Physical study of Nickel Serum Level in blood samples from Iraqi populations

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ABSTRACT

Trace elements examining of basic biological components in the human and animal body, is essential due to the increase and the decrease in them may lead to toxicity. In this study, 32 patients who were diagnosed with lung cancer in 32 healthy volunteers were compared. Serum level concentrations of Fe trace elements were measured using Atomic Absorption Spectrometry. There was statistical significance difference in nickel serum levels when comparing the mean of healthy with patient concentration, where the value of P (0.05 > p) was found. The level of serum components in the patient may be important in causing lung cancer.

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Nickel
LC (lung Cancer Samples) and N (Atomic absorption Healthy Samples)

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Arab Article:

دراسة فزيائية لمستوى النيكل في عينات مصل الدم لدى السكان العراقيين

شيماء عواد كاظم

عُـامَـة الكوـفَـة/كلية العلم/قسم الفيزياء/العراق

تَـمّ الدراسة على تعرف النيكل في مصل الدم، حيث تمّ تشخيص مصابين في كلًا من المصل وعَـيْـنات سرطان الرئة (LC) وعينات الاصحاء (N). حيث تمّ تأكيد أن هناك دالة إحصائية تُـتِرِكَر النيكل في مستويات المصل عند مقارنة متوسط الطبيعية مع تركيز المريض، حيث كانت قيمة الاحتمالية أقل من 0.05. يلعب دور مهم في امراض سرطان الرئة.
1. INTRODUCTION

Cancer consider the main reason of the most deaths among people worldwide, lung cancer accounts for 16%, according to the World Health Organization. which is the most common solid tumor diagnosed [1]. During the 11 years ago (2000-2010), the number of lung cancer in the population of Iraq (27599), (1050) (3.80%) of males and (26549) (96.20%) of females[1].

Several studies have shown that the mineral compounds of these elements act as an anti-estrogen activator, and further confirm the relationship between element compounds and the same elements that maybe causes risk of lung cancer where lead, cadmium and arsenic are a source of oxidative stress related to lung cancer[2,3,4]. Some trace minerals act as catalysts that increase the oxidative damage of biological molecules and DNA, which is also known to be carcinogenic and capable of producing toxic effects such as (Reactive oxygen species) ROS formation and [5]. The main objective of this study is to try to find a relationship between cancers such as lung cancer, and the percentages of concentrations of influencing factors using an atomic absorption device and whether the association between increase or decrease its concentrations is taken into account in medical treatments to prevent cancer expansion as much as possible[6,7].

Trace Elements and Immunity

Previously it has been observed that there is a strong relationship between health and nutrition and that immunity is highly responsive to nutrients. The presence of the proportions of the elements to suit the needs of the body is a key factor of nutrition that protects humans and animals from infection [8]. In the current study, we try to find what happens if there is a defect in the trace elements and how that will effects the blood cells and body organs such as tissues and bones marrow, lymph nodes and whether the concentration of these elements that have a relationship with immune cells [9].

Nickel

Nickel is a rather common element, representing 0.018% of the earth’s crust, compared to 0.0015% lead. Nickel compounds are known carcinogens in both human and animal models. There is evidence that the genotoxic effects of nickel compounds may be indirect through the inhibition of DNA repair systems [1]. An uptake of too large quantities of nickel has the following consequences:

a) Higher chances of development of lung cancer, nose cancer, larynx cancer and prostate cancer.

b) Sickness and dizziness after exposure to nickel gas.

c) Lung embolism.

d) Respiratory failure.

e) Birth defects.

f) Asthma and chronic bronchitis.

g) Allergic reactions such as skin rashes, mainly from jewellery.

h) Heart disorders [10]. patients with liver cancer and another a group without liver cancer, the nickel deposits reported to be clearly more common in the group with liver cancer[11.12].

Materials and Methods

In order to achieve this study, first step blood samples were taken from human of ages (24-84) years. This work carried out at the middle Euphrates (cancer) center, Al Najaf city, Iraq also control samples were collected from Al Sader general hospital at al-Najaf al-Ashraf Governorate , which consist of two stages:

- Blood samples were taken from donors in the hospital from vein and categorized for examination.
The collected blood samples were labeled, and kept in clean and hygiene places for examination by atomic absorption spectroscopy.

Five milliliters of blood were collected for each patient and the sample was placed in clean and dry test tube without any anti-coagulant which kept for 45 minutes at room temperature (22 ± 2°C) for the formation of clot. Serum of patients were separated by centrifuge at 1500 r.p.m. up to 15 minutes and were collected in screw capped test tubes. A Shimadzu model AA-670 Flame Atomic Absorption Spectrophotometer (FAAS) was used for the determination of Fe concentration with wavelengths equal (328.1, 217.0, 228.8) nm respectively, and its widths of is (0.5, 1, and 0.5) nm respectively where was the flame fuel is acetylene that supported by air.

Sample digestion

The 0.001 liters of serum were placed in a glass beaker and 10 ml was added to the beaker as (1:1) HClO₄ / HNO₃ acid mixture. The mixture was transferred to a 25 ml vial that was pre-cleaned, then diluted with double distilled water and stored for analysis later by atomic absorption [6, 7].

Calibration

These compounds, less melting in the watery medium appear to be the most carcinogenic substances. The involvement of carbonyl Ni [carbon dioxide] in lung and sinus cancer in industrial workers is implicated as a potential carcinogen in tobacco smoke.

Ni deficiency is a major risk factor for lung cancer. And its value (R2) was 0.9928 in figure (1). The results of our study clearly show the difference in concentration of serum control and lung cancer patients. This significantly reduced level (p >0.05) of this component was also agreed with other studies, while the Levine test was found to be significant (P=0.05).

![Calibration curve of Ni in aqueous solution](image.png)

The results were so similar to those published in other literatures while that found the Levene's Test is significant p = 0.05.

Statistical Analysis

The SPSS the statistical program (SPSS for Windows version 20, SPSS Inc., Chicago, Illinois, USA), was used, the results were computed the mean and standard deviation were compared with the lowest and highest value. Std. Mean Error, Levine's Test and P-value that can be considered as a statistical function when the value of (p <0.05 ) while if (P >0.05 ) statistically there are non-significant all relation for all results as shown in Table 1.

Results and Discussion

Thirty-two samples were collected from lung cancer patients and compared with thirty healthy controls, the mean age are (24 -84) years and (86 -22) year respectively and Ni element concentrations were measured for patients and health. The results were statically compared for patients and healthy samples as shown in table below:
Table (1): Serum traces elements concentration (Ni) in patients of lung cancer and control subjects

<table>
<thead>
<tr>
<th>Sq.</th>
<th>Code</th>
<th>Age(year)</th>
<th>Concentrations(ppm) of Ni in health human (N)</th>
<th>Code</th>
<th>Age(year)</th>
<th>Concentrations(ppm) of Ni in lung cancer (L.C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>N1</td>
<td>84</td>
<td>0.0453</td>
<td>T1</td>
<td>85</td>
<td>0.0893</td>
</tr>
<tr>
<td>2.</td>
<td>N2</td>
<td>80</td>
<td>0.044</td>
<td>T2</td>
<td>82</td>
<td>0.096</td>
</tr>
<tr>
<td>3.</td>
<td>N3</td>
<td>70</td>
<td>0.068</td>
<td>T3</td>
<td>81</td>
<td>0.084</td>
</tr>
<tr>
<td>4.</td>
<td>N4</td>
<td>65</td>
<td>0.0533</td>
<td>T4</td>
<td>80</td>
<td>0.0827</td>
</tr>
<tr>
<td>5.</td>
<td>N5</td>
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<td>0.0987</td>
<td>T5</td>
<td>78</td>
<td>0.0800</td>
</tr>
<tr>
<td>6.</td>
<td>N6</td>
<td>52</td>
<td>0.0507</td>
<td>T6</td>
<td>76</td>
<td>0.0933</td>
</tr>
<tr>
<td>7.</td>
<td>N7</td>
<td>50</td>
<td>0.0480</td>
<td>T7</td>
<td>75</td>
<td>0.1427</td>
</tr>
<tr>
<td>8.</td>
<td>N8</td>
<td>48</td>
<td>0.0613</td>
<td>T8</td>
<td>73</td>
<td>0.0733</td>
</tr>
<tr>
<td>9.</td>
<td>N9</td>
<td>40</td>
<td>0.0653</td>
<td>T9</td>
<td>72</td>
<td>0.0907</td>
</tr>
<tr>
<td>10.</td>
<td>N10</td>
<td>45</td>
<td>0.0733</td>
<td>T10</td>
<td>70</td>
<td>0.0840</td>
</tr>
<tr>
<td>11.</td>
<td>N11</td>
<td>37</td>
<td>0.0440</td>
<td>T11</td>
<td>68</td>
<td>0.0840</td>
</tr>
<tr>
<td>12.</td>
<td>N12</td>
<td>35</td>
<td>0.0227</td>
<td>T12</td>
<td>67</td>
<td>0.0827</td>
</tr>
<tr>
<td>13.</td>
<td>N13</td>
<td>31</td>
<td>0.0400</td>
<td>T13</td>
<td>66</td>
<td>0.1053</td>
</tr>
<tr>
<td>14.</td>
<td>N14</td>
<td>30</td>
<td>0.0360</td>
<td>T14</td>
<td>65</td>
<td>0.1280</td>
</tr>
<tr>
<td>15.</td>
<td>N15</td>
<td>28</td>
<td>0.0560</td>
<td>T15</td>
<td>64</td>
<td>0.1280</td>
</tr>
<tr>
<td>16.</td>
<td>N16</td>
<td>25</td>
<td>0.0467</td>
<td>T16</td>
<td>63</td>
<td>0.100</td>
</tr>
<tr>
<td>17.</td>
<td>N17</td>
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<td>0.0373</td>
<td>T17</td>
<td>62</td>
<td>0.1080</td>
</tr>
<tr>
<td>18.</td>
<td>N18</td>
<td>23</td>
<td>0.0427</td>
<td>T18</td>
<td>61</td>
<td>0.1053</td>
</tr>
<tr>
<td>19.</td>
<td>N19</td>
<td>22</td>
<td>0.0427</td>
<td>T19</td>
<td>60</td>
<td>0.1187</td>
</tr>
<tr>
<td>20.</td>
<td>N20</td>
<td>20</td>
<td>0.0347</td>
<td>T20</td>
<td>59</td>
<td>0.1093</td>
</tr>
<tr>
<td>21.</td>
<td>N21</td>
<td>46</td>
<td>0.0453</td>
<td>T21</td>
<td>58</td>
<td>0.1427</td>
</tr>
<tr>
<td>22.</td>
<td>N22</td>
<td>43</td>
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<td>T22</td>
<td>52</td>
<td>0.1573</td>
</tr>
<tr>
<td>23.</td>
<td>N23</td>
<td>41</td>
<td>0.0467</td>
<td>T23</td>
<td>51</td>
<td>0.132</td>
</tr>
<tr>
<td>24.</td>
<td>N24</td>
<td>39</td>
<td>0.1267</td>
<td>T24</td>
<td>50</td>
<td>0.1413</td>
</tr>
<tr>
<td>25.</td>
<td>N25</td>
<td>34</td>
<td>0.0427</td>
<td>T25</td>
<td>44</td>
<td>0.1333</td>
</tr>
<tr>
<td>26.</td>
<td>N26</td>
<td>32</td>
<td>0.0387</td>
<td>T26</td>
<td>42</td>
<td>0.1480</td>
</tr>
<tr>
<td>27.</td>
<td>N27</td>
<td>29</td>
<td>0.0693</td>
<td>T27</td>
<td>41</td>
<td>0.1320</td>
</tr>
<tr>
<td>28.</td>
<td>N28</td>
<td>27</td>
<td>0.0413</td>
<td>T28</td>
<td>39</td>
<td>0.1360</td>
</tr>
</tbody>
</table>
Table (2): Comparison between the patient and control groups for (Ni) as trace elements

<table>
<thead>
<tr>
<th>Element</th>
<th>Group</th>
<th>Upper limit</th>
<th>Lower limit</th>
<th>Mean± SD</th>
<th>P-value</th>
<th>Std. Error Mean</th>
<th>Levana’s Test</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe</td>
<td>Patients</td>
<td>72.2757</td>
<td>12.7809</td>
<td>.115581 ±.0265</td>
<td>0.0</td>
<td>0.004</td>
<td>8.491</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>40.4479</td>
<td>13.4293</td>
<td>.053834 ±.0204</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

We noted the concentration of nickel in patients higher than control as compared with another published research [13]. Since the value of P-value is smaller than 0.05, it is not statistically significant. Therefore, we found statistical significance for serum concentrations of nickel and for lung cancer patients that are compared with healthy human.

**Conclusions**

1- The present study were highlights the role of nickel in the emergence of lung cancer.

2- Identified the concentration of metal ions in the blood and can be utilize as pre-indicator for cancer, including lung cancer.

3- The concentration of nickel element in patient samples is higher than its concentration in healthy control samples.

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REFERENCES


