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Selenium and total antioxidant levels in patients with intra-bronchial and extra-bronchial lung cancer

Zainab Yasoob Ejam[1,*], Esraa Rafied[1], Doaa Nassr Wahhab[2], Saif S. Radhi[1]

[1]*Department of Pharmaceutical Chemistry, College of Pharmacy, University of Babylon, Hillah, Iraq*
[2]*Department of Clinical Laboratory Sciences, College of Pharmacy, University of Babylon, Hillah, Iraq*

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*** CORRESPONDING AUTHOR:**
Zainab Yasoob Ejam, Department of Pharmaceutical Chemistry, College of Pharmacy, University of Babylon, Hillah, Iraq; e-mail: pharm.zainab.yasoob@uobabylon.edu.iq

ABSTRACT

This study investigates the levels of total antioxidant capacity (TAC) and selenium (Se) in patients with lung cancer treated at the Taiba Hospital for Surgical Specialties. Fifty-seven patients aged 40 to 80 years were included in the study, with samples collected through bronchoscopy between December 19, 2021, and April 11, 2022. Patients were classified into two groups based on tumour location: 24 patients with extra-bronchial tumours (EXO; group A) and 33 patients with intra-bronchial tumours (ENDO; group B). All diagnoses were confirmed by histological and cytological tests. Significant differences in TAC and Se levels were observed between the groups. The EXO group exhibited lower TAC levels (1.783 ± 4.391 units/mL) compared to the ENDO group (5.616 ± 4.915 units/mL; p=0.004). In contrast, Se levels were higher in the EXO group (95.954 ± 3.233 ppb) than in the ENDO group (84.200 ± 3.824 ppb; p<0.001). These findings reveal a strong association between tumour type and the levels of TAC and Se, suggesting their potential utility as biomarkers for the diagnosis and prognosis of lung cancer. Further research is warranted in order to explore the clinical implications of these findings for treatment and prevention strategies.

1. Introduction

Lung cancer has remained the most common type of cancer worldwide in recent decades. In 2012, an estimated 1.8 million new cases were reported (representing 12.9% of all cancers), with 58% occurring

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in less developed countries. The prevalence of lung cancer is typically lower in women, reflecting gender differences in smoking behavior. Globally, lung cancer is also the leading cause of cancer-related death. Mortality rates (per 100,000) in 2012 were 47.6 and 44.8 among men in Central and Eastern Europe and Eastern Asia, respectively, and 23.5 and 19.1 among women in Northern America and Northern Europe, respectively[1].

Selenium (Se) is an essential micronutrient implicated in numerous biological processes; it plays a critical role in the function of several organs, including the thyroid, brain, muscles, prostate, and testis. Se exists in both organic and inorganic forms, with distinct biochemical properties. The margin between its deficient and toxic intake levels is notably narrow: both extremes are associated with adverse health outcomes. Moderate Se deficiency has been linked to increased risks of male infertility, nephropathy, prostate cancer, neurological disorders, ischaemic heart disease, and endemic osteoarthropathy[2]. The anticancer properties of Se have been proposed for over a century, beginning with early *in vivo* observations of tumour regression. It has been shown to inhibit DNA damage *in vitro* and to reduce pulmonary metastasis and radiation-induced carcinogenesis *in vivo*. A meta-analysis of observational studies has further associated Se levels with decreased lung cancer risk[3].

Due to their physiological role, the lungs are highly exposed to oxidative damage. Elevated oxygen pressure (comparable to atmospheric levels) promotes oxidation, especially in the presence of reactive oxygen species (ROS) from tobacco smoke and air pollution. Oxidative stress is a major factor in lung cancer pathogenesis; consequently, protection against ROS is considered a key preventative strategy.

Systemic antioxidant defence comprises both exogenous and endogenous elements, the total activity of which defines the total antioxidant capacity (TAC)[4]. ROS generated in inflamed tissues – including superoxide anion, hydrogen peroxide, and hydroxyl radical – can damage cellular structures, denature proteins, and injure DNA, thereby promoting tumour development. These species affect physiological metabolism, activate oncogenic pathways, and contribute to both the initiation and the progression of a carcinoma. Moreover, the body continually consumes antioxidant reserves in order to counteract the ROS-induced damage, thereby exacerbating oxidative stress[5].

Lung cancer encompasses a heterogeneous group of tumours, broadly classified into non-small cell lung cancer (NSCLC) and small cell lung cancer. NSCLC accounts for approximately 85% of all lung cancer cases and includes over 50 histological subtypes. Epidermal growth factor receptor (EGFR) tyrosine kinase inhibitors are considered first-line therapy for NSCLC patients with EGFR mutations, owing to significantly improved objective response rates and progression-free survival compared to conventional chemotherapy[6].

2. Methodology

Fluid samples were collected from patients diagnosed with lung cancer at the Taiba Hospital for Surgical Specialties. Sampling was performed by expert physicians through bronchoscopy between December 19, 2021, and April 11, 2022. Over this five-month period, 57 patients (male and female, aged 40–80 years) underwent chest radiography and computed tomography (CT) scanning prior to diagnostic bronchoscopy. All cases were confirmed histologically and cytologically.

Patients were categorized into two groups based on tumour location: group A and group B. In group A, extra-bronchial tumour (EXO) bronchoalveolar lavage fluid (BALF) samples were obtained by washing the bronchial area, although tumours were located outside the bronchial lumen and were not visible through bronchoscopy. These tumours were detected *via* CT scanning and X-ray imaging. This group consisted of 24 patients of both sexes. In group B, intra-bronchial tumour (ENDO) BALF samples were obtained from the tumour site itself, located within the bronchial lumen and being visible through bronchoscopy. This group included 33 patients of both sexes.

Se concentrations were measured *via* atomic ab-

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Table 1. Levels of total antioxidant capacity and selenium in the bronchoalveolar lavage fluid (BALF) obtained from patients with extra-bronchial (group A; N=24) and intra-bronchial (group B; N=33) lung tumours.

Parameters	**Group A** (mean ± SD; N=24)	**Group B** (mean ± SD; N=33)	***p*-value**
Total antioxidant capacity (units/mL)	1.783 ± 4.391	5.616 ± 4.915	0.004
Selenium (ppb)	95.954 ± 3.233	84.200 ± 3.824	<0.001

sorption spectroscopy. Total antioxidant capacity (TAC) levels (in units/mL) were quantified using spectrophotometry at the laboratories of the Ministry of Science and Technology. These assays were used in order to evaluate correlations with lung cancer pathology.

Ethical approval for this study was obtained in accordance with the Declaration of Helsinki. The study protocol was confirmed by the Ethical Committee of the University of Babylon's College of Pharmacy (document #5; date: December 25, 2024). Informed consent was obtained from all participating women.

Statistical analyses were performed using the SPSS software (version 23). Data were expressed as mean ± standard deviation (SD). Group comparisons were assessed using independent *t*-tests and Mann–Whitney U tests for parametric and nonparametric variables, respectively. Age and body mass index (BMI) were compared using one-way analysis of variance (ANOVA). A *p*-value below 0.05 was considered as statistically significant.

3. Results and Discussion

The total of 24 patients with extra-bronchial tumours (group A) exhibited a mean TAC of 1.783 ± 4.391 units/mL, whereas the 33 patients with intra-bronchial tumours (group B) showed a significantly higher mean TAC of 5.616 ± 4.915 units/mL (p=0.004). Similarly, mean Se levels were 95.954 ± 3.233 ppb in group A and 84.200 ± 3.824 ppb in group B, again reflecting a statistically significant difference (p<0.001), as summarized in Table 1.

These findings reveal a clear divergence in TAC and Se profiles between patients with extra-bronchial (EXO) *versus* intra-bronchial (ENDO) lung tumours. Group A's lower TAC levels may point to impaired antioxidant defence mechanisms, while the elevated TAC in Group B suggests a compensatory response to increased oxidative stress; an inference supported by heightened levels of oxidative stress markers observed in ENDO cases[7]. It is well established that antioxidant systems are disrupted during carcinogenesis. Nevertheless, the specific contributions of endogenous and exogenous factors to TAC remain poorly defined in lung cancer. The antioxidant status in such patients likely reflects disease stage and individual physiological variability. Further research is needed in order to identify the dominant drivers of TAC alterations in this population[4].

Group A also exhibited significantly higher Se levels than Group B. The role of Se in lung cancer appears complex and may involve a biphasic effect, whereby both deficient and excessive levels influence risk. Some studies have linked low Se concentrations to increased incidence of lung cancer, though consensus on causality remains elusive[3,8].

The statistical significance of these intergroup differences supports a strong association between tumour type and both TAC and Se levels. These parameters may have diagnostic or prognostic utility, and their further exploration could refine the biochemical understanding of lung cancer pathophysiology.

To validate these findings, larger and longitudinal studies are warranted. Such studies could elucidate whether TAC and Se levels function as reliable biomarkers for disease progression or outcome prediction. If confirmed, they might inform therapeutic strategies aimed at optimizing antioxidant and micronutrient status in affected patients.

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4. Conclusion

This study demonstrates a statistically significant relationship between bronchial tumour type and both TAC and Se levels. These findings merit further research in order to clarify mechanistic pathways and to evaluate potential implications for treatment and preventative care in lung cancer.

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Conflicts of interest

None exist.

ORCIDs

0000-0001-9434-3757 (Z.Y. Ejam); 0000-0002-3712-693X (E. Rafied); 0000-0001-8465-5503 (D.N. Wahhab); 0000-0001-8185-6190 (S.S. Radhi)

References

1. Talebi S.S., Badfar G., Shohani M., Soleymani A., Azami M. The relationship between selenium and lung cancer: an updated systematic review and meta-analysis. *Int. J. Cancer Manag.* 11(6), e8370, 2018. DOI: 10.5812/ijcm.8370
2. Kuršvietienė L., Mongirdienė A., Bernatonienė J., Šulinskienė J., Stanevičienė I. Selenium anticancer properties and impact on cellular redox status. *Antioxidants (Basel)* 9(1), 80, 2020. DOI: 10.3390/antiox9010080
3. Fritz H., Kennedy D., Fergusson D., Fernandes R., Cooley K., Seely A., *et al.* Selenium and lung cancer: a systematic review and meta analysis. *PLoS One* 6(11), e26259, 2011. DOI: 10.1371/journal.pone.0026259
4. Zabłocka-Słowińska K., Porębska I., Gołecki M., Kosacka M., Pawełczyk K., Pawlik-Sobecka L., *et al.* Total antioxidant status in lung cancer is associated with levels of endogenous antioxidants and disease stage rather than lifestyle factors – preliminary study. *Contemp. Oncol. (Pozn.)* 20(4), 302–307, 2016. DOI: 10.5114/wo.2016.61850
5. Yang Y.W., Dai C.M., Chen X.H., Feng J.F. The relationship between serum trace elements and oxidative stress of patients with different types of cancer. *Oxid. Med. Cell. Longev.* 2021, 4846951, 2021. DOI: 10.1155/2021/4846951
6. de Mello R.A., Neves N.M., Tadokoro H., Amaral G.A., Castelo-Branco P., Zia V.A.A. New target therapies in advanced non-small cell lung cancer: a review of the literature and future perspectives. *J. Clin. Med.* 9(11), 3543, 2020. DOI: 10.3390/jcm9113543
7. Di Carlo E., Sorrentino C. Oxidative stress and age-related tumors. *Antioxidants (Basel)* 13(9), 1109, 2024. DOI: 10.3390/antiox13091109
8. Jaworska K., Gupta S., Durda K., Muszyńska M., Sukiennicki G., Jaworowska E., *et al.* A low selenium level is associated with lung and laryngeal cancers. *PLoS One* 8(3), e59051, 2013. DOI: 10.1371/journal.pone.0059051

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