid condition such as cardiac or renal, liver disease and should have a confirmed diagnosis of leukemia receiving induction chemotherapy.

Setting of the Study: The study was conducted at the oncology department, Cairo University hospitals

Tools: Data pertinent to the study variables were collected by means of the following tools, which were adopted from Jarvis [29] and modified by the researcher.

Socio-Demographic data sheet; it was developed by the researcher to collect data related to patient's age, sex, occupation, marital status, residence, level of education.

Modified Patient generated-subjective global assessment (PG-SGA). This was initially developed by Bauer *et al.* [14] and modified by the researcher. The reliability test of this tool was 'r' 0.90. Validity of the instrument was judged by the experts. The aim of this tool is to assess the nutritional status of patients with cancer (Leukemia). This form consisted of anthropometric measurements regarding weight and height such and the body mass index (BMI); Triceps skin fold thickness (TSF), Mid-arm circumference (MAC) and the Mid- arm muscle circumference (MAMC), assessment of risk factors leading to malnutrition: It consists of risk factors, which include taking a health history regarding conditions that might interfere with adequate food intake for example unintentional weight loss/ gain; decreased appetite, taste alteration, difficulty in chewing or swallowing, vomiting, diarrhea, constipation, food allergies and unable to feed self.

- **Dietary data:** It included six items about foods that the patient used to take, food like and dislike, food restrictions; and if there are vitamins or mineral and number of meals per day as well as the usual daily

food intake. Physical assessment data: described the actual clinical signs of patient's nutritional deficiencies such as condition of skin, hair, lips, gums, eyes, nails and complaints regarding neurologic and musculoskeletal system. Laboratory investigations data: It includes laboratory tests that should be done for patient having Leukemia such as Albumin, Hemoglobin (Hb) and Hematocrite (Hct) and activities of the patients. Screening Summary [15] Explained that patients are considered to be nutritionally at risk if they have one or more of the following factors: Severely underweight (body weight of 20% = ideal body weight)

- Severely overweight (body weight 20% > ideal body weight)
- Unintentional weight loss of = 10% of usual body weight.
- Serum albumin = 3.5 gm /dl.
- Total lymphocyte count = 1500/mm³
- Three or more reported risk factors mentioned in the health, illness history as decreased appetite, vomiting, diarrhea and constipation.

Pilot Study: A pilot study was conducted on 10 patients with leukemia to test the clarity of the data collection sheet and to estimate the time needed to collect data. Pilot study was excluded in the study sample.

Procedure: Once permission was obtained to proceed with the proposed study, the researcher initiated data collection. Patients who agreed to participate in the study were interviewed by the researcher to fill out the socio-Demographic data sheet. Then the Modified Patient generated-subjective global assessment (PG-SGA) was completed. Each patient was nutritionally assessed after receiving induction chemotherapy within 72 hours of admission. Evaluation of nutritional status of patient had leukemia is measured by modified Patient generated-subjective global assessment (PG-SGA). It took around one hour per patient. PG-SGA was assessed through measurement of height by tape measures, body weight by using foot scale and measurement of body weight values as BMI, it consists of the weight divided by the height squared. Also (TSF) was measured by skin fold caliper in the mid way between the acromion process of the scapula and the olecranon process (the tip of the elbow). (MAC) was measured by using a measuring tape around the arm at the mid point of the upper arm and (MAMC) was calculated by using the following formula $MAMC (cm) = MAC (cm) - [0.314 \times TSF (mm)]$.

All of these anthropometric measures were obtained once except triceps skin fold thickness was measured three times to identify the average of measurement.

Identifying risk factors that affect nutritional status were assessed, such as unintentional weight loss / gain, problems in ingestion, digestion and / or absorption, movement, in addition to other factors were assessed as food allergies, multiple medications and unable to feed self. Also; the researcher reviewed the patient's files to document the laboratory investigations as Albumin, Hb, Hct. In addition 24-hour recall of food intake estimates the amount and the quality of the home diet; also it included the examination of the physical signs of nutritional deficiencies such as dryness of skin and hair, cloudy eyes, cracks at the sides of the lips, fissured tongue, bleeding per gums, brittle or ridged nails, pain in calves and osteomalacia. The quantity of the eaten food was assessed by asking the patient about food type. The diet was considered incomplete if one or more of the previously mentioned items was missed. PG-SGA also assess activities and functions of the patients which may affect their quality of life

Statistical Design: The data collected was computed by SPSS, version 23 to obtain means and standard deviations and t- test was used to compare equality of means between variables. r- test was used to identify relationship between quantitative variables and chi-square test was used identify relationship between qualitative variables. A probability level of 0.05 was been adopted as the level of significance for all the statistical tests; the threshold of significance was fixed at 0.05 levels where P value indicates the degree of freedom.

RESULTS

The current study was carried out to assess nutritional status among patients with Leukemia receiving induction chemotherapy. The results of the study will be presented in the following sequence:

Part I: This part was devoted to socio demographic characteristics of the study subjects such as age, sex, occupation, marital status, level of education.

Part II: The second part presents results related to the Modified Patient generated-subjective global assessment (PG-SGA): anthropometric measurements, risk factors affecting nutritional status, laboratory results and screening summary, dietary history and physical signs of nutritional deficiency and activities of the patients.

Table (1) illustrates the demographic characteristics of the study sample according to their gender. As can be seen above that the majority of both male and female patients in the study sample were over 40 years to 60 years (85.7%) and (93.2%) respectively. In relation to occupation, it was observed that (44.6%) of male patients had other work such as driver, carpenter and mechanics. It was also evident that the majority of male patients (91.1%) were married. While all (100%) of the female patients were housewives and married. As regard to level of education, most of male and female patients were illiterate (44.6%) and (86.4%) respectively.

It is was also evident that no statistically significant difference was found between sex and each variable of age, marital status. While statistically significant differences were found between sex and occupation & level of education.

Part II:

Patient Generated-Subjective Global Assessment (PG-SGA): Anthropometric measurements, risk factors affecting nutritional status, laboratory results and screening summary, dietary history and physical signs of nutritional deficiency.

Fig. 1 Shows that only (39 %)of the subjects had normal BMI. While; the majority (61%) had abnormal BMI. Of these 58 % had different degree of obesity and only 3% were underweight

Table (2) clarified that nearly two thirds of 89 patients who are above or equal 41 years of age had abnormal body mass index and 40% of them had normal body mass index. On the other hand 72.7% of 11 patients less than 40 years old had abnormal body mass index and 27.3% of them had normal body mass index. Table (2) also shows a statistically significant correlation between BMI and age of the study sample.

Fig. 2 shows that the highest mean of anthropometric measurements is mid arm circumference (28%) and the lowest mean of anthropometric measurements is mid arm muscle circumference (20.9%) among the study sample.

Table (3) shows that statistically significant correlations were evident between Body mass index and anthropometric measurements as TSF, MAC and MAMC in the study sample.

Fig. 3 illustrates that the most common nutritional risk factors were related to gastrointestinal problems as decreased appetite (86.0%), taste alteration (64.0%), The lowest percent (4.0%) as reported by patients was unable to feed self.

Table 1: Demographic characteristics of the study sample according to gender (N =100)

Variables	Sex				χ ²	P- value
	Male (N=56)		Female (N=44)			
	NO.	%	NO.	%		
Age:						
20-30 years	3	5.4 %	1	2.3 %	2.198	0.545 * NS.
31-40 years	5	8.9 %	2	4.5%		
41-50 years	20	35.7 %	21	47.7%		
51-60 years	28	50.0 %	20	45.5%		
Occupation:						
Employee	16	28.6%	0	0.0%	1.20	0.000 Sign.
House wife	0	0.0%	44	100.0%		
Farmer	15	26.8%	0	0.0%		
Others	25	44.6%	0	0.0%		
Marital Status:						
Single	4	7.1%	0	0.0%	1.91	0.425 * NS.
Married	51	91.1%	44	100.0%		
Divorced	1	1.8%	0	0.0%		
Level of education:						
Illiterate	25	44.6%	38	86.4%	18.86	0.000 Sign.
Read & Write	11	19.6%	4	9.1%		
Secondary	13	23.3%	2	4.5%		
University	7	12.5%	0	0.0%		

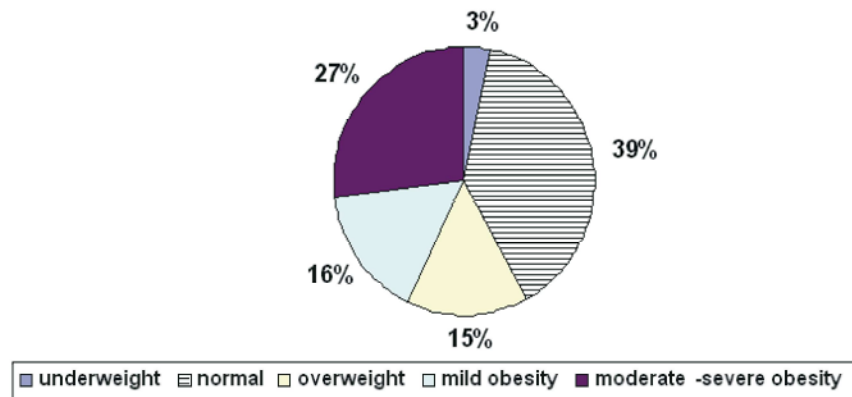


Fig. 1: Percentage distribution of BMI among the study sample

Table 2: Percentage distribution of Body Mass Index (BMI) according to age among the study sample (N=100)

Body mass index (BMI)	Age					
					Total	
	< 41 years		≥41 years			
	NO.	%	NO.	%	NO.	%
Below normal	0	0.0%	3	3.3%	3	3.0%
Normal	3	27.3%	36	40.4%	39	39.0%
Overweight	5	45.4%	10	11.3%	15	15.0%
Mild obese	2	18.2%	14	15.7%	16	16.0%
Moderate and severe obesity	1	9.1%	26	29.3%	27	27.0%
Total	11	100.0%	89	100.0%	100	100.0%

$\chi^2 = 11.077$ P .026

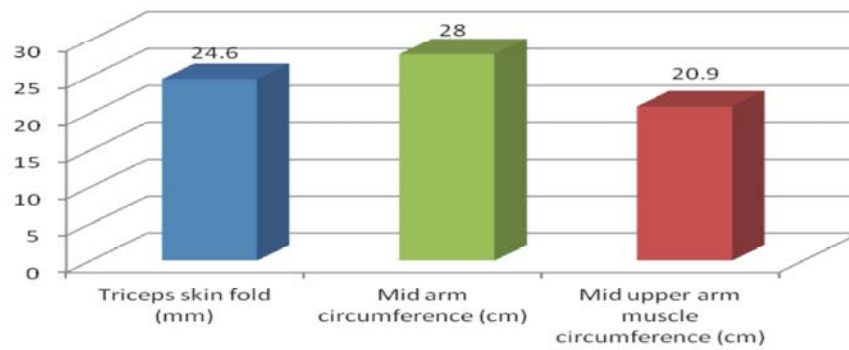


Fig. 2: Mean anthropometric measurements among the study sample (N=100)

Table 3: Correlation between Anthropometric Measurements and Body Mass Index in the study sample (N=100)

Anthropometric Measurements		Body Mass Index
TSF	Correlation	0.787
	P-value	0.000
MAC	Correlation	0.844
	P-value	0.000
MAMC	Correlation	0.712
	P-value	0.000

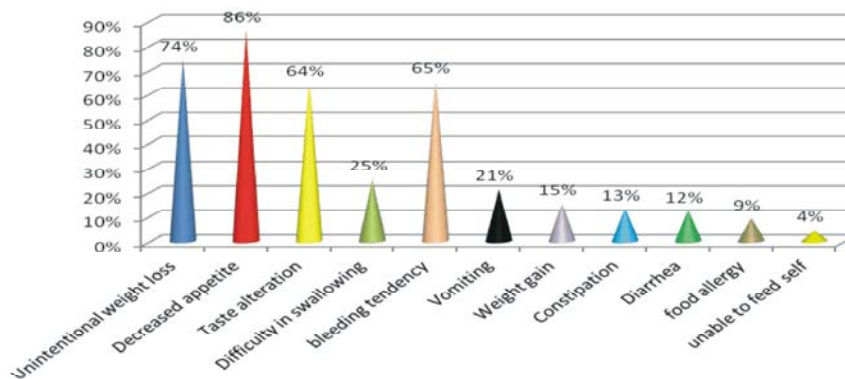


Fig. 3: Percentage distribution of nutritional risk factors among the study sample (N=100)

Table 4: Percentage distribution of laboratory tests among the Study sample according to gender (N=100)

Laboratory tests	Sex				χ ²	P-value
	Male (56)		Female (44)			
	No.	%	No.	%		
Hemoglobin						
Lower	56	100.0%	41	93.1%	3.31	>0.05 * NS.
Normal	0	.0%	3	6.9%		
Hematocrit						
Lower	54	96.4%	43	97.4%	1.41	>0.05 * NS.
Normal	2	3.6%	1	2.6%		
Higher	0	0.0%	0	0.0%		
Albumin						
Lower	51	91.0%	42	95.5%	3.6	>0.05 * NS.
Normal	2	3.6%	2	4.5%		
Higher	3	5.4%	0	0.0%		

* NS. = Not significant

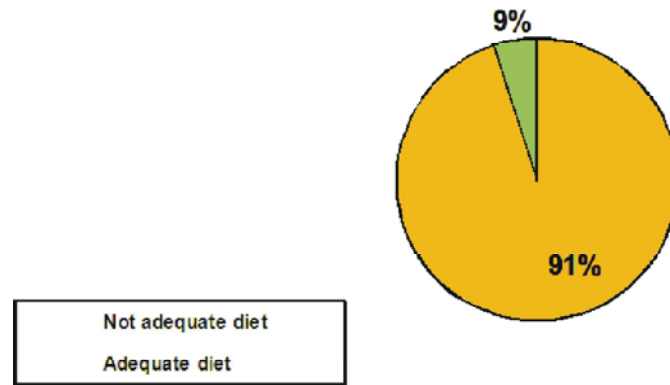


Fig. 4: Percentage distribution of adequacy of food intake among the study sample (N=100)

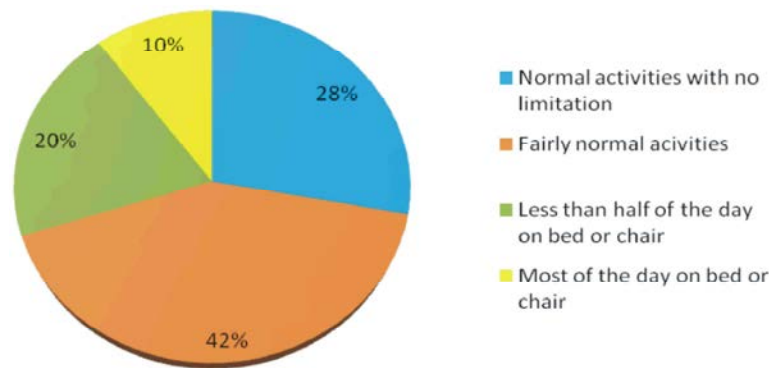


Fig. 5: Percentage distribution of activities and functions among the study sample (N=100)

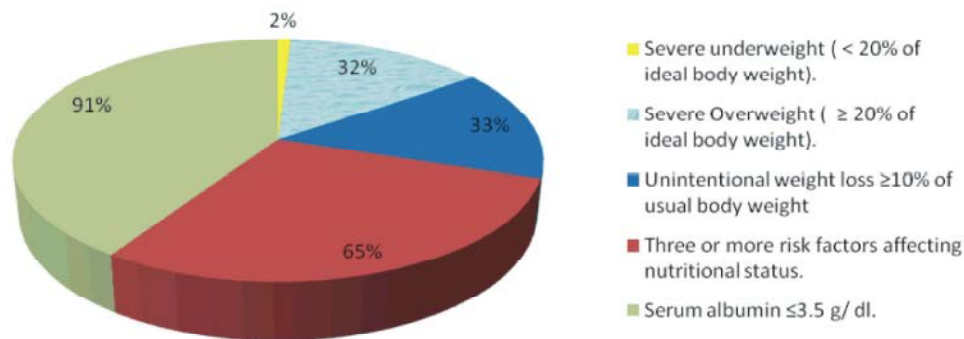


Fig. 6: Percentage distribution of screening summary of nutritional status among the study sample (N=100)

Table (4) illustrates that the majority of both male and female in the study sample had low hemoglobin, hematocrit and albumin. No statistically significant difference of most laboratory as hemoglobin, hematocrit and albumin tests existed between male and female patients of the studied sample.

Fig. 4 Clarifies that (91%) of the study sample described their diet as inadequate diet, while only (9%) described their diet as an adequate diet.

Figure (5) clarified that 42% of the patients had fairly normal activities and the lowest percentage (10%) was related to most of the day on bed or chair.

As can be seen from figure (6) that the majority of the sample (91%) had serum albumin level ≤ 3.5 g/ dl and (65%) of the study sample had three or more risk factors affecting nutritional status. It also shows that (33%) had Unintentional weight loss $\geq 10\%$ of usual body weight before hospital admission.

Table (5) illustrates that the highest value of physical signs of nutritional deficiency (201%) was related to mouth problems as pale tongue, pale lips, cracks at the side of lips and bleeding per gums. The lowest value of physical signs of nutritional deficiency (0.0%) was related to neurological signs.

Table 5: Percentage distribution of physical signs of Nutritional deficiency among the study sample (N=100)

Physical signs of Nutritional deficiency	Number	%
Skin		
- Dry	67	67.0
- Dry and ecchymosis	25	25.0
- Dry and petechiae	3	3.0
Total	95	95.0
Hair		
- Dry	55	55.0
- Spare	5	5.0
- Dull	5	5.0
- Dry and spare	20	20.0
- Dull and dry	9	9.0
Total	94	94.0
Eyes		
- Cloudy	44	44.0
- Red	4	4.0
Total	48	48.0
Mouth		
- Pale lips.	66	66.0
- Cracks at the side of lips.	26	26.0
- Pale tongue.	91	91.0
- Pale and fissured tongue.	4	4.0
- Bleeding per gums.	14	14.0
Total	*201	201.0
Nails		
- Ridged	99	99.0
Total	99	99.0
Musculoskeletal		
- Pain in thighs	14	14.0
- Pain in thighs and joint.	34	34.0
- Pain in calves	5	5.0
Total	53	53.0
Neurologic signs (No neurological disorders)	100	100.0

* Patients have more than one response

DISCUSSION

For patients with leukemia, malnutrition may be caused by not getting enough calories, protein or other nutrients like vitamins and minerals, either because of the disease, its treatment or various other related complications that can affect appetite and how the body digests, absorbs and uses food. Being malnourished may make patients weak or drained. In some cases, it may lead to disruptions or delays in the treatments needed to fight cancer. Malnutrition may also lead to longer hospital stays. Another form of malnutrition involves the consumption of too many calories, which may lead to weight gain and excess weight. This may increase the risk of a cancer recurrence, secondary cancer or another chronic illness like heart disease or diabetes. The aim of this study was to evaluate nutritional status among

patients with leukemia receiving induction chemotherapy. Discussion of the study findings will be presented in the following sequence:

Part I: Socio-demographic characteristics of the studied sample.

Part II: Patient generated-subjective global assessment (PG-SGA).

As regards to socio-demographic characteristics of the studied sample, it was observed that the majority of the total sample was males with age range between 41 to 60 years (middle age). The study reported that there was no statistically significant difference between gender and each variable of age, marital status, while a statistically significant difference was found only between gender and occupation and level of education.

With reference to age and gender, it was noticed that the majority of the studied sample is in the middle adulthood that were characterized by work. The majority of them were male patients. This is documented by Malihi *et al.* [1] and Strom *et al.* [2] who reported that percentage of leukemia is higher among male patients than female patients in Egypt. Other study reported that leukemia is more common in men who are middle aged or older but it may occur in younger person [3].

Moriwaki *et al.* [29] also mentioned that leukemia is twice as common in men as in women and is especially prevalent among malnourished patients over age 50 years old. While, Sautz *et al.* [4] reported that leukemia is more common in men more than women between 32 to 45 years old. Other study on number of patients who had leukemia reported that the majority of them were male patients; their average age was 67 years [5].

On the other hand, Nevin and Dorgan [6] reported that mean age of the sample was 49 years. However, the majority of the sample were female patients not male patients, according to his study which was carried out on a number of patients had leukemia.

In relation to occupation, it was observed that the majority of male patients were act causal work as drivers, carpenters, mechanics and farmers. And the majority of male patients were married, while all of the female patients in this study were housewives and married. According to the study which was carried out on a number of patients had leukemia by Esfahani *et al.* [30] it was revealed that the majority of the sample was working causal work. As regards to the study which was carried out on a number of patients had leukemia by Nevin and Dorgan [6] reported that the majority of the sample was married.

In relation to level of education, the majority of the studied sample were illiterate. According to the study which was carried out by Nevin and Dorgan [6] it revealed that the majority of the sample had lower secondary education, this result doesn't agree with our study.

In relation to the anthropometric measurements, the majority of the sample had abnormal body mass index (BMI), the majority of them were obese, while the minority were underweight. Obesity is a predisposing factor to many pathological conditions as cardiovascular, respiratory and digestive diseases [13]. Overweight and obesity are known risk factors for a number of cancers, with recent evidence suggesting that risk of hematologic cancer is also increased in obese individuals [14]. The same author added that the majority of studies have shown a modest, but statistically significant association between obesity and leukemia, with a recent meta-analysis of prospective studies for individuals with BMI > 30.0 kg/m² compared to individuals with a BMI < 24.9 kg/m².

Other author [15] defined obesity as a disease of complex, multiple causes leading to an imbalance between energy intake and output and to the accumulation of large amount of body fat. According to world health organization (2014), obesity is an increasing worldwide health problem at an alarming rate in both developed and developing countries, it is estimated to affect 18% of the global population.

The terms obesity and overweight are often used interchangeably, obesity refers to excess body fat while overweight referees to excess weight for height, which may come from muscles, bone, fat and/ or body water [17].

Obesity, particularly among adults is increasing in the Middle East and Latin America as it is in the united states and Europe. While in Egypt, obesity levels decreased slightly but remained among the highest in developing countries. Esfahani *et al.* [30] reported that patients with leukemia are at high risk for poor nutritional status either obesity or weight loss. According to the study which was carried out on 310 patients diagnosed as leukemia by Nevin and Dorgan [6] they reported that the majority of the sample had a different degree of obesity ranging from middle to severe obesity; these results indicate that there is an association between obesity and leukemia.

With reference to the mean of anthropometric measurements, the study reported that the highest mean of anthropometric measurements was mid arm circumference and the lowest mean of anthropometric measurements was MAMC. Lacey and Pritchett [20] reported that (MAC), (TSF), (MAMC) are useful in

identifying the most severely malnourished patients especially those with cancer. According to the study which was carried out by Insel *et al.* [19] on patients with leukemia, it revealed that the mean values for (MAC) decreased in female patients more than male patients with leukemia while (MAMC) decreased in male patients more than female patients.

As regards to correlation of anthropometric measurements, the study clarified that there is statistically significant correlation between anthropometric measurements such as TSF, MAC and MAMC, of the sample, the study also illustrated that statistical significant differences were evident between BMI and other anthropometric measurements as TSF, MAC, MAMC. The researcher pointed out that nurse should monitor anthropometric measures as body weight, height, body mass index, mid arm circumference, mid arm muscle circumference and triceps skin fold thickness to assess nutritional status of the patient with leukemia. The researcher also reported that there are relationships between body mass index and triceps skin fold thickness, people with a higher BMI tends to have a higher percentage of body fat or TSF except for highly muscular people like body builders.

According to study which was carried out by Townsend *et al.* [24] on a number of patients with leukemia, it was reported that BMI is used to detect malnutrition correlated significantly with TSF and MAMC. In relation to nutritional risk factors, the study revealed that the most common nutritional risk factors were related to gastrointestinal problems as decreased appetite, taste alteration, difficulty in swallowing and vomiting. Unintentional weight loss and decreased mobility were also two of nutritional risk factors that affect nutritional status. There is an increased risk of malnutrition associated with chronic disease especially diseases of leukemia, therefore patients with leukemia may lose their weight rapidly and become susceptible to undernourishment [10].

The researcher pointed out that malnutrition can result from a variety of conditions such as insufficient nutrients intake, maldigestion, malabsorption and loss of nutrients. Additionally, Brinksma *et al.* [12] explained that malnutrition in leukemia is multifactorial, in adequate diets and unnecessary dietary restrictions of protein, fluid and salt can lead to suboptimal oral intake. Ktilling and Mikman [9] on the same line added that patients with leukemia are at high risk for developing malnutrition and anemia due to deficient food intake, anorexia, nausea and vomiting, poor gastrointestinal absorption, inadequate

caloric and protein ingestion, alteration in the carbohydrate, protein and fat metabolism and also increase bleeding tendency due to thrombocytopenia. In recent study, a high prevalence of malnutrition was found in patients with leukemia. A total 64.7% of patients were diagnosed with malnutrition and 27.9 % of them were had severe malnutrition and in critical need of nutritional intervention and support [29].

The majority of the studied sample had serum albumin level ≤ 3.5 gm/dl, had three or more risk factors affecting nutritional status, had unintentional weight loss $\geq 10\%$ of usual body weight and were severely over weight. While the minority were severely underweight. Alodio *et al.* [13] reported that unintentional weight loss of 10 to 20% of the patients usual body weight indicates moderate protein calorie malnutrition and loss of more than 20% indicates severe protein calorie malnutrition. Bauer *et al.* [14] mentioned that there is a relationship between prevalence and characteristics of malnutrition, nutritional status and the severity of leukemia. The study which was carried out on 60 patients with Leukemia by Brinksma *et al.* [12] pointed out that the majority of them were malnourished on admission and percentage of malnutrition increased during treatment process.

The researcher clarified that the majority of the studied sample described their diet as inadequate diet that didn't contain all essential components of balanced diet. While the minority of them described their diet as an adequate diet because they eat different types of food. Lnchs and Mlauth [10] mentioned that patients with leukemia need to increase their supply of dietary proteins to achieve a nitrogen balance, most of them tolerate a normal or even increased dietary protein intake without complications.

According to study which was carried out on a number of hospitalized patients with leukemia by Smith *et al.* [27] They added that hospitalized leukemic patients have a high prevalence rate of malnutrition and most of them don't satisfy their nutritional requirements, so their caloric intake are decreased which is an independent risk factor of short term mortality.

The study illustrated that the highest value of physical signs of nutritional deficiency among the studied sample was related to mouth problems as pale tongue, pale lips, cracks at the side of lips and bleeding per gums. The lowest value of physical signs of nutritional deficiency was related to neurological signs. Leukemic patients who are malnourished, their skin is pale, thick, dry and changes in pigmentation are common. Hair is thin, tightly curled and pulls out easily. Joints ache and bones

are soft and tender. The gums bleed easily; the tongue may be swollen and cracked. Visual disturbance include night blindness and increase sensitivity to light. Anemia, diarrhea, muscle twitches and cracking of the lips may also develop. Sassi [31] mentioned that the main symptoms of malnutrition are sudden weight loss or gain, loss of body fat, fatigue, muscle wasting, weakness, hair loss, skin and hair pigment changes. Brinksma *et al.* [12] classified clinical manifestations of malnutrition as mild, moderate and severe malnutrition. In mild to moderate malnutrition, adults generally lose their weight, TSF, MAMC are reduced and levels of albumin may be low. In severe malnutrition, muscle mass is decreased, fatigability is increased, coldness sensation, dryness and cracking of the skin may also occur.

CONCLUSIONS

The study results revealed that the majority of the study subjects with leukemia are at risk for developing malnutrition based on nutritional assessment data. The majority of the study subjects were obese or had different degree of obesity. The most common nutritional risk factors of patients had leukemia were related to gastrointestinal problems as decreased appetite, taste alteration, difficulty in swallowing and vomiting. The majority of patients of the studied sample had a physical signs of nutritional deficiency related to mouth problems a pale tongue and lips and bleeding per gums, the majority of them also complains from dryness of skin and hair, so these patients at high risk for developing malnutrition.

Recommendations: Based on the findings of this study, the following recommendations were made: Health care team of the hospital as physicians, nurses and dietitians should do the following:

- Replicate this study by using a large number of patients with different diagnosis from different geographical areas in Egypt.
- Formulate PG-SGA sheet to be suitable for Egyptian patients had different type of cancer in the hospitals.
- Identify and record nutritional risk factors of the admitted patients.
- Have equipment for assessing nutritional status of the patients as skin fold calipers, tape measure and body weight scale and identify how to use it correctly.
- Provide nutritional counseling for all patients had leukemia in the hospital about the components of adequate diet, what diets should be avoided.

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