
ORIGINAL ARTICLE

Epidemiological Study and role of Zinc and Lead on Breast Cancer in El Oued (Algerian) Population

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ABSTRACT

The aim of this study is to analyse the epidemiological and appreciate the distribution of breast cancer and to evaluate the effect of zinc and lead in women breast cancer in El Oued population. Our epidemiological study was carried out on 1505 cancer patients in the period (2007-2017) of the El Oued region. For mineral study, This work is carried out on 36 volunteers women, were divided into two groups; a group of 20 healthy control women and 16 women has breast cancer. In Results for 316 cases of breast cancer recorded, 28.95% patients were aged between 41-50 years. In the other hand, 1.9% of cancer patients are men versus 98.1% are women. In this study, 48% of the breast cancer patients had a tumor affecting the right breast whereas 52% of the people were affected in the left breast. On the other hand, decrease of level of zinc in serum ($p < 0.05$) and hair ($p < 0.01$) of patient indicate the importance of zinc in the diseases, also the increase of serum lead level ($p < 0.001$) in patients and in soil of different area of El Oued is an important indicator of the effect of the environment on the disease. Hence epidemiological studies are needed to understand the variations and the occurrence of breast cancer. We noted also the importance of zinc deficiency as a food agent as well as the role of heavy metal contamination such as lead as risk factors for breast cancer.

Keywords: Breast, Cancer, Epidemiology, Zinc, Lead, El Oued.

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INTRODUCTION

Cancer is a disease characterized by abnormal cell growth localized in a specific place or can invade other parts of the body. Cancers cells can form a tumor which invades the local tissue. Cancer has become the leading cause of death [1]. among the important types of cancer in women and the most studied, breast cancer that develops in the breast tissue. it is the leading cause of death among women. However, it occurs in males also [2]. It is a tumor that affects the mammary gland [3]. Breast cancer is a major malignant tumor for women with approximately 23% percent. Its frequency is very high for developed countries specifically [4]. It is very difficult to determine the cause of breast cancer. Studies scientists have shown that some person-specific characteristics or behaviors were more often observed in women who had breast cancer than in other women [5]. Age is taken as a non-modifiable risk factor for breast cancer. the inherited genetic factor is very important as in the case of BRCA1 and BRCA2 gene mutation, as well as the personal or family history of breast cancer [6]. Other important risk factors for breast cancer include various benign breast disease, delayed menopause, postmenopausal overweight, sedentary lifestyle, and alcohol consumption [7]. The environment is also an important factor, 5-10% of all cases of cancer caused by exposure to environmental pollution (such as pesticides and heavy metals [8]), among the protective factors of breast cancer are breastfeeding, balanced physical activity and healthy weight [9, 10]. The increase in tissue mass [11] and in estrogenic activity [12,13], abdominal fat mass [14, 15] are factors favoring the appearance of breast cancer. Zinc is a very important element in inhibiting the development of cancer and that many forms of cancer are associated with the low level of zinc in the body [16]. Other risk factors which add to the burden of breast cancer are sun exposure, tobacco, physical activity etc [17]. Several risk factors are introduced as causative factors of developing

breast cancer [18], exposure to environmental pollution (such as pesticide and heavy metals) and lifestyle play an important role in the etiology of this disease [19]. Breast cancer is the most important cancer among women in Algeria by estimating 11,000 new cases / year, with specific epidemiological characteristics as all developing countries compared to Western countries [20]. The therapeutic system is multidisciplinary including chemotherapy, surgery and radiotherapy [21]. The treatment option for breast cancer depends on the type, extent and the stage of the breast cancer. The treatment options available are surgery, radiation, chemotherapy, immunotherapy and targeted therapy. Surgery after chemotherapy is called adjuvant therapy and chemotherapy before surgery is called neo-adjuvant therapy. This article is about a study of the distribution of breast cancer patients in El Oued population.

MATERIAL AND METHODS

Study subject

The ethical approach was requested and validated by the Ethics Committee referenced (78 EC/CMB/FNSL/EU2018) of the Department of cellular and molecular Biology, Faculty of Natural Sciences and Life, University of El Oued. Of all cancer cases studied in this study, there are 316 registered breast cancer cases from oncology service of BEN AMOR DJILANI Hospital in El Oued stat, Algeria were collected and information such as the patient's name, age, sex, type of cancer and treatment provided was noted. For mineral study, This work is carried out on 36 volunteers women of age between 25 -80 years, were divided into two groups; a group of 20 healthy control women with mean age 42.82 ± 1.20 year, the other group of 16 women has breast cancer in Oncology service of Hospital BEN AMOR DJILANI with mean age 45.48 ± 1.37 year. All the volunteers (control and patients) in this study are live in the El Oued area located in the southeast of Algeria.

Sample collection

Performed blood sampling for both groups is done morning fasting. It is performed on the vein of the bend of the elbow. After the blood sampling, the blood is collected in dry tubes are centrifuged at 3000 rpm for 10 minutes then recover the serum to achieve Metal (zinc and lead) analysis. We remove a few samples of hair from each patient's and controls to estimate the zinc in hair. On the other hand, we take samples of the soil of all the studied areas to estimate the percentage of lead in the soil.

Determination of Zinc concentration

In serum samples

In the serum samples, zinc was determined after 10-fold dilution. In this case, the zinc calibration range solutions were prepared from a stock solution of zinc nitrate at 1 mg / ml. All solutions were soaked in HNO_3 (10% v/v) [22].

In Hair samples

Cut a random piece from a patient and healthy woman's hair. Put in Erlenmeyer flask, 0.1g of hair, 4ml with nitric acid. Warm up to the hotplate at 75°C for 25 min, Then allow to cool. After cooling 1 ml of oxygenated water is added. Other times Heat the hotplate to 40°C until all the bubbles drop and then increase the temperature to 85°C . wash 3 times with 1.5 ml distilled water. Finally do the dosage of zinc [23].

Determination of lead level

In the serum samples

In the serum samples, lead was determined after 10-fold dilution. In this case, the lead calibration range solutions were prepared from a 1 mg/mL lead acetate from a stock solution, All solution were soaked in HNO_3 (10% v/v) [22].

In soil samples

Soil samples had been taken in different regions of the El-Oued (Algeria) and some neighboring areas. Each sample was placed in a plastic bag and numbered.

Soil samples are dried in an oven at 40°C for at least 16 hours. It is then shredded on a 2 mm sieve. Then mineralized; is carried out on about exactly 0.5 g of this powder with 2 ml of HNO_3 and 6 ml of HCl . This step is done at 95°C for 75 minutes on a heating block. Obtained liquid was used for these lead assays. Lead calibration range solutions were prepared from a 1 mg/mL lead acetate from a stock solution, All solution were soaked in HNO_3 [24].

Statistical analysis

The results were monetized with mean \pm SEM. the software SPSS V20.0 is a tool by which has made all the statistical analyzes. The statistical test used to compare between means of different groups is Student's t-test. Differences were considered statistically significant at $p < 0.05$.

RESULTS AND DISCUSSION

2.1. Epidemiological study of Cancer in El-Oued region

The objective of this study is to find out the distribution of breast cancer patients in El Oued population. The statistical data can help in the effective prediction of the future trends of breast cancer in El Oued state which will help in improving the various treatment options and facilities available for breast cancer patients. A total of 316 cases of breast cancer patients were analyzed. Based on data collected between 2007-2017 by the El Fajr Association of Cancer patients help and oncology service of BachirBennacer Hospital, it was found that breast cancer to have the first highest prevalence (24.91%) among cancer types (figure 1). It was found in this study that 59% of the breast cancer patients are from the central region of the state of El Oued. It was found also that 17% the patients are from the North region, 6% of the patients are from south region, 16% of the patients are from East region and 2% of the patients are from West region of El Oued area (figure 2a). The central region is known for its large population density and it is therefore logical to have the largest proportion of breast cancer in comparison to other regions. Cancer patients in this area are spread over neighborhoods that have earned the continent Rabah, Warmas, Quoinin and the municipality of El Oued. The northern region consists of the cities of the Djamaa, El Moghair, and Guemar, it is known as a large population density. The southern region of El Oued state is known as several cities with a medium population density and include Ogla, Baiadha and Rabah. The eastern region is known to have a large population density, including the cities of HasiKhalifa, Dabila, Talib Al-arbi. The western region is dominated by the deserts and a few cities such as Mihwansah and wad ElAllanda. In this study it was found that males accounted for 1.9% of the breast cancer population and females accounted for 98.1%. In this study, breast cancer occurs to be most commonly affecting the females when compared to the males (figure 2b). In man breast cancer is very rare, it is estimated that there is less than 1% of all breast cancer and less than 1.5% for all malignant tumors. Several important differences exist between the sexes in clinical presentation and prognosis. Males present at a later age and often after a longer delay. The tendency for ulceration of the overlying epidermis is far greater in men than women [25]. Research carried out in 2010, shows the relationship between genetics and breast cancer, these studies have been reported that people who carry a BRCA2 gene is very sensitive to the disease with a percentage of 8% compared to people who do not carry. Similarly, a study conducted on 321 families shows that 16 men between the ages of 29 and 79 have breast cancer with BRCA2 gene mutation [26]. In this study, it was found that there were no breast cancer patients between the age groups 0-20 years of age. 4.68% of the people between 21-30 years, 21.92% of the people between ages 31-40 years, 28.95% of people between 41-50 years, 25.15% of people between 51-60 years, 10.52% of people between 61-70 years, 6.73% between 71-80 years and 2.05% of people more than 80 years were found to be affected by breast cancer in El Oued population (figure 3). Hence majority of the breast cancer patients are between the age group of 41 to 50 years. It has a least prevalence between 21 to 30 years and also below that age group, as there is 0% prevalence between age groups 0-20. This is similar to study conducted by Henouda *et al.* (2015) in which there were no breast cancer in age between 0-20 years and it was found that majority of the breast cancer patients are between the age of 36 to 40 years by 65.9% in Algerian eastern Women [27]. This high rate of breast cancer among women in this age range is caused by several factors, such as the sedentary lifestyle of Algerian women in this age group. In addition, the estrogen level is very high during the premenopausal period of the woman which increases the risk of breast cancer [28]. In this study it was observed that 48% of the breast cancer patients had a tumor affecting the right breast whereas the remaining 52% of the people were affected due to tumor in the left breast (figure 4). Hence breast cancer is most commonly found affecting the left breast when compared to that of the right breast several studies have shown that the left breast is most affected by unilateral breast cancer than the right breast [29]. This can be explained by the volume of the left breast that is larger than the right which is more sensitive to the disease [30]. Otherwise, breastfeeding is a protective factor for breast cancer, as mothers prefer to use the right breast over the left when breastfeeding, which increases the risk of breast cancer occurring on the breast. left that right [31].

Zinc and lead level

Zinc level in serum and hair

The relationship between trace elements and breast cancer progression has been studied in several studies. We will seek the systematic variation of the concentration of the trace elements during the course of the breast cancer disease. In our study as shown in Figure 6, compared to controls, serum Zn levels had significantly low ($p < 0.05$) in breast cancer patients which agree with result of HONG *et al.*, (2006) study [32], Zinc level in the serum of patients with cancer is lower than healthy individuals has been shown in other epidemiological study [33]. Our study also (Figure 5) found that there was a lower

hair zinc level ($p < 0.01$) in the breast cancer patients, which is in agreement with the hypothesis of the decrease of zinc level in hair of the patients has a cancer by an increased consumption compared to the healthy peoples [34]. Hair is considered as a biological material by which one can detect and follow the status of trace elements in the body [35]. Zinc is an essential element of life, which is of specific functional importance in various physiological systems [36]. As its role in the physiology of the mammary glands during lactation and even post-lactation [37], zinc also plays a role in cellular signaling such as the phosphorylation cascade of MAPK and Akt required for cell development under normal conditions or in pathological cases such as cancer [38].

.Lead level in serum and soil

In our study (Figure 6), lead levels had significantly high ($p < 0.001$) in serum of breast cancer patients compared to controls, this result versus the result of Xiao et al.(2014) who found that there is no significant difference in Pb level compared to controls[39]. there is not much evidence on the carcinogenic aspect of lead in humans [40]but lead can cause cancer by a genetic aspect through direct interaction with DNA by experience in a group of workers exposed to lead [41], this interaction appears to be due to an increase in the release of reactive oxygen species, species that are very sensitive to cellular constituents including the proteins involved in DNA repair, which may contribute to the disappearance of cancerous cells [42].

In Figure 7, clarify the result the Pb level, Our result shows that there are different levels of lead between the different regions of El Oued where the higher Pb level was determined in Taghzot with concentration 16.25 mg/kg and the lowest one is Bayada with 0.78mg/kg. the mode of exposure of lead is by inhalation (dust and vapor) or by ingestion which makes the exposure and intoxication by lead in the environment is a can by artificial sources than natural [43]as the exposure by the paint industry and the exposure to the soil that cause serious toxicity, in addition to the fuel and leaded feed are other major sources of lead intoxication among children and adults[44].

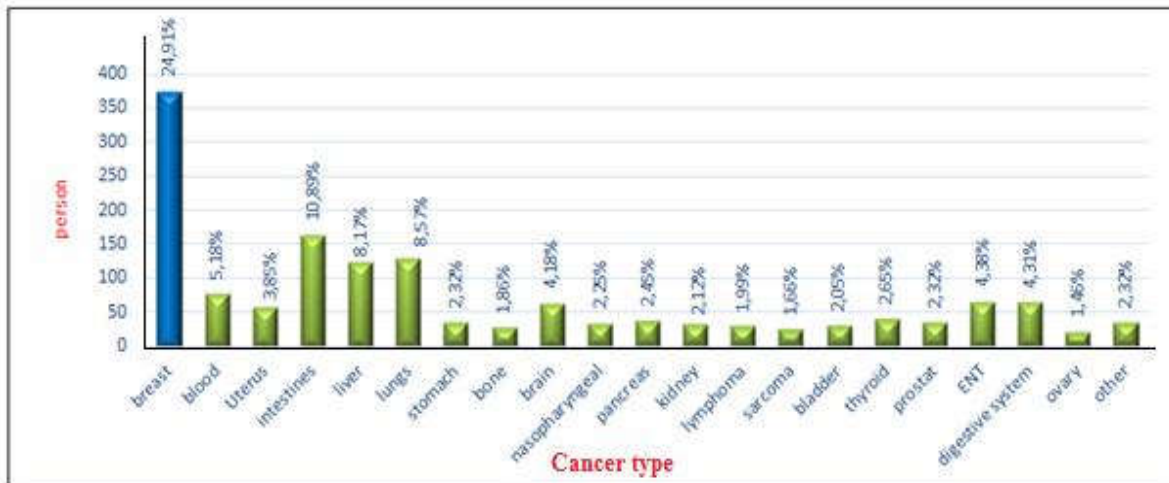


Figure 1: The proportion of breast cancer compared to other types of cancers in El Oued region

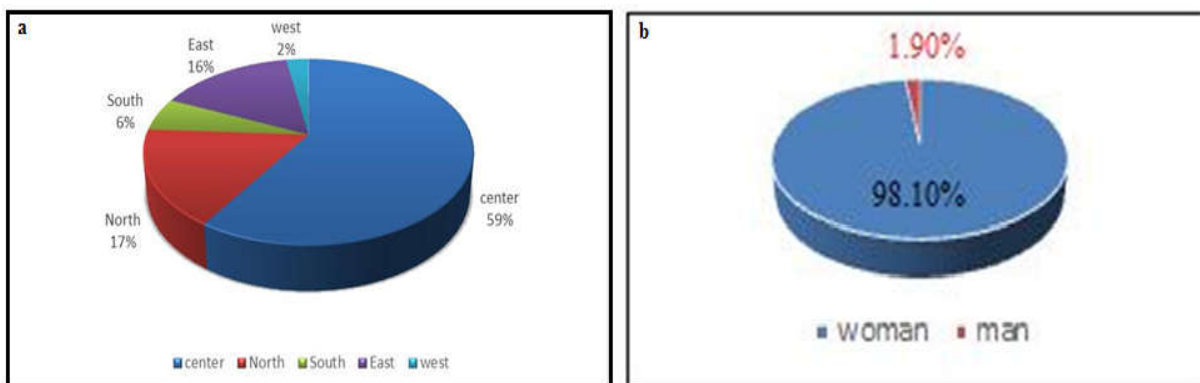


Figure2: Distribution of breast cancer by regions (a) and by sex(b) of the state of El Oued

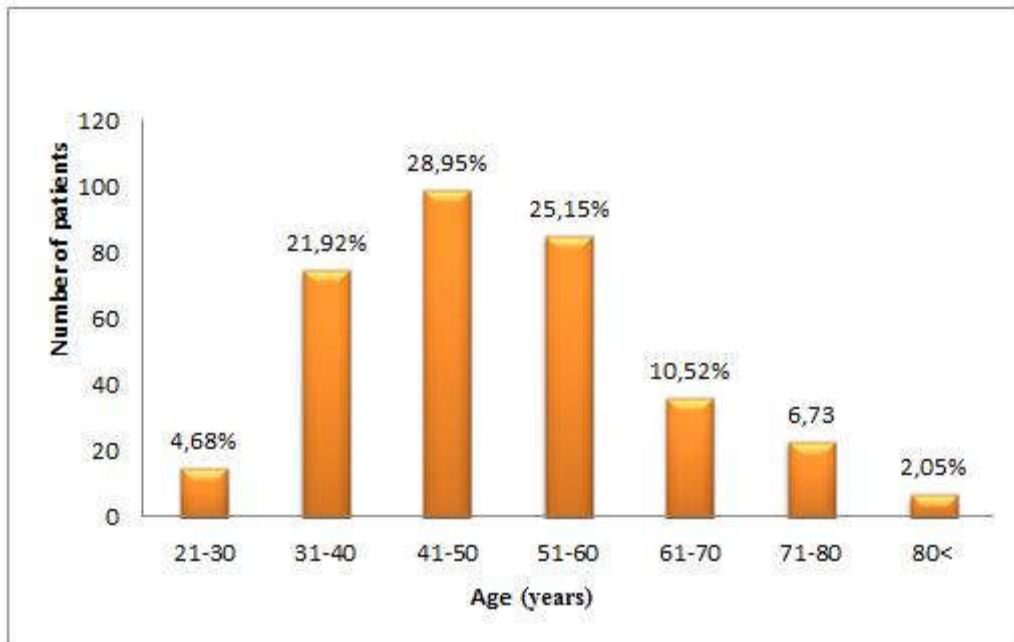


Figure 3: Distribution of Breast Cancer by Age in El Oued Region

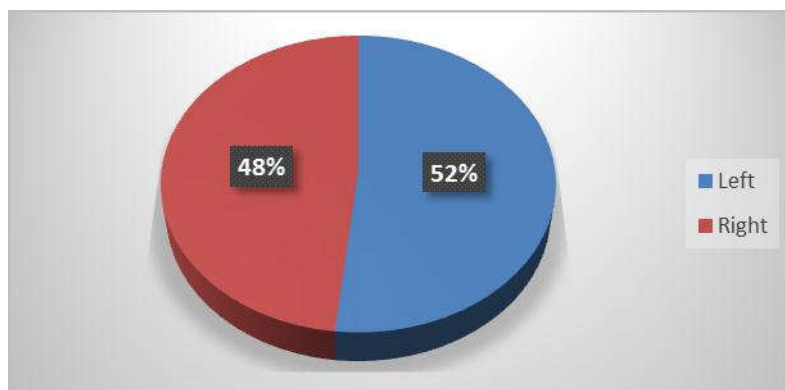


Figure 4: Breast cancer incidence in right or left breast

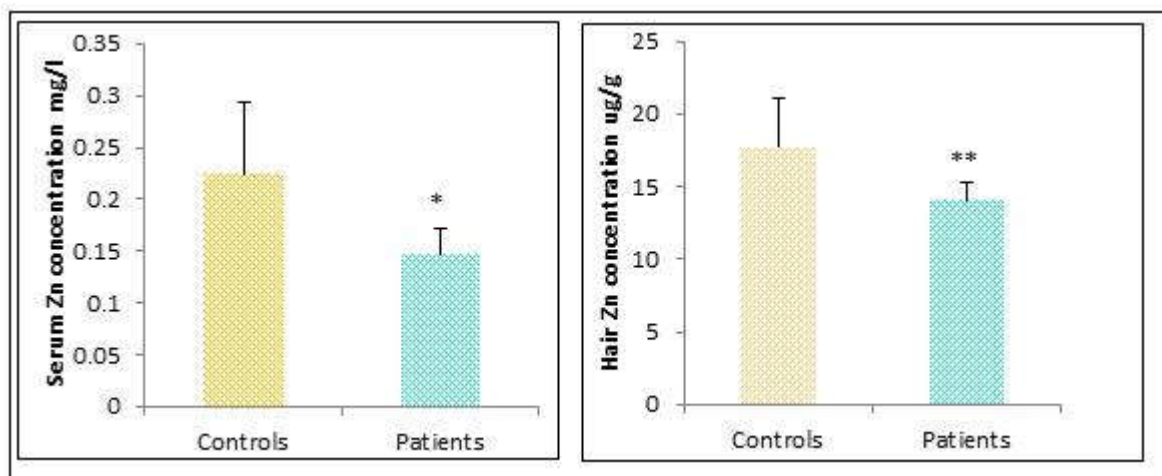


Figure 5: Serum and hair Zn level in control and patients. *: $p < 0.05$; **: $p < 0.010.001$: significantly different from control group.

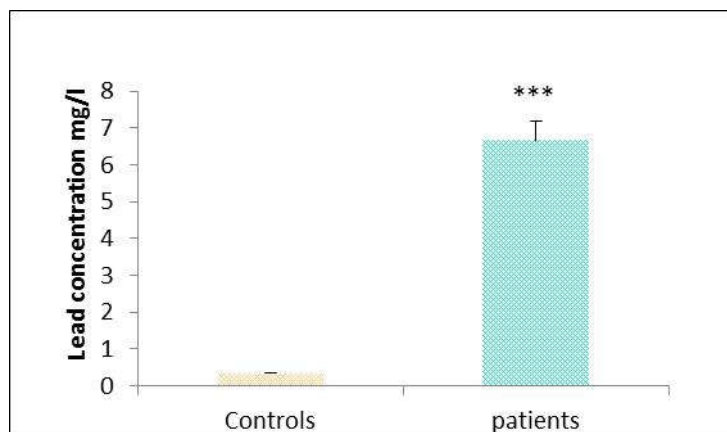


Figure 6: Serum Pb level in control and patients.***p < 0.001: significantly different from control group.

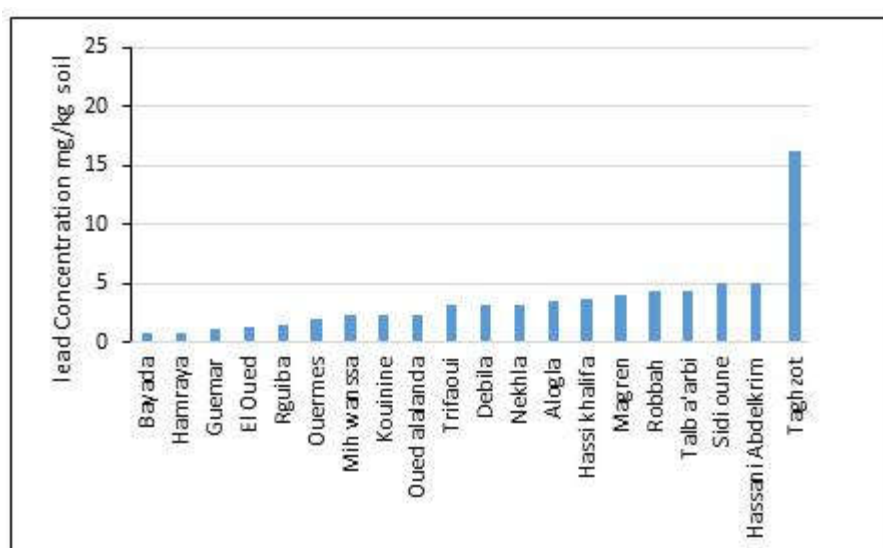


Figure 7: Soil lead level in different area of El Oued (Algeria).

CONCLUSION

This study examines the distribution of breast cancer patients in order to improve facilities and implement effective treatment measures to control the disease and thus help to reduce mortality in the society associated with the disease. This study also reevaluated environmental contamination by lead is a very important risk factor for breast cancer expected in the region of El Oued. Moreover, The low Zinc level in breast cancer patients, indicates the importance of diet factors and zinc deficiency in breast cancer expected.

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