# A Physiological Study of Albumin Level for Patients with Non-Hodgkin Lymphomas

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## Abstract

Cancers cause increases in mortality in different countries each year. The late diagnosis of cancers contributes to patient death significantly. Recently, the efforts of scientists began towards examining several markers that help in early detection. This paper aims to monitor the relationship between serum albumin level and NHL beside some variables such as weight, age, sex and several other diseases. The demographic data and samples were collected from people with and without NHL. Then, the albumin concentration was assessed using the biochemical tests. After that, the data were analyzed statically using Minitab-16 program, T-test and ANOVA. The results showed a significant difference ($P \leq 0.05$) in albumin level between control and the patients with NHL. The same pattern was for patients with NHL and other diseases. In contrast, there was no considerable difference between male and female with NHL. Furthermore, the findings illustrated a decrease in albumin concentration for old patients' less than young patients. On the other hand, the overweight patients revealed more albumin level that the patients with normal weight. Serum albumin is considered an important sign for the early detection of NHL. This early diagnosis will play a good role beside the chemotherapy and other kind of treatment. This will help to reduce the risk and mortality because of cancers worldwide.

**Keywords:** *Non-Hodgkin lymphomas (NHL), Serum albumin level, Cancer, Overweight.*

## Introduction

Cancer is a major public health problem in different countries around the world. Recent studies reported by the World Health Organization (WHO) expected that cancer will affect approximately 15 million people at the beginning of 2020. The same study assumed that two-thirds of the previous number will die each year [1]. Factors found to be influencing in cancer diagnosis at an earlier stage have been explored in several studies. These prognostic factors include general factors for different cancers and specific factors for particular types of cancers such as blood counts [2], quality of life, malnutrition [3] and tumor markers [4].

Serum albumin measurement method used for determining the nutritional situation in cancer. However, other methods such as skin-fold thickness and weight loss used as anthropometric parameters [5, 6].Hodgkin lymphoma (HL) and non-Hodgkin lymphomas (NHL) are major public health problems. In Sweden, nearly 160 patients

affected by HL each year, most of them are young people. Surprisingly, at the same time, this disease one of the best among the other types of cancers that response to radiotherapy and/or chemotherapy [7]. However, during recent decades, the incidence of NHL has grown by 4% more than in the past decades around the world. One of the reasons that cause a decrease in the incidence of HL is that recent diagnoses of lymphoma have classified HL as NHL. Generally, the incidence of HL is rare in Asians, but it is doubled in the USA [8]. Serum albumin plays an important role to assess the function of the visceral protein. However, albumin synthesis is affected by inflammation and malnutrition [9].

The normal level of serum albumin in the adult is 3.5-5.0 g/dL and less than this range is called hypoalbuminemia [10]. In the final stage of the tumor, host metabolism will be affected by growth factors and pro-inflammatory cytokines production as part of

the inflammatory response [11]. Liver proteins production, such as C-reactive protein (CRP), will be stimulated by Interleukin-6 released by the tumor or surrounding cells. This situation cases demand an increase of several amino acids. These amino acids will be provided by skeletal muscle breakdown in the case of diet. Furthermore, IL-6 and other cytokines production might cause a decrease in serum albumin concentration [12].

However, the microvasculature might become more permeable for albumin passing because of tumor necrosis. In addition, different cytokines such as TNF, IL-6, and IL-Ib might be released by liver cells as a result of tumor cells present in the liver. This production may moderate the synthesis of albumin but as a part of the cancer progress the levels of albumin will be decreased significantly and this consider an important sign of cancer [13].

Serum albumin is commonly used to estimate disease prognosis and progression, the severity of disease and the nutritional status. A number of researchers have reported that serum albumin is known as an independent indicator of different cancers such as breast [14], lung [3], and pancreatic [15]. Moreover, low serum albumin can be considered as a prognosticator indicator for cancer diagnosis [16].This paper will focus on the relationship between albumin concentration and non-Hodgkin lymphomas (NHL). Where, the

albumin will be examined with different variables in patients with NHL. These variables will include weight, age groups and sex.

## Methods

### Sample Collections

Blood samples were collected from patients with NHL (after 20 days of taken chemotherapy) at the Unit of endocrine and tumors at Al Ramadi hospital, Iraq. The study involved collecting 50 samples from men and women diagnosed with NHL under the radio and/ or chemotherapy. Other 50 samples were taken from people without lymphoma as control samples. Other data from patients and healthy people were recorded such as age, weight, duration of NHL disease, and information regarding any other diseases.

### Determination of Albumin in Serum

The albumin concentration was assessed using a kit from the linear company. The method depends on the binding between an anionic dye, bromocersol green (BCG) and the protein. This reaction is performed at acidic pH conditions and leads to shifts in the wavelength absorption of the complex. Using the spectrophotometer at 630 nm the intensity of the color represents the albumin concentration within the sample.

$$BCG + Albumin \xrightarrow{pH\ 4.3} BCG\text{-albumin complex}$$
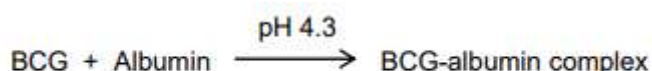
The Reagent contents include Bromocresol reagent (R1) and albumin standard (CAL). The procedure was followed as illustrated in

the table below, then the tubes were left at room temperature for 1 min and the absorption was recorded at 630 nm.

| Tube | Blank | Sample | Cal. Standard |
|---|---|---|---|
| R1. Reagent | 2 ml | 2 ml | 2 ml |
| Sample | - | 10 µl | - |
| Cal. Standard | - | - | 10 µl |

The concentration of albumin was measured as mention in the formula below:

$$\frac{A_{Sample}}{A_{Standard}} \times C_{Standard} = g/dL\ albumin$$

## Statistics

Data are shown in categories: as a median and range. The results were statically analyzed at a significant difference at the level of probability (P ≤0.05). Minitab-16 program was used to examine different variables such as people with and without NHL, sex, age, and weight. Furthermore, this program was utilized to find the standard deviation and deviation. In addition T-test and ANOVA were used to investigate the differences and perform more statistics tests [17].

## Results and Discussion

The present study was designed to determine the effect of NHL on serum albumin. Previous studies reported that albumin level might be used as an indicator for the risk of several types of cancers [18].

The study population includes 100 samples, 50% as control, 25% men and 25% women with NHL. Different factors were recorded including age, sex, weight, and diseases. The statistical analysis illustrated a significant decrease (p≤ 0.05) in albumin concentration for people with NHL (3.6 g/dl) compared to control which is slightly more than 4 g/dl (Fig. 1). This finding is in agreement with Brady and his colleagues findings which showed that T-cell leukemia/lymphoma (ATLL) leads to lower albumin levels [19]. Furthermore, another study conducted in Japan showed that patients with non-Hodkin lymphoma have a lower albumin concentration less than other people [20]. However, the results showed almost there is no considerable difference (p≤ 0.05) in albumin concentration between men and women who are suffering from NHL (approximately 3.9 g/dl) (Fig. 2).
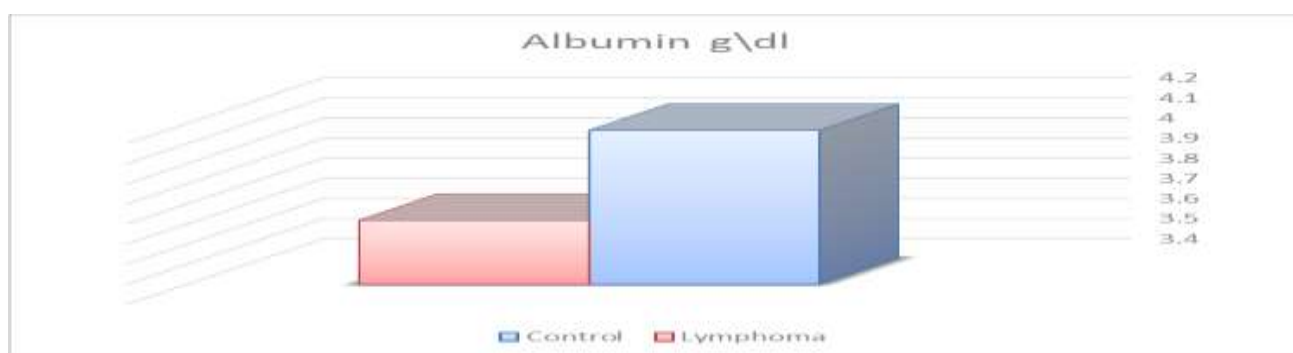


**Figure 1: Albumin concentration for people without NHL and patient diagnosed with NHL**
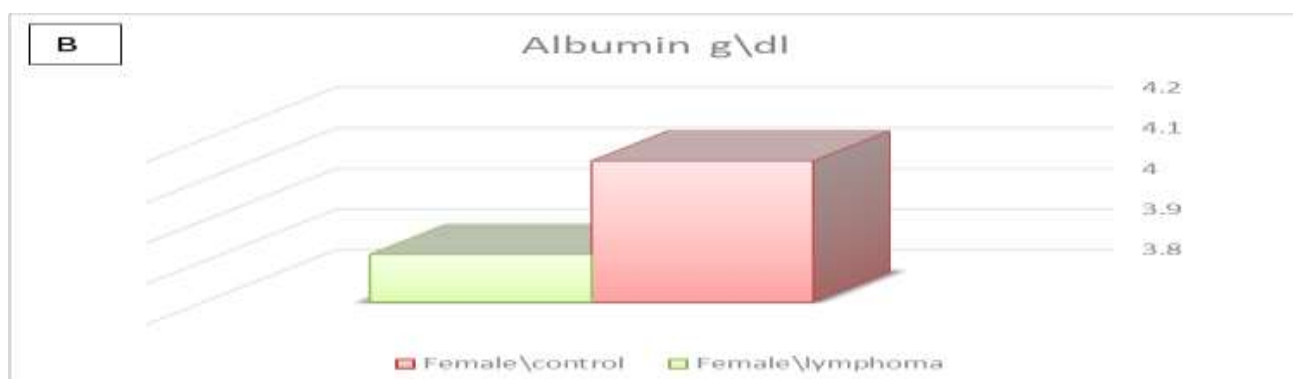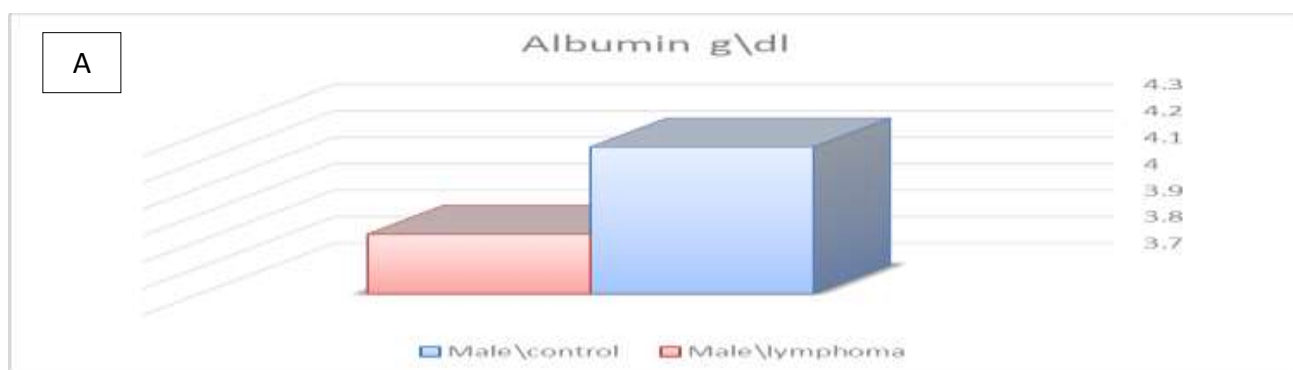




**Figure 2: Comparing the concentration of albumin in patients with NHL for the two sex**

On the other hand, Fig. 3 reports the effects of diseases on the albumin level. As it is apparent from this Figure, a significant fall associated with the affected by NHL (3.9 g/dl) and other diseases (3.8 g/dl) compared to the control. This study confirms that the albumin level is associated with several diseases. A study conducted in 2003 reported that albumin concentration decreases as a result of several diseases such as liver diseases [21]. The same results were obtained by [22], who illustrated that albumin synthesis is decreased in patients with cancers and other diseases.



**Figure 3: Impact of NHL and different disease on the albumin concentration**

Turning to age, the albumin level in three different age groups was investigated. As illustrates in Fig. 4, it can be seen that youngest healthy people have the highest level of albumin (4.4 g/dl) compared to other two groups (4 g/dl and 3.9 g/dl respectively). For patients with NHL, the same pattern has been followed, where that age group (20-35) was 3.8 g/dl, while the age group (36-50) and (51-65) have less albumin concentration 3.7 g/dl and 3.6 g/dl respectively. These results agree with the findings of other studies, in which a previous study illustrates that the albumin level in patients with diffuse large B-cell lymphoma (DLBCL) decreased gradually to 3.5 g/dl after ten years the progress of age [23].
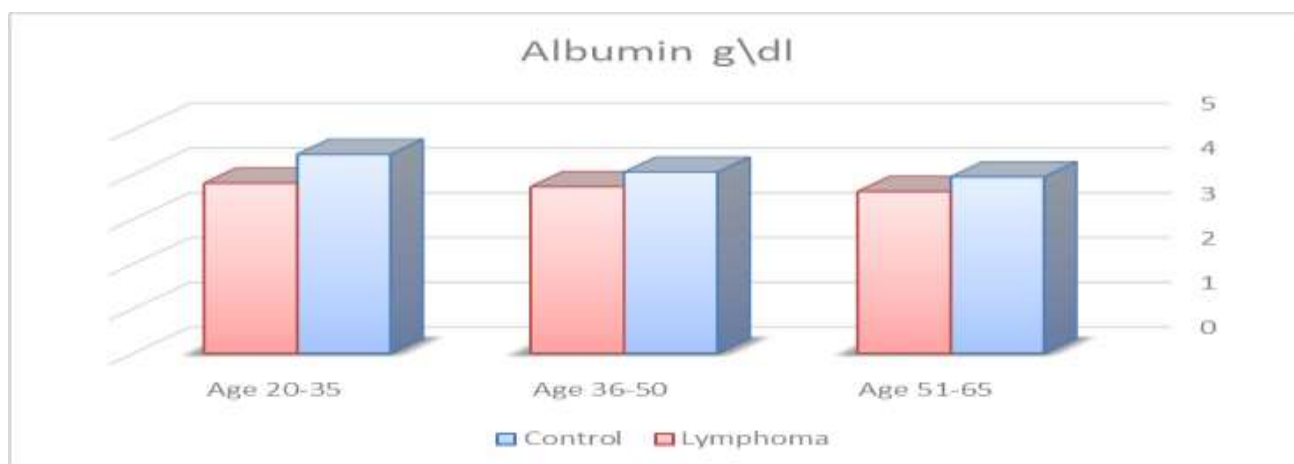


**Figure 4: Albumin concentration for different age groups with or without NHL**

Finally, the albumin concentration of normal and overweight patients with NHL was investigated. There is a clear trend of decreasing for patients with NHL and overweight. It was 4.1 g/dl for patients suffered from overweight and NHL, while it was 3.77 g/dl for patients with NHL and normal weight (Fig. 5). However, the findings of the current study do not support previous research introduced by [24]. In their study included 1741 individuals, albumin serum was under 3.5 g/dl for 7.7% of them who suffered from overweight. While the albumin concentration was above 3.5 g/dl for other thin people. This situation confirms the effect of NHL on the albumin level in this study combined with weight.
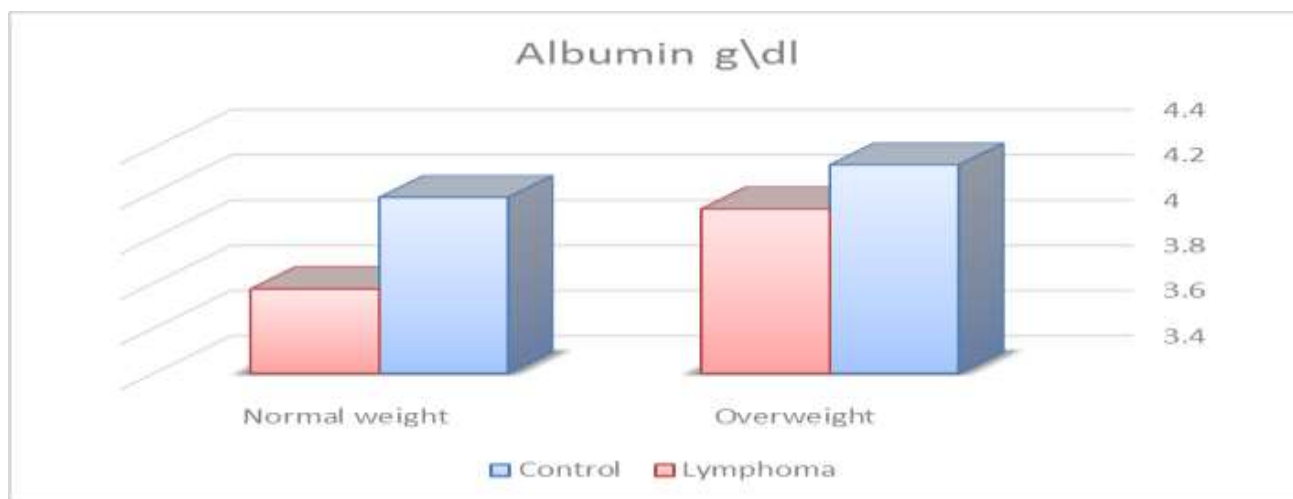
**Figure 5: Effect of weight on the albumin concentration patients with NHL and control**

## Conclusion

In summary, our present research demonstrates that the decrease in the serum albumin level is associated with NHL. As the results show that patients with NHL have less albumin than people without NHL. Furthermore, this research confirmed results from previous studies that several variables such as age and some diseases. However, there is no difference in albumin level between men and women. This research reported that albumin level could be a potential marker for NHL and that might help in earlier diagnosis. However, more molecular investigations are needed to understand the relationship between albumin concentration and NHL.

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