Original Research Article

Exploration of Qualitative and Quantitative Phytochemical Constituents in *Solanum tuberosum* L. exposed to Ambient Air Pollution from Roadside Traffic

ABSTRACT

Solanum tuberosum L. is a useful vegetable crop and a member of the Solanaceae family that yields starch molecules with a high concentration. The analysis of both qualitative and quantitative phytochemical substances was the main focus of the current investigation. We have chosen places with road traffic and without road traffic (control) for the crop comparison analysis. The qualitative phytochemical substances analysed protein, carbohydrate, iodine, phenol, tannin, flavonoids, saponin, glycosides, steroids, terpene, and alkaloids. The complete phenolic content exhibits a total mean value of 0.03712, surpassing the threshold of 0.03176, while the overall flavonoid content shows a total mean value of 0.04696, exceeding the threshold of 0.03764. Crops growing close to busy road traffic had lower phytochemical substances, in terms of quantity and quality. This record demonstrates the detrimental impact of air pollution caused by vehicles on crop vegetation. Crop vegetation differs between control and road traffic sites, according to data on both qualitative and quantitative phytochemical substances.

Keywords: *Solanum tuberosum* L., Qualitative, Quantitative, phytochemical substances

1. INTRODUCTION

Air pollution is one of the most critical environmental problems. The amount of traffic has led to air pollution being a major health hazard. Unlike other environmental problems, this type of transportation-related air pollution is mostly caused by nature, making it infamously difficult to prevent. It hurts and kills people, animals, and plants in areas with heavy traffic. Roadside trees and crops significantly increase air filtration, which lowers pollution in the environment[1].There is more proof that recently identified microscopic contaminants, like air pollution, are causing contamination in terrestrial and aquatic ecosystems. Traffic is the primary means of transporting people and their things. Because contaminated air can bioaccumulate in food chains, breathing it in can be harmful to human health. Studies on air pollution have historically largely focused on water bodies, but more recent research has shown that land areas especially agricultural ones are widely contaminated. This is the only thorough study that we are aware of that looks at agricultural contamination in terms of its causes, effects, and mitigation techniques, despite the wealth of literature on-air pollution[2].Moreover, pollution not only reveals its effects but also enhances our comprehension of how plants absorb it and its impact on both people and animals. We also make recommendations for future directions in the study of environmental pollution in

ecosystems on land[3]. To comprehensively explore the transport region of the scrutinized organ leaves, the research was broadened to encompass an element of diverse environmental circumstances. The silver birch, *Betula pendula* L., is a widely spread deciduous tree found in moderately mild to frigid northern hemisphere temperatures. It is a common feature of many forest communities, such as urban forests and parks. According to the study, silver birch is a pioneering plant because of its low habitat needs for air pollution transport, as indicated by the amount of specific total phenolic and flavonoid content in the leaves[4]. A Mediterranean host-spot pollution region is defined as a region with heavy traffic and industrial areas. Pomegranate trees suffered greatly from a variety of industrial airborne pollutants, including biochemical alterations that included an investigation of the overall number of flavonoids and phenolics. The total phenolic and flavonoid content varied in this study, demonstrating their total dependence on stress and polluted and non-polluted environments[5].Through stomata, traffic air pollution is easily absorbed and transported by leaves, having detrimental effects [6]. Vehicle emissions pollution increased dramatically in tandem with the expansion of the automotive sector and the population surge. These automobile emissions are primarily directed towards the vegetation found around highways and roadside locations. In this overview, the effects of car emissions on plants are briefly discussed. On the other hand, it was also claimed that roadside vegetation might be able to lessen the harmful effects of automobile emissions. There was also a theory that suggested certain ways in which plants could function as bioindicators of air pollution. The paucity of studies on the impact of vehicle pollution on roadside vegetation and more especially, crops is one of the main problems. More research has been called for namely, to examine the function that nanocarbon particle pollution plays.It was stressed how crucial it is to find long-term solutions to these mounting concerns. The fruit peel of the pomegranate *Punica granatum* L. was collected from two locations close to the industrial area that had varying air quality. The first location showed the contaminated site, which is situated in the industrial sector near the oasis. The Control site, which was 37 km from the industrial region, was the second site mentioned. The total phenolic and flavonoid content of pomegranate fruit peel methanol extract was identified and measured [7]. There are many separate phytochemicals found in plants [8,9]. Total phenolic and flavonoid levels, among other phytochemical components, were detected and quantified in the peel extract, according to the article. Comparing the peel retrieved from the contaminated location to the control site, there was a higher total phenolic and flavonoid content [10]. Nowadays, traffic air pollution, dust, or Particulate Matter (PM), is one of the primary issues affecting human health and crops, owing mostly to the rapid development of industrial activity and road traffic[11]. The primary goal of this study is to determine the amount of traffic-related air pollution that could be harmful to human health by analyzing the phytochemical makeup of extracts from both contaminated and unpolluted *Nerium oleander* L. from the Morocco Meknes region. The report also includes accurate information. Research has indicated that there are differences in the total flavonoid content between the two extracts obtained from the polluted and unpolluted *N. oleander* L. plants [12]. Numerous effects of anthropogenic pollution can be seen in plants and the air. Monitoring pollution via bioindicators, or compounds found in living

organisms like plants, could prove to be a useful approach to environmental monitoring. The bioindicators of Sadat City, Egypt's residential and industrial areas were examined in this study. Phenolic and flavonoid components were identified through spectrophotometric analysis of *Bougainvillea glabra* L. (paper flower) leaves. In leaves, it was discovered that the industrial zone had significantly higher concentrations of flavonoids, which are phenolic compounds, than the residential zone. This work showed that total phenolic and flavonoid compound levels in *B. glabra* L. plants are significantly impacted by pollution, highlighting the negative effects of pollution on environmental health and opening the door for the use of plants as bioindicators [13]. *Portulaca oleracea* L. underwent quantitative phytochemical analysis for several key characteristics, including alkaloids, flavonoids, tannins, proteins, and saponins. The leaf samples were collected from two areas a roadside spot that was prone to air pollution from automobile tailpipes, and an unpolluted garden. Leaf samples taken from contaminated areas also showed signs of nutrient stress, water stress, and high-temperature stress. The leaf sample contains high percentages of phytochemical substances such as tannins, alkaloids, flavonoids, and saponins, as well as nutritional component protein. Compared to samples from garden settings, those from contaminated sites had noticeably higher percentage values. The research shows that *P. oleracea* L. may grow in wastelands that are stressed by fertilizer, water, traffic, and air while also displaying reasonably high amounts of phytoconstituents [14]. Investigating the impact of varying exposure levels to road dust on a sample of the traditional African plant *Barleriadinteri* L. phytochemical makeup, Samples of *B. dinteri* L. were collected from two distinct places inside the study area: the test sample was taken close to a dusty road, while the control sample was taken further away. Using spectrophotometry, the total phenolic, tannin, flavonoid, and saponin contents in the sample extracts were also quantitatively examined. The qualitative analytical results showed that there was a substantial difference in the phytochemical contents of the extracts from the test and control samples. Quantitative analysis revealed that the total tannin, total flavonoid, total phenolic, and total saponin concentrations in leaf extracts from the experimental sample were higher than those from the control sample. The root test sample had higher total phenolic and flavonoid levels, much as the control sample had higher total tannin levels. The results indicate that exposure to road dust pollution has a moderate effect on the quality of the phytochemicals held by the samples of plant leaves and roots, despite a substantial quantitative influence in the phytochemicals. The findings of the study suggest that *B. dinteri* L. accumulates more phytochemicals as a result of road dust pollution, especially in its leaves [15]. *Ficuscarica* L. and *Schinusmolle* L. two tree species planted in the Asir region of Saudi Arabia, are the subjects of this study, which aims to investigate the impact of various environmental factors on their phytochemical contents. Plant extracts obtained from the aerial portions of the plants were used to test the phytochemical components compared to the extracts from non-polluted, the phytochemical levels were different in the plant extracts from the two plants grown in the polluted sites[16].

The main important objective is to evaluate the phytochemical substances of *Solanum tuberosum* L. in road traffic and non-road traffic situations (control).

2. MATERIAL AND METHOD

2.1 Study area

Hapur is located in Uttar Pradesh northwest. Hapur experiences cold winters and hot summers because of its humid climate, which is influenced by the monsoon and extends from latitude 28.730579 to longitude 77.775879[17].

2.2 Collection of crop sample

Near Morepur on NH-235, two sites were chosen for the crop sample, traffic and non-traffic. The control site is 1000 meters separated from the traffic road site. *Solanum tuberosum* L. was the crop species used in this investigation. The C.C.S. University, Meerut, Uttar Pradesh, India in the Department of Botany, identified and recognized the crop sample taxonomically. Bot/PB/261 is the sample number.

2.3 Consideration of the air quality index at the sampling site

The series 500 (S500) gas monitoring equipment from Aeroqual (Hapur district, NH-235), was utilized to measure the concentrations of CO, NO, NO2, SO2, O3, and UV at the different sample locations. Every day from 7 a.m. to 3 p.m., the air quality at every location was monitored for a recorded period.

2.4 Standing preparation to extract a solvent

The Soxhlet method was used to extract the powdered leaves. Separate batches of 250 milliliters each of several solvents were utilized to extract 01gram of evenly dispersed plant powder from a thimble. Methanol was the solvent that was employed. When the solvent in the extractor syphon tube no longer has colour, the extraction process is considered complete, which happens after 24 hours. The extract was subsequently heated in a beaker over a hot plate that was set at 64.7ºC to distil it from its solvent. To prepare the extract of the leaves for phytochemical analysis, it was chilled to 4ºC.

3. Analysis of phytochemical substances

3.1 Qualitative analysis

The usual methods listed below were used to investigate if the extract contained any bioactive compounds[18-20].

3.1.1 Test for proteins

3.1.1.1 Millon's test

When 2 milliliters of leaf extract were combined with Millon's reagent, a white precipitate was formed that became red when heated gently, indicating the presence of protein[18-20].

3.1.1.2 Ninhydrin test

When 2 milliliters of a 0.2% Ninhydrin solution were heated with the leaf extract, a violet colour was generated, signifying the presence of proteins[18-20].

3.1.2 Test for carbohydrates

3.1.2.1 Fehling's test

The leaf extract was mixed with two milliliters of Fehling A and Fehling B reagents, each in an equal volume, and heated gradually until the mixture boiled. At the base of the tube, a brick-red precipitate would form when reducing sugars were present[18-20].

3.1.2.2 Benedict's test

When two milliliters of Benedict's reagent and leaf extract were combined and boiled, a reddish-brown precipitate formed, indicating the presence of carbohydrates[18-20].

3.1.2.3 Molisch's test

The mixture of leaf extract and two milliliters of Molisch's reagent were ready after giving it a good shake. The concentrated H_2SO_4 (02 milliliters) had to be gently poured down the side of the tube next. Carbohydrates were detected by the formation of a violet ring during the interphase[18-20].

3.1.3 Iodine test

The leaf extract was mixed with two milliliters of iodine solution. The hue changed to a deep blue or purple when the carbohydrate was present[18-20].

3.1.4 Test for phenols and tannins

The mixture contained the leaf extract and two milliliters of a 2% $FeCl_3$ solution. A blue-green or even black colour indicated the presence of tannins and phenols[18-20].

3.1.5 Test for flavonoids

3.1.5.1 Shinoda test

After mixing a tiny amount of magnesium ribbon bits and leaf extract, drops of strong hydrochloric acid were added. A few minutes later, a reddish-pink colour appeared, indicating the presence of flavonoids[18-20].

3.1.5.2 Alkaline reagent test

A 2% NaOH solution was added to two milliliters to prepare the leaf extract. The intense yellow colour that had been produced turned colorless when a few drops of diluted acid were added, suggesting the presence of flavonoids[18-20].

3.1.6 Test for saponins

3.1.6.1 Foam test: A few drops of each plant extract were dissolved in various solvents, diluted to a volume of 25 millilitres in distilled water, and vigorously stirred for almost ten minutes. The extract's ability to form layer foam suggested the presence of saponins. The 5 milliliters of distilled water were shaken hard and then the liquid was let to settle in a test tube with leaf extract. The presence of saponins was assumed because stable foam developed[18-20].

3.1.7 Test for glycosides

3.1.7.1 Liebermann's test

The leaf extract was mixed with two milliliters of acetic acid and two milliliters of chloroform. Ice was used to rock-cool the mixture. With extreme caution, H_2SO_4 was added. A shift in colour from violet to blue to green indicated the existence of the steroidal nucleus, or the glycine portion of the glycoside[18-20].

3.1.7.2 Salkowski's test

The leaf extract was mixed with two milliliters of chloroform. After that, 2 milliliters of concentrated H_2SO_4 were cautiously added and steadily stirred. A reddish-brown hue indicates the existence of the glycoside, also known as the steroidal ring[18-20].

3.1.7.3 Keller-kilani test

The leaf extract was combined with two milliliters of glacial acetic acid and one or two drops of a 2% $FeCl_3$ solution. To the combination, two milliliters of concentrated H_2SO_4 were added in a different test tube. At interphase, a brown ring would appear if cardiac glycosides were present[18-20].

3.1.8 Test for steroid

The 2milliliters of chloroform that had already been mixed with crude extract were treated side by side with concentrated H_2SO_4. In the presence of steroids, the lower layer of chloroform turned red. Two milliliters of chloroform were combined with the crude extract in an independent experiment. The mixture was then mixed with two milliliters of concentrated H_2SO_4 and acetic acid. The emergence of a greenish colour indicated the presence of steroids[18-20].

3.1.9 Test for terpenoids

After dissolving the leaf extract in two milliliters of chloroform, it was dried. Two milliliters of concentrated H_2SO_4 were added to this, and it was heated for approximately two minutes. There was a greyish colour due to the terpenoids[18-20].

3.1.10 Test for alkaloids

3.1.10.1 Mayers test: For every millilitre of plant extract diluted in various solvents, a few drops of reagents solution were added. Alkaloids were present when a pale or cream hue formed.

3.1.10.2.Hager's test: 0.5 ml of each plant extract diluted in various solvents was mixed with a few drops of Hager's reagent solution. The precipitate's yellow appearance suggested that alkaloids were present in the extracts.

3.1.10.3 Tannic test: 0.5 ml of each plant extract diluted in various solvents was mixed with a few drops of 10% tannic acid. The presence of alkaloids in the extracts was revealed by the formation of a buff-coloured precipitate.

The 2milliliters of 1% hydrochloric acid combined with a slow-heating leaf extract combination were used. Then, Wagner's and Mayer's reagents were added to the mixture. The turbidity of the precipitate that was formed indicated the presence of alkaloids[18-20].

3.2 Quantitativeanalysis

The method used determined the quantitative phytochemical analysis[21].

3.2.1 Total phenolic content

The modified Folin-Ciocalteu reagent method was utilized to evaluate the phenol content present in the water-based extract. 1 milliliter of plant extract, 2 milliliters of a 2% Na_2CO_3 solution, and 2.5 milliliters of a 10% Folin-Ciocalteu reagent were combined. The resulting mixture was allowed to incubate at room temperature for 15 minutes. The sample's absorbance was measured at 765 nm. Gallic acid (1 mg/ml) was used as a reference. To assure accuracy, we conducted three runs of each test. The standard curve was used to produce the gallic acid equivalent (mg/g of extracted material), which was used to show the results[21].

3.2.2 Total flavonoid content

3.2.2.1 Alkaline reagent test: After dissolving 1 millilitre of each herbal extract (leaf, stem, and root) in various solvents, a little amount of NaOH solution was added. The appearance of a yellow hue that vanished when diluted acid was added suggested the presence of flavonoids.

3.2.2.2 The ferric chloride test (FeCl3): The presence of flavonoids was revealed by the formation of a blackish precipitate when a few drops of FeCl3 were added to the herbal extracts.

We modified the aluminum chloride colourimetric method to determine the number of flavonoids present in it. A mixture was produced and left to stand at room temperature for thirty minutes. It included 1milliliter of plant extract sample, 3 milliliters of methanol, 2milliliters of 10% aluminumchloride, 1milliliter of potassium acetate, and 5milliliters of distilled water. At 420 nm, we measured the absorption. Quercetin (1 mg/ml) was used as a reference. Using the standard curve, the number of flavonoids in the isolated product was calculated and expressed as mg/g of quercetin equivalent[21].

4. StatisticalAnalysis

A t-test was utilized to analyses the plant samples. The established technique revealed that the values of 0.0001 had a significant difference [22].

5. RESULTS

5.1 Evaluating the air quality at the sampling sites

Figures **1** and **2**show the concentrations of CO, NO, NO2, SO2, O3, and UV at the major road traffic and control sites respectively, it was recorded that, compared to the control sites, the air quality concentrations on the road traffic were higher. Between the road traffic and the control sites was a statistically significant difference in the mean of the total air quality index values (159.1<255.4).

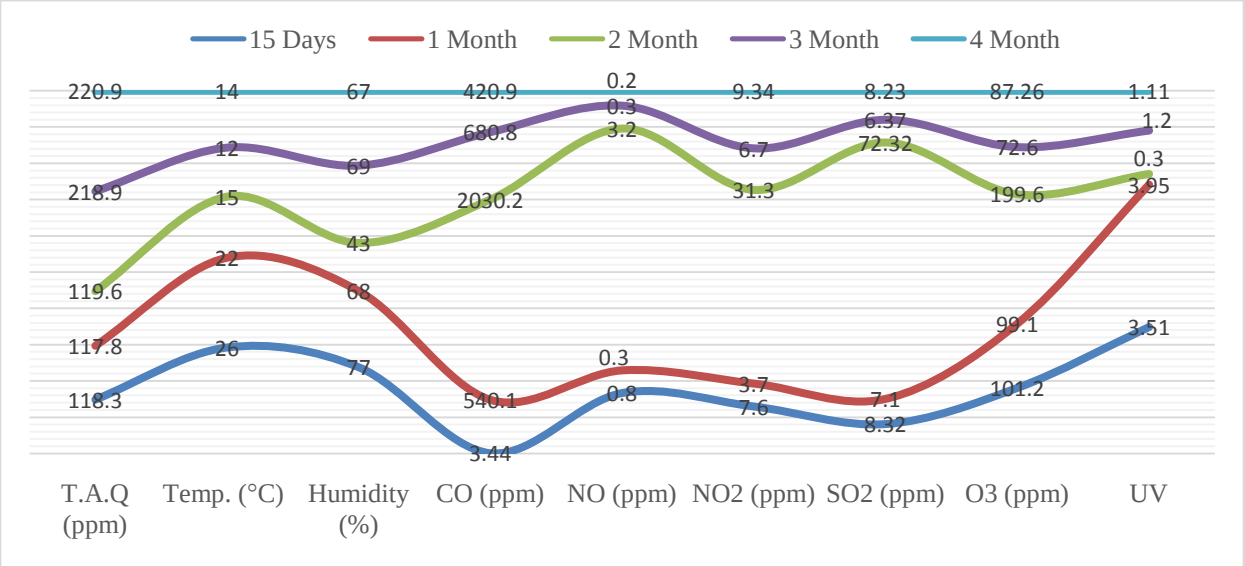


Fig. 1: Variable gas concentrations at the under-control site

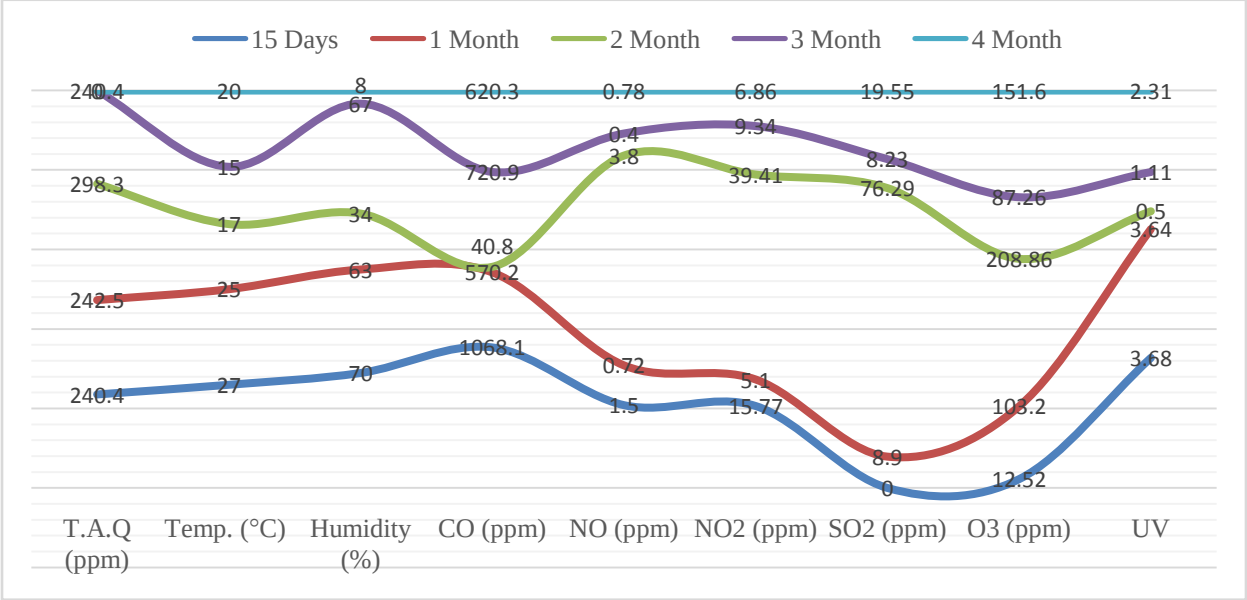


Fig. 2: Variable gas concentrations at the under-road trafficsite

5.2 Qualitative analysis

Tables 1and 2, showedqualitative analysis (protein, carbohydrate, iodine, phenol, tannin, flavonoids, saponin, glycosides, steroid, terpene, and alkaloid) demonstrates that throughout the observation period, the quality of qualitative phytochemical substances was shown to be bad under the road traffic. The quality of qualitative phytochemical substances was seen to be better for the crop growing away from road traffic.

Qualitative Substances	15 Days	1 Month	2 Month	3 Month	4 Month
Protein	+	+	+	+	+
Carbohydrate	+	+	+	+	+
Iodine	-	+	+	+	+
Phenol	+	+	+	+	+
Tannin	-	+	+	+	+
Flavonoids	+	+	+	+	+
Saponin	-	+	+	+	+
Glycosides	+	+	+	+	+
Steroid	+	+	+	+	+
Terpene	+	+	+	+	+
Alkaloid	+	+	+	+	+

Table. 1: The qualitative substances under the Control site

Qualitative Substances	15 Days	1 Month	2 Month	3 Month	4 Month
Protein	-	-	+	+	+
Carbohydrate	+	+	-	+	+
Iodine	-	-	+	-	-
Phenol	-	-	+	-	+
Tannin	-	+	-	-	-
Flavonoids	-	-	+	-	+
Saponin	-	+	+	+	-
Glycosides	+	-	+	+	+
Steroid	+	-	-	+	-
Terpene	+	-	+	+	-
Alkaloid	-		-	+	-

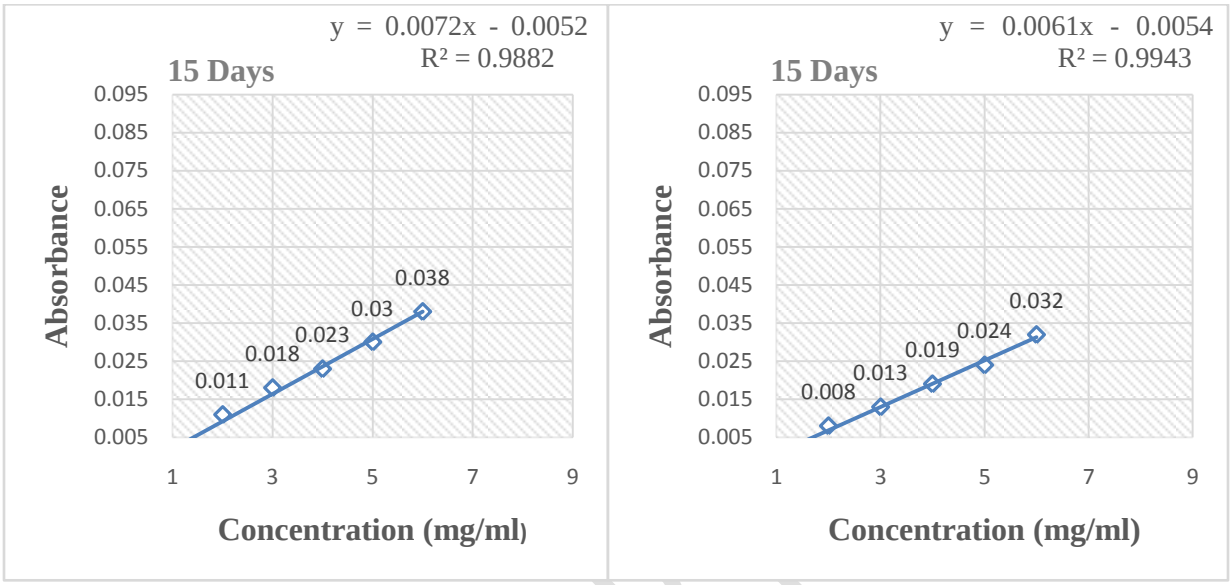
Table. 2: The qualitative substances under the road trafficsite

5.3 Quantitativeanalysis

5.3.1 Total phenolic content

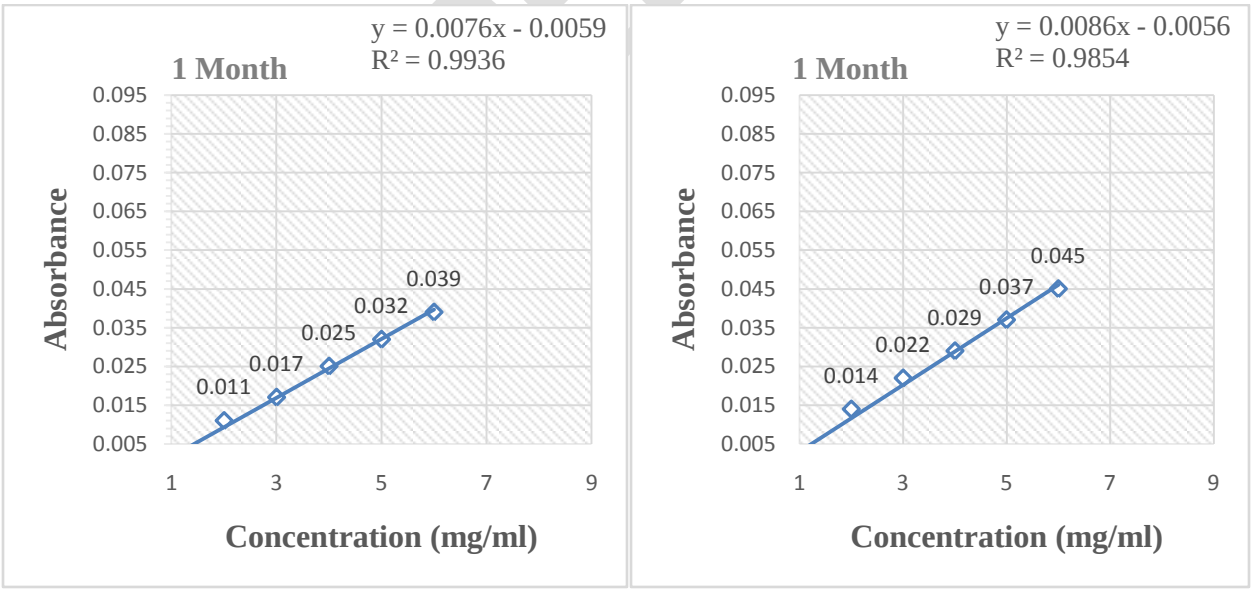
Figures 3 and 4showed that during the investigation, we were able to show that crops planted close to busy road traffic had lower levels of these quantitative phytochemical substances, whereas the control sites had higher levels of total phenolic content values. Research indicates that, whereas these characteristics were lacking from the road traffic, they were present in the leaves of the control sites. With a total mean value of (0.03712 > 0.03176), the results

demonstrate that the total phenolic content levels at the road traffic and the control sites differed substantially. The control and road traffic site data showed a statistically significant difference (Variance <0.0001).



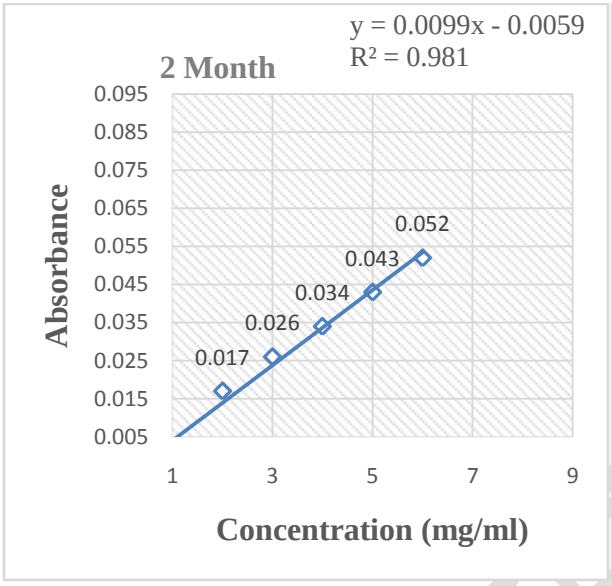
A - C.S 15 Days

B - R.T. S 15 Day

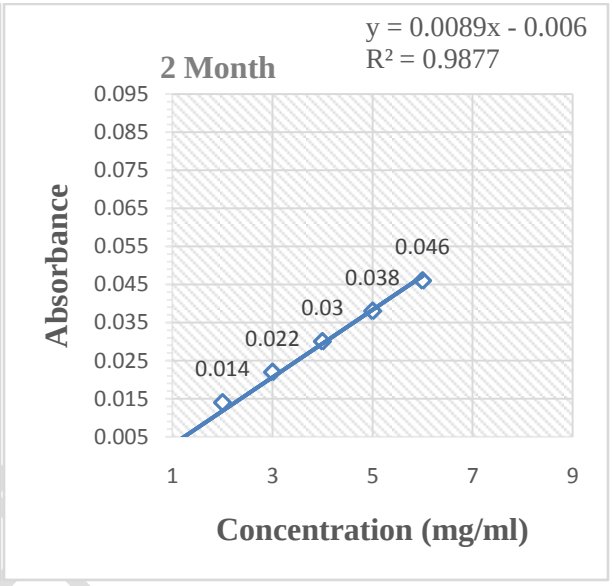


C - C.S 1 Month

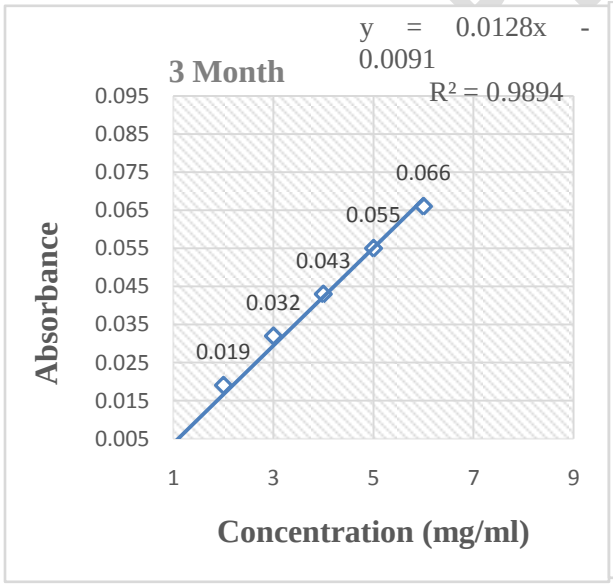
D - R.T. S 1 Month



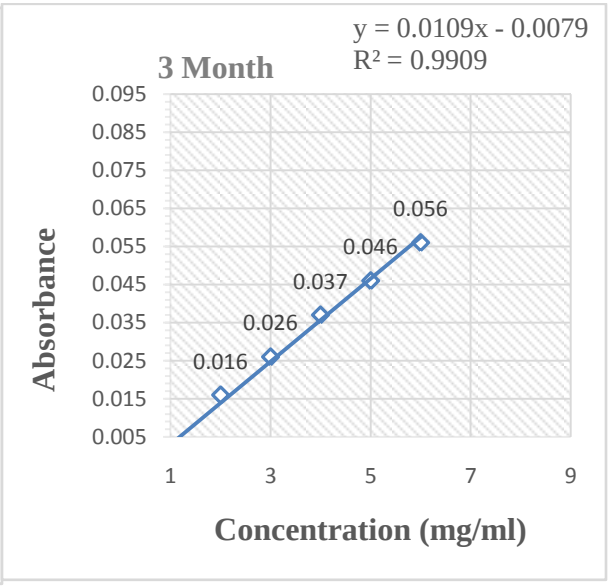
E - C.S 2 Month



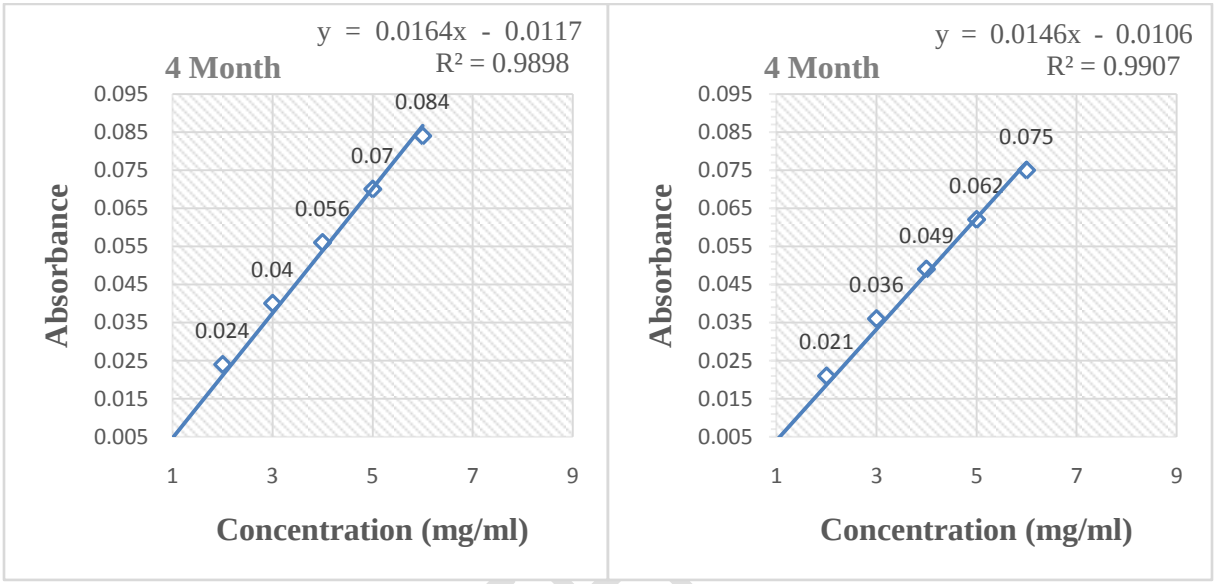
F - R.T.S 2 Month



G - C.S 3 Month



H - R.T.S 3 Month



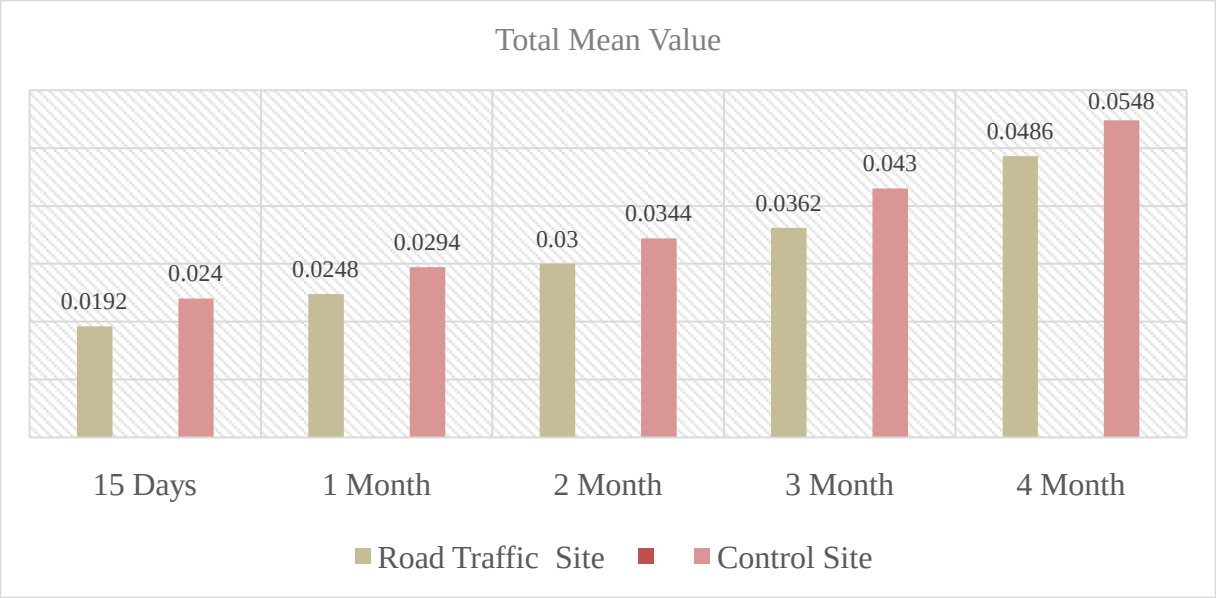
I - C.S 4 Month

J - R.T.S 4 Month

C.S – Control Site

R.T.S –Road Traffic Site

Fig. 3: The standard curve showing the total phenolic content value at various intervals under the control and road traffic sites

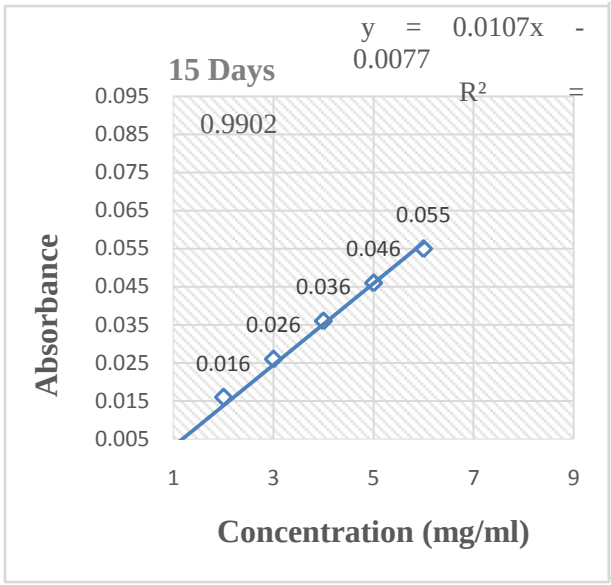


Significant at: Variance = 0.0001 (Variance < 0.05 is considered very high significant).

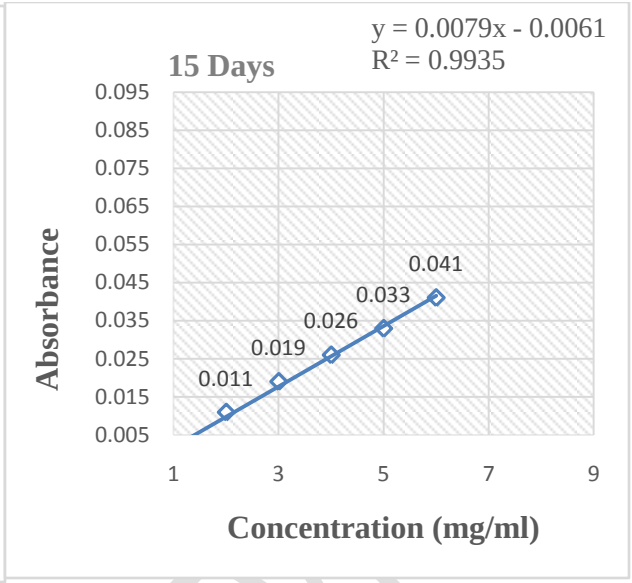
Fig. 4: The total mean values at the level of total phenolic content that were calculated for the under-road traffic and control sites

5.3.2 Total flavonoidcontent

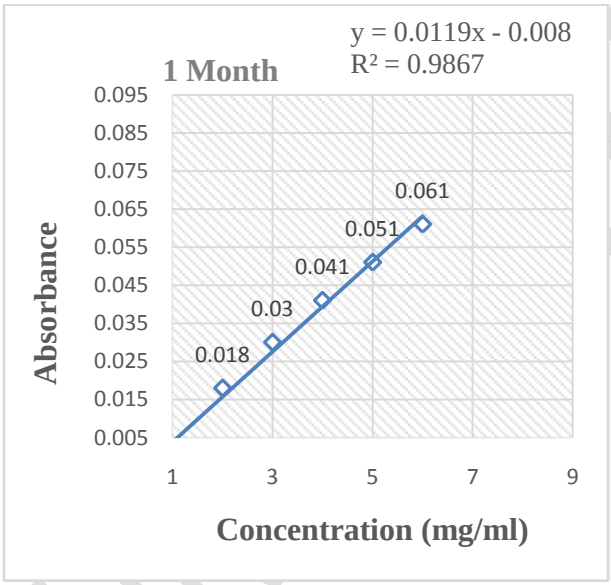
Figures 5and 6showed that during the investigation, we were able to show that crops planted close to busy road traffic had lower levels of these quantitative phytochemical substances, whereas the control sites had higher levels of total phenolic content values. Research indicates that, whereas these characteristics were lacking from the road traffic, they were present in the leaves of the control sites. With a total mean value of (0.04696 > 0.03764), the results demonstrate that the total flavonoid content levels at the road traffic and the control sites differed substantially. The control and road traffic site data showed a statistically significant difference (Variance <0.0001).



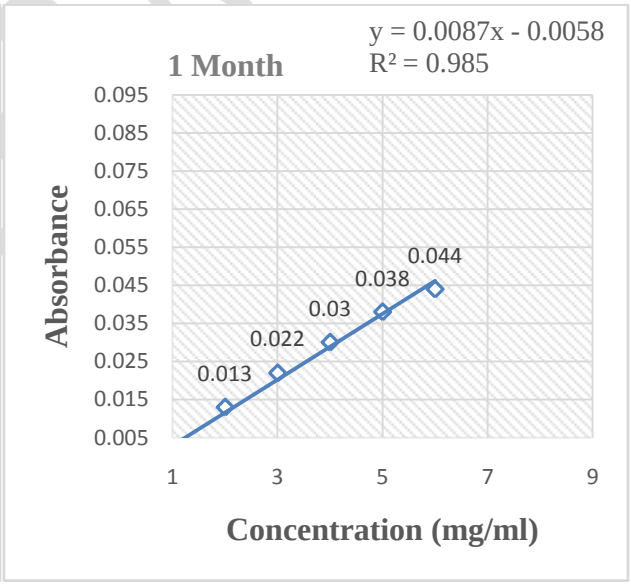
A - C.S 15 Days



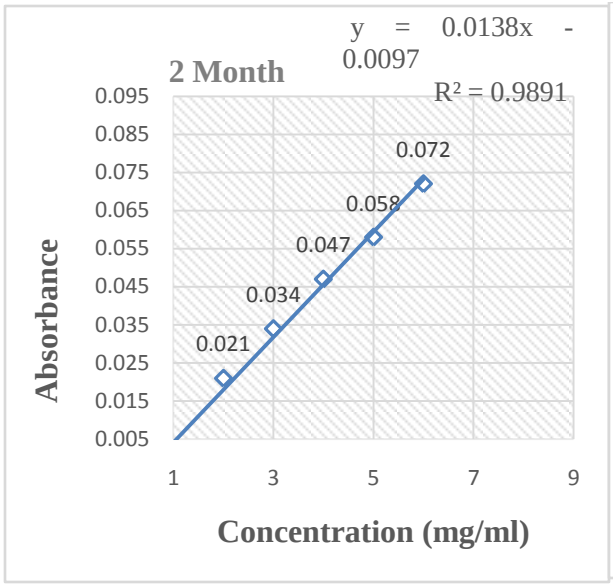
B - R.T. S 15 Day



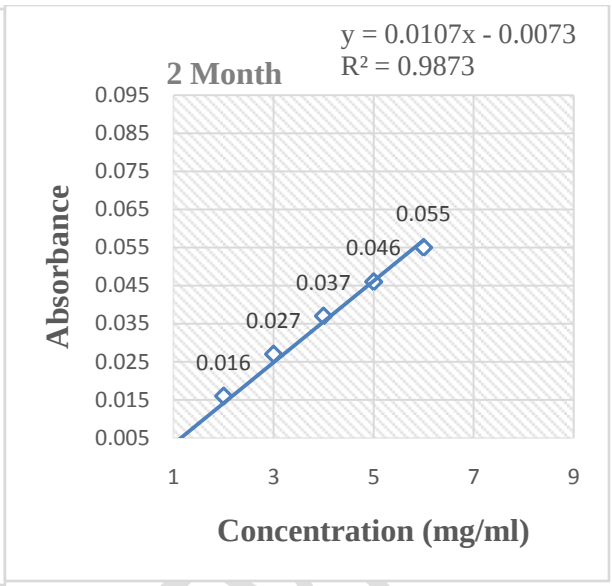
C - C.S 1 Month



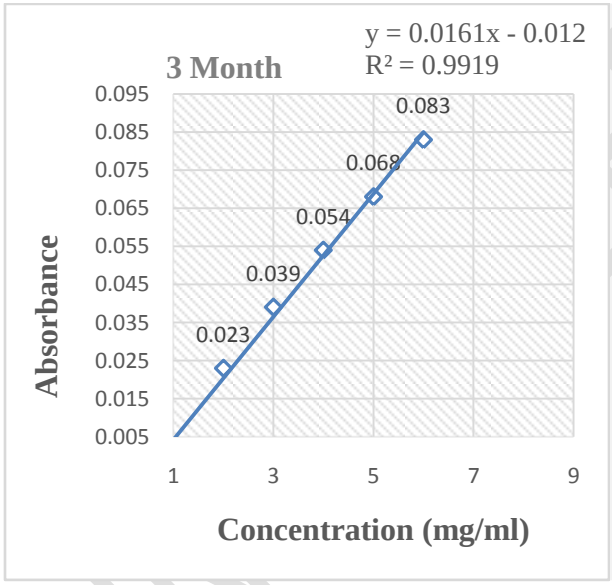
D - R.T. S 1 Month



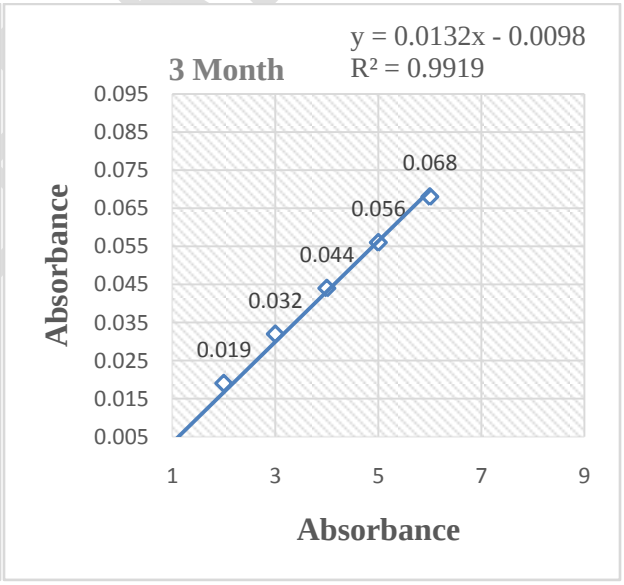
E - C.S 2 Month



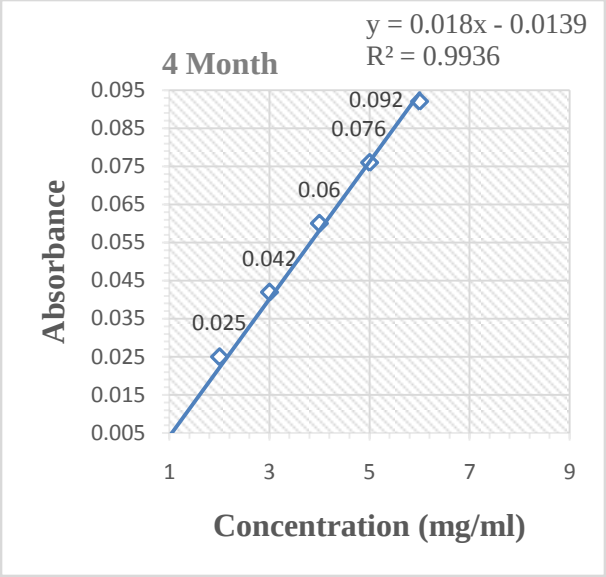
F - R.T.S 2 Month



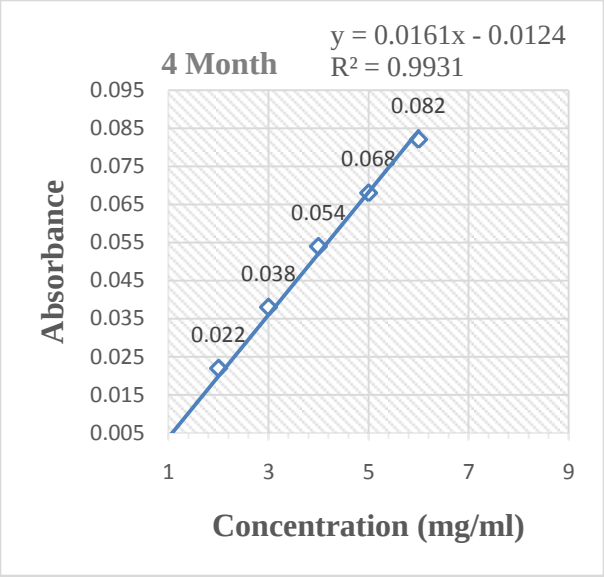
G - C.S 3 Month



H - R.T.S 3 Month



I - C.S 4 Month

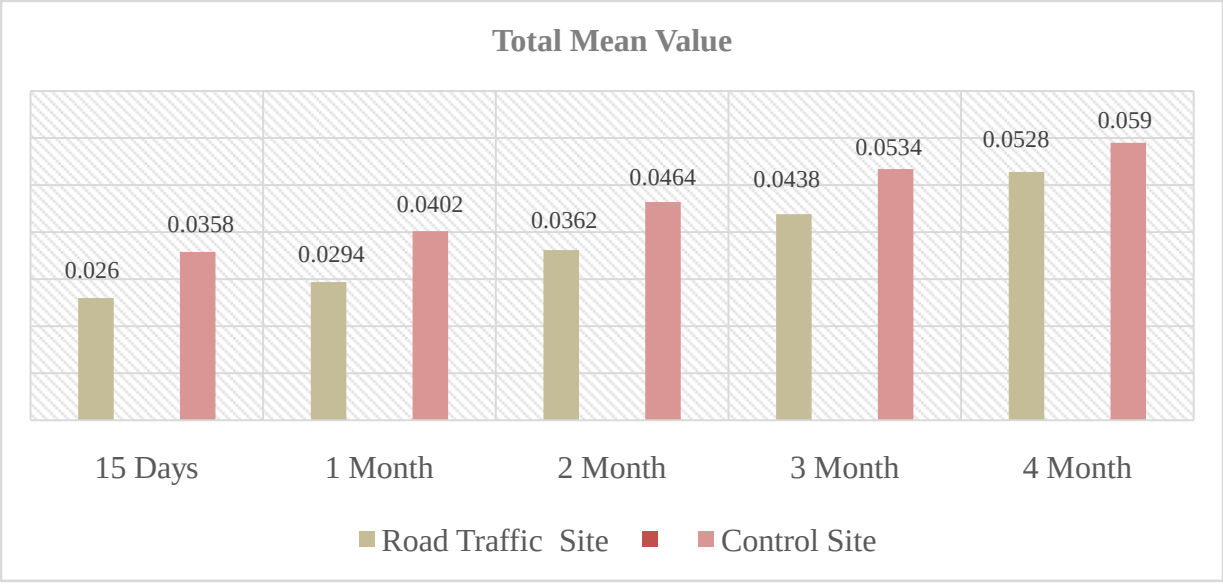


J - R.T.S 4 Month

C.S – Control Site

R.T.S – Road Traffic Site

Fig. 5: The standard curve showing the total flavonoid content value at various intervals under the control and road traffic sites



Significant at: Variance = 0.0001(Variance < 0.05 is considered very high significant).

Fig. 6: The total mean values at the level of total flavonoid content that were calculated for the under-road traffic and control sites

6. DISCUSSION

The observed concentrations of carbon monoxide (CO), nitrogen monoxide (NO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), and ultraviolet (UV) radiation at prominent road traffic and control locations revealed elevated air quality levels at the road traffic sites in comparison to the control sites. Between the road traffic and the control sites was a statistically significant difference in the mean of the total air quality index values (159.1<255.4).The qualitative analysis (protein, carbohydrate, iodine, phenol, tannin, flavonoids, saponin, glycosides, steroid, terpene, and alkaloid) demonstrates that throughout the observation period, the quality of qualitative phytochemical substances was shown to be bad under the road traffic. The quality of qualitative phytochemical substances was seen to be better for the crop growing away from road traffic.The record showed that the qualitative substances analysis (protein, carbohydrate, iodine, phenol, tannin, flavonoids, saponin, glycosides, steroid, terpene, and alkaloid) the quality of qualitative phytochemical substances is seen to be negative in the crop growing on the roadside, control site the quality of qualitative phytochemical substances is seen to be positive in the crop growing away from the road. The recorded quantitative data were analyzed as a total mean value of total phenolic content (0.03712 > 0.03176) and the total mean value of total flavonoid content (0.04696 > 0.03764) between the control and road traffic sites. The control and road traffic site data were statistically significant the total phenolic content (Variance <0.0001) and total flavonoid content (Variance <0.0001).

The primary parameters of *P. oleracea* L., namely protein, carbohydrate, iodine, phenol, tannin, flavonoids, saponin, glycosides, steroid, terpene, and alkaloid, were quantified using phytochemical estimation. As previously mentioned, plant samples were gathered from garden areas and roadside locations that were exposed to air pollution caused by vehicle emissions. For leaves, a separate phytochemical study was performed [14].Shows the total phenolic and flavonoid content of plant extracts. Comparing *F. carica* L. from a polluted location to one from a non-polluted site, the total phenolic compounds in the former (45.23 mg/g) were lower. *F. carica* L. from the polluted location had a lower level of total flavonoids (13.08 mg QE/g) than the non-polluted site (14.76 mg QE/g) [16]. The contents of total flavonoids and total phenolics in various pomegranate leaf extracts were displayed. The obtained data indicated that seasons and areas were substantial ($p<0.05$) variations in TPC and TFC. The TPC and TFC varied more in the summer than in the spring in polluted versus unpolluted areas. The results of the Tukey mean comparison indicated that during the summer and spring, there was a significant difference ($p<0.05$) in the TPC and TFC contents of distinct pomegranate leaves between polluted and unpolluted areas [5].In comparison to the floral extract, the phenolic content of the leaf extracts of *Ocimum* and *Moringa* was found to be significantly higher ($P<0.001$) in the methanolic extract. *Ocimum* flower extract had a phenolic content that was 60.18 percent greater than that of

Moringa flower extract. In comparison to their flower extract, we discovered that the phenolic content of *Ocimum* leaves increased by 26.01%, whereas the phenolic content of *Moringa* leaves increased by 111%. The total phenolic content of *M. oleifera* L. and *O. tenuiflorum* L. is high in both their leaf and flower extract extracts, ranging from 2.28 to 2.18 mg/mL and 1.08 to 1.73 mg/mL, respectively [23]. The methanolic leaf and floral extracts of *O. tenuiflorum*L. and *M. oleifera* L. had a considerably greater total flavonoid concentration (P<0.001). *Ocimum* leaf and flower content was 4.47 mg/mL and 4.54 mg/mL, respectively, compared to 4.44 mg/mL for *Moringa*. The *Ocimum* flower had a flavonoid concentration that was 1.56% higher than that of the leaf extract, whereas the *M. oleifera* L. leaf extract had a flavonoid content that was 0.68% higher. *Ocimum* plant extract has a higher total flavonoid concentration than *Moringa* plant extract, according to our results[24], this study examined the total phenol and flavonoid levels of two cultivars of *E. angustifolia* L. The results showed that the Fariman version methanolic extracts contained higher flavonoids and phenolic components than the Mashhad variant One of the many factors influencing plant secondary metabolite levels, especially phenolic compounds, is climate. In this study, the total flavonoid and phenolic content of plants growing in the DI Khan district were examined. The present study's total phenolic contents ranged from 47±1.24 to 215±1.24 mg GAE/100 g, with *Citrullus lanatus* L. and *Fragaria vesca* L. showing the highest values, according to a gallic acid standard curve (R2 = 0.9896). Using the catechin standard curve (R2 = 0.9762), Flavonoid concentrations ranged from 15±0.81 to 73±0.81 mg CE/100 g, with *C. lanatus* L. and *F. vesca* L. exhibiting the greatest flavonoid contents. Flavonoids and phenolic compounds were least abundant in *Cucumis melo* L. The plants that have the largest concentrations of phenolic and flavonoid chemicals include *Vitis vinifera* L., *F. vesca* L., and C. *lanatus*L., according to these data [25].

7. CONCLUSION

The outcomes of the research substantiate those diverse manifestations of vehicular road traffic congestion precipitate air pollution in the road traffic environment, eliciting deleterious consequences. In addition to the fact that these objective qualities showed that crops are adversely affected by some gases (CO, NO, NO2, SO2, O3, and UV), agricultural air pollution is currently a significant health hazard. The quality of both qualitative and quantitative phytochemical substances is shown to be better in the crop growing away from the road traffic and is observed to be less in the crop growing on the road traffic site.

8. FUTURE PERSPECTIVES

Outlined are the primary objectives of the analysis aimed at discerning and comprehending the effects of emissions on diverse plant species. The acquisition of qualitative and quantitative data is crucial for accurately pinpointing the specific impacts of plant emissions. This could be useful in assessing the environmental pollution risk. It is important to ensure *S. tuberosum* L. leaves are also good fodder for livestock and there should be security of edible parts. Roadside crops are

negatively impacted by traffic air pollution. To prevent pollution caused by road traffic, trees should be planted on both sites of the road. Fewer vehicles should be utilized, electric vehicles should be used, and crops should be grown farther away from busy roads.

10. POTENTIAL FOR CONFLICT OF INTEREST. Exactly zero.

11. REFERENCES

1. Hashad, K., Yang, B., Gallagher, J., Baldauf, R., Deshmukh, P., & Zhang, K. M. (2023). Impact of roadside conifers vegetation growth on air pollution mitigation. ***Landscape and Urban Planning,*** *22*(9), 104594
2. Singh D, Sharma M. K, Sharma M. K, Singh M. (2023). Assessment of Physical and Biochemical Qualities of *Solanum tuberosum* L. Under Roadside Traffic Polluted Area. ***Curr Agri Res.*** 11(3). doi : http://dx.doi.org/10.12944/CARJ.11.3.29
3. Ullah, R., Tsui, M. T. K., Chow, A., Chen, H., Williams, C., &Ligaba-Osena, A. (2023). Micro (nano) plastic pollution in terrestrial ecosystem: emphasis on impacts of polystyrene on soil biota, plants, animals, and humans. ***Environmental Monitoring and Assessment,*** 195(1), 252.
4. Makuch-Pietras, I., Grabek-Lejko, D., Górka, A., & Kasprzyk, I. (2023). Antioxidant activities in relation to the transport of heavy metals from the soil to different parts of *Betula pendula* L., Journal ***of Biological Engineering,*** *17*(1), 1-25.
5. Ben Amor, A., Rahmani, R., Bennani, L., Ben Yahia, L., Ben AtiaZrouga, K., Chaira, N., &Nagaz, K. (2023). Investigation of phenolic compounds potential to reduce dust pollution of pomegranate trees. ***International Journal of Phytoremediation,*** *25*(4), 430-440.
6. Cui, N., Qu, L., & Wu, G. (2022). Heavy metal accumulation characteristics and physiological response of *Sabina chinensis* L. and *Platycladusorientalis* L. to atmospheric pollution**.** ***Journal of Environmental Sciences,*** *11*(2), 192-201.
7. Muthu, M., Gopal, J., Kim, D. H., & Sivanesan, I. (2021). Reviewing the impact of vehicular pollution on road-side plants future perspectives. ***Sustainability,*** *13*(9), 5114.
8. Kumar, A and Arya, H. (2022). Phytochemical analysis and synergistic larvicidal action of *Argemonemexicana* L. against third instar larvae of *Aedes aegypti* (Diptera: Culicidae). ***Journal of Science Innovations and Nature of Earth***,*2*(1), 14-20.
9. Kumar, A and Arya, H. (2023). Phytochemical screening and larvicidal evaluation of leaf extract of *Tinosporacordifolia* L. against third instar larvae of *Aedes aegypti* (Diptera: Culicidae). ***International Journal of Entomology Research***,*8*(4), 11-19.
10. Ben Amor, A., Ben AtiaZrouga, K., Chaira, N., Ben Yahia, L., &Nagaz, K. (2021). Identification and Characterization of Phenolic and Flavonoids Compounds Extracted from Tunisian Pomegranate Fruit Peel Exposed to Air Pollution: Gabes City, Tunisia. ***Pollution,*** *7*(2), 435-444.

11. Harrison, R. M., Allan, J., Carruthers, D., Heal, M. R., Lewis, A. C., Marner, B., & Williams, A. (2021). Non-exhaust vehicle emissions of particulate matter and VOC from road traffic: A review. ***Atmospheric Environment,*** *262*, 118592.
12. Fliou, J., Riffi, O., Amechrouq, A., Elhourri, M., El Idrissi, M., Ahlafi, H., &Lhachimi, Z. (2020). Phytochemical screening and analysis of heavy metals of *Nerium oleander* L. leaves. ***Mediterranean J Chem,*** *10*(4), 346-354.
13. Azzazy, M. F. (2020). Plant bioindicators of pollution in Sadat city, Western nile Delta, Egypt. ***PLoS One,*** *15*(3), e0226315.
14. Negi, S. (2018). Quantitative phytochemical analysis of *Portulaca oleracea* L. Growing in unpolluted and polluted area. ***The Pharma Innovation,*** *7*(5, Part I), 619.
15. Molefe, N. I., Mogale, M. A., &Gololo, S. S. (2018). Qualitative and Quantitative Phytochemical Analysis of Leaves and Roots of *Barleriadinteri* L. and *Varying Exposure* L. to Road-Dust Pollution. ***Asian Journal of Chemistry,*** *30*(11), 2521-2526.
16. Radwan, A. M., Reyad, N. F., &Ganaie, M. A. (2018). Comparative studies on the effect of environmental pollution on secondary metabolite contents and genotoxicity of two plants in Asir area, Saudi Arabia. ***Tropical Journal of Pharmaceutical Research***, *17*(8), 1599-1605.
17. Joshi, P. C. & Swami, A. (2007). Physiological responses of some tree species under roadside automobile pollution stress around city of Haridwar, India. ***Environmentalist,****27*(3), 365-374.
18. Sofowora, A. (1993). Medicinal plants and traditional medicine in Africa. Spectrum Books Limited. *Ibadan, Nigeria*, 1-153.
19. Trease, G.E., Evans, W.C. (1989). Pharmacognosy, *11th edn. Bailliere Tindall*, *London*, pp. 45-50.
20. Harborne, J.B. (1973). Phytochemicals Methods. *Chapman and Hall Ltd., London*, pp. 49-188.
21. Aiyegoro, O. A., & Okoh, A. I. (2010). Preliminary phytochemical screening and in vitro antioxidant activities of the aqueous extract of *Helichrysumlongifolium* L. DC. ***BMC complementary and alternative medicine,*** *10*(1), 1-8.
22. Gomez, K. A. & Gomez, A. A. (1984). *Statistical procedures for agricultural research*. Johnwiley& sons.
23. Sankhalkar, S., & Vernekar, V. (2016). Quantitative and Qualitative analysis of Phenolic and Flavonoid content in *Moringa oleifera* L. and *Ocimumtenuiflorum* L. ***Pharmacognosy research,*** *8*(1), 16.
24. Schwartz, E., Tzulker, R., Glazer, I., Bar-Ya'akov, I., Wiesman, Z., Tripler, E., & Amir, R. (2009). Environmental conditions affect the color, taste, and antioxidant capacity of 11 pomegranate accessions' fruits. ***Journal of Agricultural and Food Chemistry,*** *57*(19), 9197-9209.

25. Saeed, A., Marwat, M. S., Shah, A. H., Naz, R., Abidin, S. Z. U., Akbar, S., & Saeed, A. (2019). Assessment of total phenolic and flavonoid contents of selected fruits and vegetables. ***Indian Journal of Traditional Knowledge*** *(IJTK), 18*(4), 686-693.