



Original Article

STUDY OF HEAVY METALS AND PERSISTENT POLLUTANTS CONCENTRATIONS IN SERUM OF BREAST CANCER PATIENTS

Ayesha Riaz^{1*}, Masooma Haider¹, Usman Ali Ashfaq², Muhammad Ahsan Riaz³, Uzma Rafi⁴, Maria Fareed Siddiqui⁵, Hina Asif⁶

¹Department of Zoology, GC Women University Faisalabad-Pakistan

²Department of Bioinformatics and Biotechnology, GC University Faisalabad-Pakistan

³Department of Environmental Sciences and Engineering, GC University Faisalabad, Pakistan

⁴Department of Biology, Lahore Garrison University, Lahore, Pakistan

⁵Department of Pharmacy, The University of Lahore, Lahore, Pakistan

⁶Shaukat Khanum Memorial Cancer Hospital, Lahore, Pakistan

*Ayeshariazrana@gmail.com

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ABSTRACT:

Cancer is a lethal disorder originates from the uncontrolled cell division in human body. Breast cancer is most dreadful especially in women but also reported in male. Human is facing a lot of issues caused by rapid industrialization also causing the life-threatening hazards. **Objective:** It is designed to estimate the level of heavy metals (HMs) Ni, Cd and Pb in serum samples of breast cancer patients in Faisalabad district. **Method:** All serum samples were examined by Spectrophotometer for Atomic Absorption (AAS). Heavy metal concentrations were found in the results such as Ni, Cd and Pb in serum of breast cancer patients higher than control. **Results:** The levels of heavy metals concentration in breast cancer patients serum were trends in Pb>Ni>Cd compared with control group. Heavy metal toxicity has proven associated with several health risks. **Conclusion:** Our results evaluated statistically significantly high concentration of Pb, Ni and Cd heavy metals.

KEYWORDS:

Breast cancer patients; Heavy Metals; Persistent Pollutants

INTRODUCTION

Rapid urbanization and industrialization have brought deleterious effects on human life. Generally, breast cancer is recorded worldwide in female population but breast cancer cases have also been reported [1]. The total number of deaths caused in cause of cancer is 7,600,00, out of which 460,000 are due to breast cancer incidences. It is the common solid tumor in females [2] with average breast cancer ratio is one in nine among women [3]. Breast cancer is also considered one of the most common cause of cancerous death among women [4,5]. According to studies, hereditary factor triggers breast cancer mutation in the *BRCA1* or *BRCA2* genes, causing early menarche, late menopause, pregnancy and old age birth, sexual and hormonal imbalances [6,7]. Among various factors, lifestyle and climate are two major factors that increase the risk of cancer incidence. Environmental factors

contribute to the incidence of breast cancer in human by direct exposure to heavy metals and persistent pollutants [8]. Humans drinking contaminated water directly or in the form of feeding on organisms that use contaminated water may have deleterious effects. Heavy metals combine with different structural and functional subunits and also with organic components of the body to form complexes which consequently disrupt the physiological functions of the body with various toxic effects. DNA damage, uncontrolled cell growth, impaired mitochondrial functions, and cell death are major toxic effects caused by heavy metals [9]. Breast cancer has an inverse relation with the mortality due to the dietary intake of selenium, zinc, chromium and cadmium which represents the anti-carcinogenic properties of selenium among these metals [10]. Heavy metals mimic the estrogen and bind to different receptors of estrogen resulting in increased breast tissues growth by inhibiting the effects of tumor suppressor genes in breast tissues. Heavy metals viz chromium chloride, antimony chloride, barium chloride, lead acetate, lithium hydroxide and cadmium chloride can cause breast cancer [11]. Breast cancer is most common worldwide malignancy that affects women [12]. In breast samples of breast cancer patients heavy metal cadmium content is observed to the high but mean level of cadmium did not differ from healthy controls [13]. Commonly diagnosed malignancy in breast cancer 25%, accounts maximum of all tumors worldwide causing 15% of cancer deaths among the females [14]. On daily basis human expose to cadmium mainly through consumption of environment contaminates cigarette smoking [15]. Including certain regions northeastern States higher rate of breast cancer than US were recorded. Several studies estimated the association between the breast cancer and environmental pollutants [16]. Increased risk of breast cancer associates with residence within 1 mile of the hazardous waste sites contains organochlorine [17] and use of home pesticides [18]. Breast cancer is one of most common women cancers worldwide. An additional 39510 women and 410 males died of breast cancer globally in 2012 [19]. Risk factor that may lead to the development of breast cancer have been reported including genetic factor, smoking, alcohol consumption, low physical activity, obesity, history of pregnancy and mensural history, etc. [20]. indicated that chemicals that mimic estrogen may also lead to increased risk of breast cancer [21]. Numerous epidemiological studies have examined association between dietary consumption of cadmium level and risk of breast cancer however findings have also contradictory and inconsistent. Evidence showed that chemical components of body care and underarm cosmetics applied to breast and underarm region could be implicated in increasing breast cancer incidence [22,23]. In places where water delivery network consists of alloys containing heavy metals people not afford filtered water with regulated concentration of heavy metals consume tap water thus risk of contamination of drinking water with heavy metals significantly increased [24]. Heavy metals in drinking water are harmful and can quickly get into the body. The epigenetic effects of these components are associated with increased risk of different forms of cancer [25]. In past few decades global rate of breast cancer incidence has gradually increased. Breast cancer is most prevalent in causing malignancy among women worldwide [26]. In *BRCA1* mutation play a role in repairing DNA, associated with breast cancer. These gene mutation and environmental toxin may possibly cause DNA repair injury [27]. Heavy metal exposure causes numerous health disorders such as cancer of respiratory system, anemia, skin disorders, reproductive disorders, depression, gastrointestinal disorders, reduce immunity, heart attack and even death [28]. Apart from cadmium (Cd), mercury (Hg), and lead (Pb) have adverse effects during fetal development on nervous and endocrine systems. During pregnancy exposure to these metals can lead to intrauterine death, abortion, and decrease intelligence quotient (IQ) and cerebral palsy [29]. Despite the risk of harm from environmental pollutants in breast milk, breast feeding is safest natural foam of nutrition for children because provides sufficient quantities of protein, carbohydrate, fat and other important component for immunity and growth [30]. In developed countries genetic factors account for only 10% of all of breast cancer case [31,32]. Breast cancer is multi-etiological and multifactorial being the most common malignant disease in women. Genetic tests have been helpful in determining risk factors linked to the dietary risk [33,34]. In the current study we evaluated heavy metals concentration in serum and adipose tissue samples in relation to causing breast cancer in female population of Pakistan. Heavy metals like Cadmium (Cd), nickel (Ni) and lead (Pb) were analyzed by Atomic Absorption Spectrophotometer (AAS).

METHODS

To study the heavy metal concentration in breast cancer patient's serum and breast adipose tissues, samples were collected from PINUM Cancer Hospital Faisalabad and Allied Hospital Faisalabad. Blood and tissue samples of breast cancer patients were collected. Criteria for selection of samples involved patients of different places of the city age between 25-60 years. Amount of blood sample was 5ml taken from forearm kept in median cubital vein. Samples of serum 5ml collected in serum Vacutainer. Fifteen blood samples and ten breast adipose tissue samples were collected from breast cancer patients from December 2019 - September 2020. Blood samples collected by professional phlebotomist with a sterilized disposable syringe (SHIFA disposable syringes) [35]. Total blood samples fifteen were collected five sample were collected from Allied Hospital Faisalabad, five sample collected from PINUM Cancer Hospital Faisalabad and five blood samples were collected from normal healthy population as control. An investigator questionnaire was used for breast cancer patients' studies. The survey involved the data based on medicinal history such as use of tobacco or alcohol, other any of disease, asked about residence of patient and physical existence of lump. Sample selection was preferably performed in the early morning hours in the cancer hospital before chemotherapy given to breast cancer patients. Blood samples (2-3ml) were collected in EDTA coated vacutainers and stored at -20°C for further analysis [36]. Blood sample were collected in EDTA coated vacutainers serum to avoid hemolysis. The blood sample incubated at 37°C for 10 minutes, the centrifugation of samples at 10,000 rpm for 10 minutes was then made. Serum samples (1.5 ml) were collected in Eppendorf tubes stored on ice or at 4°C prior to testing without freezing. In each of the 100 ml digestion flasks, 1 ml of serum was introduced, followed by 10 ml of pure nitric acid [37]. The contents of the flask were swirled for 20 minutes. After heating, the sample was cooled at room temperature by adding 5 ml of chloric acid and content stirring until the white fumes were released and the sample volume was reduced to 2-3 ml. The final 30 ml of redistilled water was added. Heavy metal levels (Ni, Cd, and Pb) in serum were measured using a spectrophotometric atomic absorption approach, as described in [38]. using atomic absorption spectrometry from graphite furnace. Generator, Shimadzu, Japan) methodology related [39]. The data were analyzed using Graph Pad 6. The ANOVA was applied with Tukey's Multiple Comparison Test applied for the significance of parameters in controls and breast cancer patients for comparison among heavy metals. Calibrated standards were made from an aqueous solution of a commercially available stock solution (Applichem®) (1000 ppm). For the creation of working standards, highly pure de-ionized water was employed. Prior to usage, all glass equipment utilized in the analytical procedure were submerged in 8N HNO₃ overnight and rinsed with numerous changes of de-ionized water. Heavy metal concentrations in the prepared samples were evaluated using an Atomic Absorption Spectrophotometer (Hitachi Polarized Zeeman AAS, Z-8200, Japan) in accordance with AOAC guidelines (1990). Cadmium (Cd), Lead (Pb), and Nickel (Ni) were among the metals chosen (Ni).

RESULTS

Concentration of Heavy metals Cadmium (Cd), lead (Pb) and nickel (Ni) detected in serum samples of breast cancer patients. The levels of these heavy metals in the serum samples in breast cancer patients were significantly higher (7.000 ± 1.000) than the normal control (3.833 ± 0.7638), according to the outcomes of current study. The level of Ni heavy metal in the serum samples of breast cancer patients were significantly higher (38.67 ± 9.074) than the normal control (19.33 ± 7.024), according to the outcomes of current data. The level of Pb heavy metal in the serum samples of breast cancer patients were significantly higher (94 ± 24.56) than the normal control (32 ± 14).

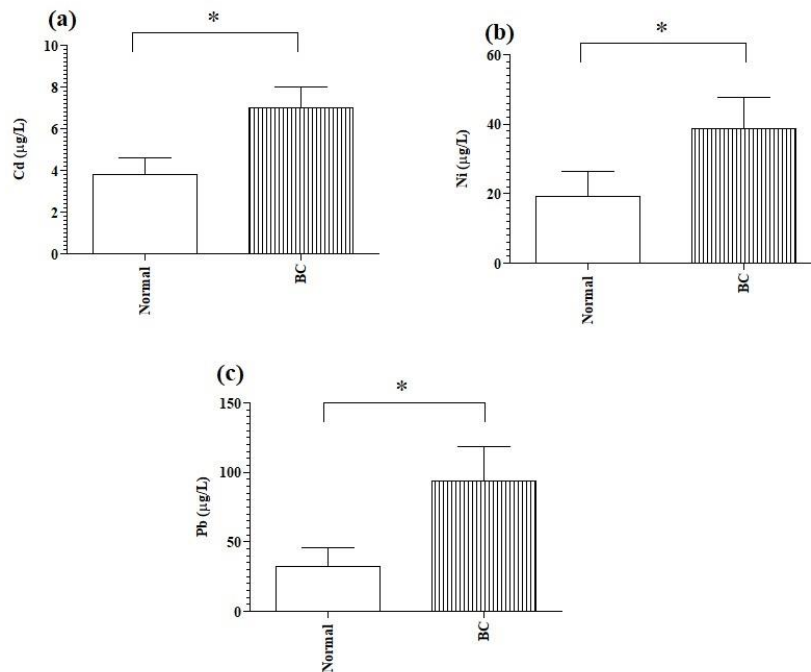


Figure 1. Showed the comparison of heavy metals concentrations in serum samples of breast cancer patients compared with control. Bars representing the values of mean \pm SD

DISCUSSION

Heavy metal cadmium in blood serum samples of breast cancer patients was non-essential heavy metal cadmium represents potential of human and environmental hazards. Cadmium establish as carcinogenic and toxic metal [40]. According to [41] cancer patients reported with higher level of cadmium in serum is consistence with our study. Cadmium (Cd) levels in serum have been significantly higher in this study. The levels of these heavy metals in the serum samples in breast cancer patients of age 25-60 were significantly higher than the normal control according to the outcomes of current study. The mean serum sample Cd concentration identified in this research was statistically high among breast cancer patients with $P > 0.05$. Heavy metal Nickel (Ni) concentration analysis in serum and breast adipose tissues samples breast cancer patients was in the environment nickel widely distributed. In human body nickel (Ni) enter through absorption, ingestion and inhalation. In general population exposure to nickel through consumption of food such as nuts and cacao products which contained 3 and 10mg nickel/kg also observed. In the current study, statistically significant high concentration of Ni observed in breast cancer patients of age between 25-60 than the normal controls. Heavy metal Lead (Pb) concentration in blood serum sample and breast adipose tissue of breast cancer patients was Led (Pb) is one of the poisonous heavy metals that is most toxic [42]. exhibit many negative impacts on general health of human. In the current study, the mean concentration of lead (Pb) observed was higher than the normal control. Lead (Pb) levels in serum have been found statistically significantly higher in current study. Major risk factor for breast cancer incidence may be related to rapid industrialization associated with widespread contamination of air, water and soil by heavy metals [43]. The effects of heavy metals, Pb, Ni, Cd were evaluated in blood of breast cancer patients and statistically high concentration of these metals were observed in breast cancer patients of age between 25-60 as compared to control suggesting the effective legislation, and detection of the areas with higher levels of heavy metals are necessary that otherwise may result in severe complications in the future due to the adverse effects imposed by heavy metals.

CONCLUSIONS

Findings of current study suggested the possible role of heavy metals through different pathogenic links may stimulate progression of breast cancer, provides evidence that environmental exposure of heavy metals might increase the chance of breast cancer. The current study was designed to detect and estimate the level of heavy metal in serum of breast cancer patients from the PINUM cancer hospital and Allied hospital Faisalabad, Pakistan. Total blood samples fifteen. Detection of heavy metal residues (cadmium, lead and nickel) were observed by Atomic Absorption Spectrophotometer (AAS). Statistically significant concentration of heavy metals in serum sample of breast cancer patients were trend of Pb>Ni>Cd.

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