Results

18) Plant extraction and identification of the chemical composition of the essential oils of the plants:

Extraction of plant material was carried out by two methods:

a) Solvent extraction (ethanol):

The yields (w/w) of ethanol extracts from parsley seeds, ginger buds, turmeric rhizomes and rocket seeds yielded amounts of 12.7%, 23.4%, 18.6% and 14.7% respectively.

b) Steam distillation:

The yield (w/w) of volatile extracts from parsley seeds, ginger buds, turmeric rhizomes and rocket seeds yielded amounts of 2.3%, 3.4%, 4.8% and 1.6% respectively and then the chemical composition of the essential oils were identified using GCMS.

19) Chemical composition of the essential oils:

a) Chemical composition of the essential oil of Parsley:

The numerical information tabulated in table (2) showed that the volatile oil of parsley seeds consisted of 21 constituents, Myristicin was the major constituent (44%) followed by Apiol 16.08% then Copaene 13.39% while α -pinene and Camphene were found in 6.91%and 4.74% respectively other constituents were identified in essential oil of parsley seeds namely, α and β pinene, Camphene, myrecene, Limonene, γ terpinene, Myretenal and Caratol.

Table (2): Chemical composition of the essential oil of Parsley (identification method MS & KI)

Name of compounds	RT	CONC%	Chemical class
Unknown	5.07	0.12	Unknown
α-Pinene	9.96	13.67	M
Camphene	10.22	4.74	M

Continued

Limonene	11.97	0.04	M
Sabiene	12.14	0.3	M
Linalool	13.45	0.65	LOC
β-Cymene	14.45	0.12	M
Phellendrene	17.50	0.18	M
Careen	18.33	0.03	M
γ-Terpinene	22.83	0.05	M
Elemene	23.32	2.1	S
B-Cymenene	23.72	0.04	M
B-1,3,8-Menthatriene	24.89	0.17	S
Thymol	25.66	0.07	LOC
Decanal	26.07	0.1	LOC
Myretenal	26.95	1.17	LOC
Copaene	28.71	13.39	S
Caryophyllene	29.83	0.08	S
Myristicin	33.31	44	S
Caratol	33.98	2.9	HOC
Apiol	34.01	16.08	HOC

* RT: retention time. CONC. %: concentration %

M: Monoterpene hydrocarbons LOC: Oxygenated monoterpenes.

HOC: Oxygenated sesquiterpenes S: Sesquiterpenes hydrocarbons.

KI: Kovat's indices MS: Mass spectrometry.

b) Chemical composition of the essential oil of Ginger:

Table (3) showed that the essential oil of ginger rhizomes consists of 38 components which were dominated mostly by four constituents represented about 79.13 % of the plant extract (zingibrene, δ-Amorphen, α-Curcumin and α-Bisabolene at concentrations 37.65, 19.76, 11.32 and 10.40 respectively).

Table (3): Chemical composition of the essential oil of Ginger **(**Identification method MS & KI):

Name of compounds	RT	CONC%	Chemical class
α-Pinene	9.69	0.10	M
Camphene	10.22	0.68	M
β-Pinene	11.63	1.96	M
Myrcene	15.21	2.45	M
α-Phllandrene	15.92	0.06	M
β-Phllandrene	16.52	0.09	M

Continued

Camphor	16.77	0.12	LOC
Cis Ocimene	17.39	3.23	M
1-Borneol	17.60	0.16	LOC
4-Terpineol	18.08	0.57	LOC
α-Terpineol	21.03	0.17	LOC
Verbenone	21.82	0.09	LOC
Geraniol	22.74	0.32	HOC
Geranial	22.93	0.69	HOC
α-Copaene	22.95	0.12	S
Bornyl acetate	23.30	1.18	HOC
x-Elemene	23.62	0.50	S
Sesquithujene	24.06	0.17	S
Cyclo isosativene	24.33	0.79	HOC
Allaromadendrene	25.09	0.78	S
β-Elemene	24.95	0.97	S
α-Muurolene	25.47	0.11	S
α-Curcumin	25.82	11.32	S
δ-Selinene	26.08	0.10	S
Zingibrene	26.11	37.65	S
β-Bisabolene	26.36	0.56	S
α-Bisabolene	26.72	10.40	S
δ-Amorphen	27.12	19.76	S
Zingibrenol (R)	27.67	1.26	HOC
Zingibrenol (S)	28.34	0.30	HOC
Veridiflorol	28.73	0.09	HOC
γ-Cadinol	28.90	0.50	HOC
Cis-Nerolidol	29.09	0.27	HOC
Trans-Caryophyllene	29.29	0.46	S
(+)-8-Cedren-9-ol	29.53	0.08	HOC
Farnesylacetate	29.86	0.48	HOC
β-Tumerone	30.15	0.62	HOC
Torreyol	30.56	0.22	HOC

* RT: retention time. CONC. %: concentration %

M: Monoterpene hydrocarbons LOC: Oxygenated monoterpenes.

HOC: Oxygenated sesquiterpenes S: Sesquiterpenes hydrocarbons.

KI: Kovat's indices MS: Mass spectrometry.

c) Chemical composition of the essential oil of Turmeric:

As shown in table(4) the chemical composition of turmeric essential oil in current analysis consisted of 39 component and was totally dominated by the presence of Curcumene, Valencene, Bisabolene, Zingibrene and at percentages of 39.84, 18.04, 16.49 and 11.41 respectively.

Table (4): Chemical composition of the essential oil of Turmeric**(**Identification method MS & KI):

Name of compounds	RT	CONC%	Chemical class
Cis-3-Hexanal	3.3	0.07	LOC
Camphene	10.2	0.26	M
1,8-Cineole	12.95	0.24	LOC
Linalool	13.45	0.37	LOC
Phellandrene	13.92	0.09	M
Borneol	17.28	1.68	LOC
β-Menth-1-en-8-ol	18.74	0.15	LOC
(+)-Cyclosativene	22.76	0.24	S
α-Copaene	22.95	0.48	S
Elemene	23.32	0.62	S
α-Humulene	23.69	0.34	S
Trans-Cyclocaryophyllene	24.07	0.14	S
A-Bergamotene	24.41	0.30	S
α-Salinene	24.80	0.16	S
Trans-Famesene	24.96	0.65	S
Allaromadendrene	25.09	0.41	S
Valencene	25.45	18.04	S
α-Curcumene	25.69	39.84	S
Zingibrene	26.11	11.41	S
β-Bisabolene	26.36	16.49	S
Sesquiphellandrene	26.77	0.09	S
β-Curcumene	27.21	0.18	S
Elemol	27.35	0.85	HOC
Germacrene B	27.53	0.53	S
Nerolidol	27.71	0.55	HOC
Trans-sesquisabinene hydrate	28.36	0.57	HOC
Zingibrenol	28.93	0.54	HOC
10-Epi-g-eudesmol	29.06	0.89	HOC
Isoaromadendrene epoxide	29.26	0.69	HOC
Caratol	29.53	0.63	HOC
β-Eudesmol	29.85	0.17	HOC
β-Cedrene	30.40	0.57	HOC
(+)-8-Cedren-9-ol	30.94	0.13	HOC
(-)-Carophyllene oxide	32.30	0.55	HOC
1,4-Trans-1,7-Transacorenone	33.34	0.11	HOC
Geranyllinalool Isomer	35.49	0.10	HOC
ar-Curcumene	36.27	0.11	S
Unknown	43.62	0.11	Unknown
Fonenol	45.75	0.11	HOC

* RT: retention time. CONC. %: concentration %

M: Monoterpene hydrocarbons LOC: Oxygenated monoterpenes.

HOC: Oxygenated sesquiterpenes S: Sesquiterpenes hydrocarbons.

KI: Kovat's indices MS: Mass spectrometry.

d) Chemical composition of the essential oil of Rocket:

The GCMS analysis revealed that rocket essential oil consisted of 20 components. The main component was Erucin which represented about 78.6% followed by Erucin nitrile and β-Ionone at concentrations of 7.46 and 4.1 respectively (table 5).

Table (5): Chemical composition of the essential oil of Rocket **(**Identification method MS & KI):

Name compounds	RT	CONC%	Chemical class
Allylnitryl	3.19	0.19	S
5-Methyl-hexanenitril	5.06	1.39	S
Tetrahydro thiophene	6.11	0.4	HOC
Heptanal	8.77	0.13	HOC
α-Pinene	9.69	0.16	M
Allyl Isothiocyanate	10.13	0.45	HOC
3-Butyl Iso-thiocyanate	10.15	0.3	HOC
4-Methylpentylisothiocyanate	10.63	0.1	HOC
β-Pinene	11.63	0.36	M
2-Phenylacetaldehyd	10.73	0.1	HOC
Limonene	11.97	0.6	M
Linalool	13.45	0.7	LOC
Hexadecanoic Acid	13.48	0.08	LOC
Erucin nitrile	15.75	7.46	S
β-Ionone	20.47	4.1	S
Octanoic acid	27.22	1.49	HOC
Erucin	28.43	78.6	S
Phytol	28.91	0.87	HOC
Pentadecanoic Acid	31.62	2.4	HOC
Tricosane	37.48	0.12	S

* RT: retention time. CONC. %: concentration %

M: Monoterpene hydrocarbons LOC: Oxygenated monoterpenes.

HOC: Oxygenated sesquiterpenes S: Sesquiterpenes hydrocarbons.

KI: Kovat's indices MS: Mass spectrometry.

20) Antifungal and anti-aflatoxigenic effects:

a) The effect of parsley essential oil and ethanolic extract on *A. flavus*:

Results in table (6) indicated that the concentrations 0.02 to 1.0 % of parsley essential oil led to gradual inhibition of *A. flavus* growth ranged from 33.82 to 63.97% (Fig. 3).

Fig. (4) and table (7) revealed that 0.02% and 0.6% of parsley ethanolic extract caused inhibition of *A. flavus* reached to 80.93%; meanwhile complete inhibition was achieved by using concentration of 3% of parsley essential oil.

b) The effect of ethanolic extract of parsley on inhibition of aflatoxins:

Table (8) showed inhibition of *A. flavus* ability to produce aflatoxin B_1ranged from 10.5 to 97% using concentrations of 0.02 to 2% respectively and complete inhibition of AFB_1 (inhibition over 95% was considered complete inhibition) was observed on using 3% of the plant extract (Fig. 5).

Data in table (9) showed gradual inhibition of *A. flavus* ability to produce aflatoxin G_1 ranged from 27.7 to 86.9% at 0.02 to 0.4% respectively while using 0.6% caused complete inhibition of AFG_1 production (Fig. 6).

Table (10) revealed that the inhibition of *A .flavus* ability to produce AFB_2 increased by increasing the plant extract concentration from 31.3 to 83.3% using concentrations of 0.02% to 0.4% respectively while complete inhibition of AFB_2 was recorded on applying 0.6% of the plant extract, (Fig. 7).

Data in table (11) showed that using 0.02% of parsley extract showed 29.2% inhibition of aflatoxin G_2 production. Complete inhibition of AFG_2 production was observed by using 2% of the plant extract (Fig. 8).

Table (6): Antifungal effect of the essential oil of parsley:

Concentrations % of parsley essential oil	0.02	0.04	0.06	0.1	0.2	0.4	0.6	1.0
Inhibition %	33.82± 1.73	31.02± 0.577	47.05± 1.154	46.69± 1.732	54.22± 2.309	61.02± 0.577	60.29± 0.0	63.97 ± 1.65

LSD = 1.153

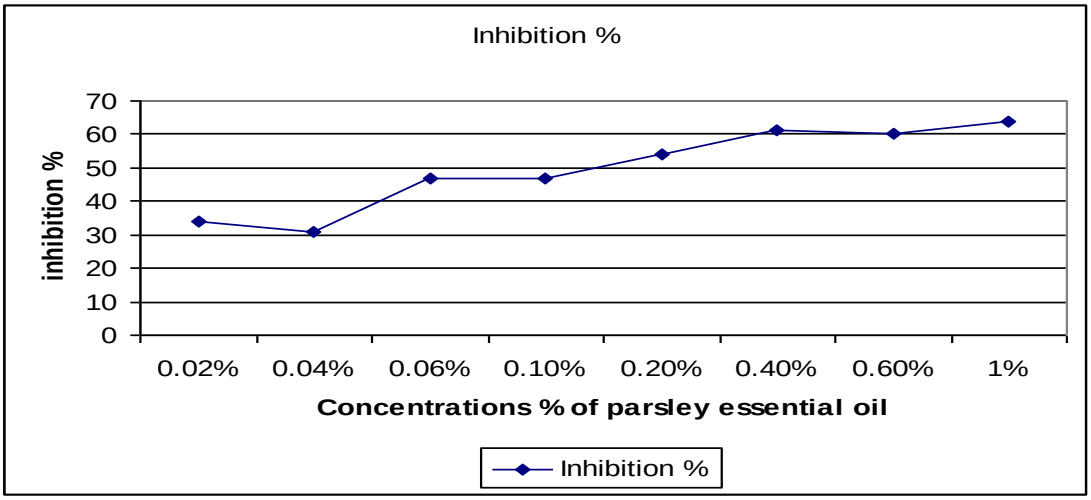

Fig. (3): Antifungal effect of the essential oil of Parsley

Table (7): Antifungal effect of the ethanolic extract of Parsley:

Concentration % of Parsley ethanolic extract	0.02	0.04	0.06	0.1	0.2	0.4	0.6	1.0	2.0	3.0
Inhibition %	22.67 ±1.1	28.12 ±1.73	31.2 ±0.57	36.53 ±1.73	40.63 ±1.15	44 ±2.3	47.07 ±1.15	58.46 ±1.15	80.93 ±1.73	100±1 .73

LSD = 0.09

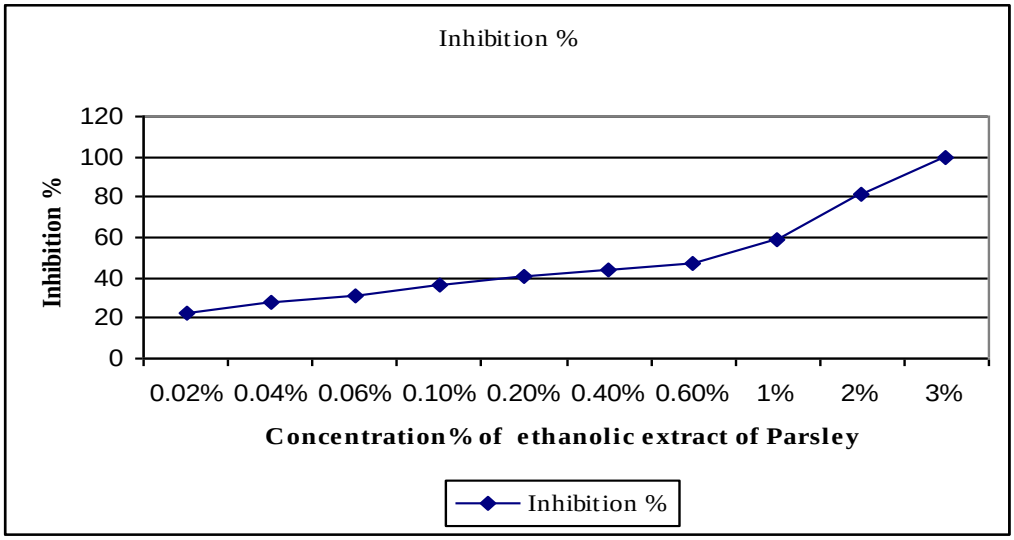

Fig. (4): Antifungal effect of the ethanolic extract of Parsley

Table (8): Effect of Parsley ethanolic extract on aflatoxin B_1 inhibition:

Concentrations % of Parsley ethanolic extract	Dry mycelium weight inhibition %	AFB_1 inhibition %
0.02	22.637±1.15	10.49± 0.6067
0.04	28.12±1.73	14.827±1.365
0.06	31.2±0.577	22.05±1.0738
0.1	36.53±1.73	36.002±1.505
0.2	40.63±1.15	43.49±0.351
0.4	44±2.3	52.63±0.1453
0.6	47.07±1.15	61.80±1.048
1.0	58.465±1.15	72.9±1.218
2.0	80.93±1.73	96.8±0.453
3.0	100±0.0	99.66± 0.238

LSD = 0.03

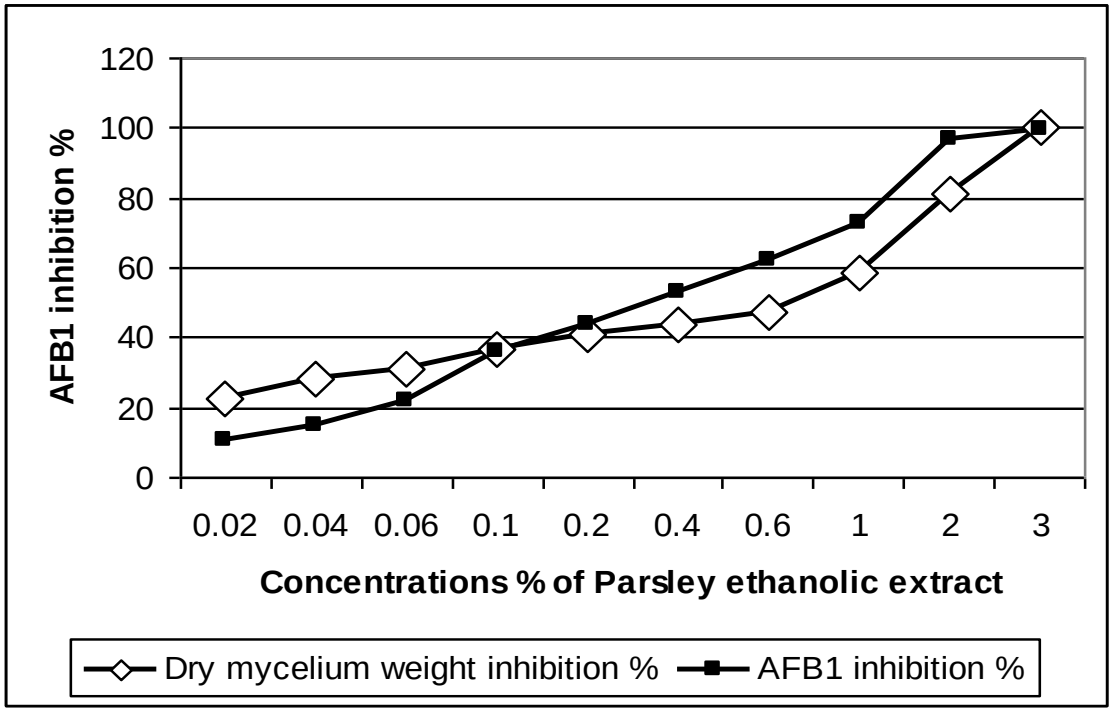

Fig. (5): Effect of Parsley ethanolic extract on aflatoxin B_1 inhibition.

Table (9): Effect of Parsley ethanolic extract on aflatoxin G_1 inhibition:

Concentrations% of Parsley ethanolic extract	Dry mycelium weight inhibition %	AFG_1 inhibition %
0.02	22.637±1.15	27.74± 0.315
0.04	28.12±1.73	38.296±1.574
0.06	31.2±0.577	54.16±1.675
0.1	36.53±1.73	62.46±1.0837
0.2	40.63±1.15	68.06±0.185
0.4	44±2.3	86.9±1.792
0.6	47.07±1.15	99.76±0.183
1.0	58.465±1.15	100±0.0
2.0	80.93±1.73	100±0.0
3.0	100±0.0	100±0.0

LSD = 0.26

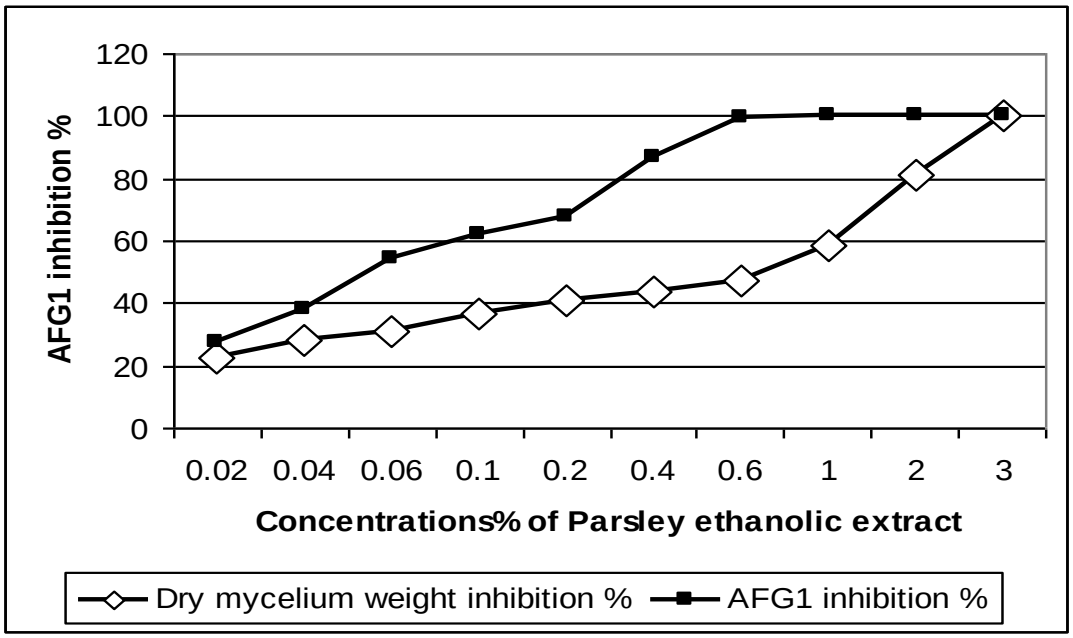

Fig. (6): Effect of Parsley ethanolic extract on aflatoxin G_1 inhibition.

Table (10): Effect of Parsley ethanolic extract on aflatoxin B_2 inhibition:

Concentrations % of Parsley ethanolic extract	Dry mycelium weight inhibition %	AFB_2 inhibition %
0.02	22.637±1.15	31.306±2.049
0.04	28.12±1.73	33.393±3.136
0.06	31.2±0.577	48.39±2.525
0.1	36.53±1.73	58.626±1.547
0.2	40.63±1.15	66.176±1.032
0.4	44±2.3	83.303±1.181
0.6	47.07±1.15	97.706±0.449
1.0	58.465±1.15	99.886±0.113
2.0	80.93±1.73	100±0.0
3.0	100±0.0	100±0.0

LSD= 0.18

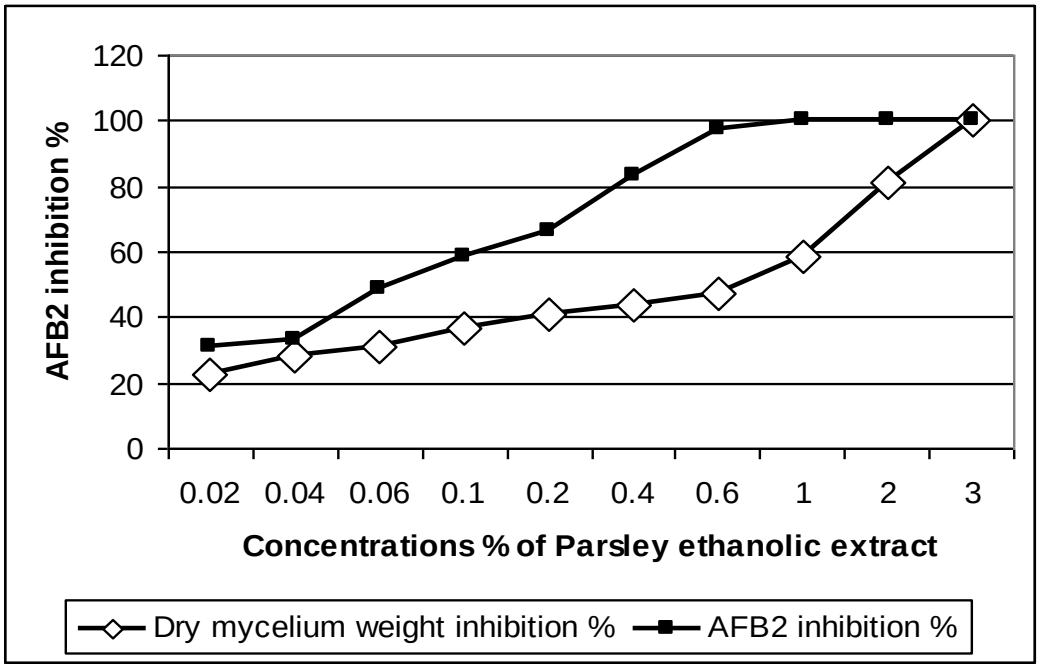

Fig. (7): Effect of Parsley ethanolic extract on aflatoxin B_2 inhibition.

Table (11): Effect of Parsley ethanolic extract on aflatoxin G_2 inhibition:

Concentrations of Parsley ethanolic extract	Dry mycelium weight inhibition %	AFG_2 inhibition %
0.02	22.637±1.15	29.213±1.320
0.04	28.12±1.73	36.98±1.071
0.06	31.2±0.577	46.206±0.225
0.1	36.53±1.73	57.706±0.409
0.2	40.63±1.15	66.76±0.185
0.4	44±2.3	81.303±0.677
0.6	47.07±1.15	95.143±0.721
1.0	58.465±1.15	94.986±0.417
2.0	80.93±1.73	96.17±0.276
3.0	100±0.0	99.766±0.233

LSD = 0.022

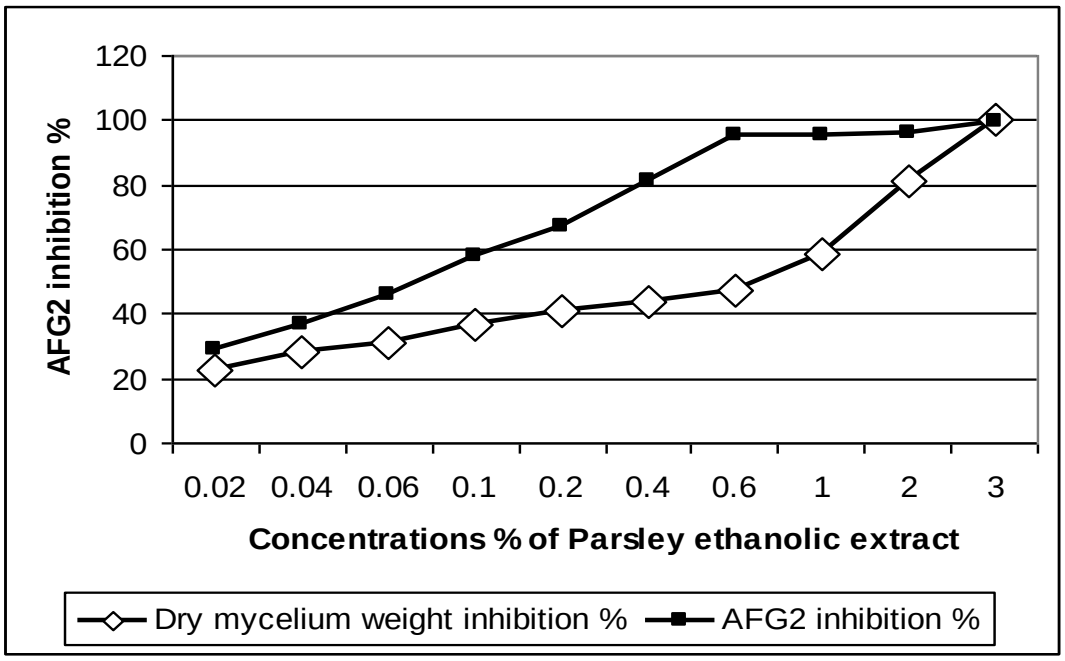

Fig. (8): Effect of Parsley ethanolic extract on aflatoxin G_2 inhibition.

c) Antifungal effect of the essential oil and ethanolic extract of rocket:

Results in table (12) showed that using different concentrations of *eruca sativa* essential oil ranged from 0.005 to 0.2% led to gradual inhibitory activity on the dry mycelium weight of *A. flavus* ranged from 85% to 92%. The complete inhibition was achieved using concentration of 0.06% (Fig. 9).

Results in table (13) showed that using different concentrations of *eruca sativa* ethanolic extract ranged from 0.02% to3% showed gradual inhibitory effect ranged from 48.1% to 100% when using 0.02% and 0.06% respectively (Fig. 10).

d) The effect of ethanolic extract of rocket on inhibition of aflatoxins:

Table (14) showed inhibition of *A. flavus* ability to produce aflatoxin B_1 ranged from 49.42 to 68.4% using concentrations of 0.02 to 0.04% respectively. Complete inhibition of AFB_1 was observed at 0.06% of the plant extract (Fig. 11).

Data in table (15) showed gradual inhibition of *A. flavus* ability to produce aflatoxin G_1 ranged from 66.47 to 85.35% at 0.02 to 0.04% respectively. Using 0.06% caused complete inhibition of AFG_1 (Fig. 12).

Concerning aflatoxin B_2 table (16) revealed that the inhibition of *A. flavus* ability to produce AFB_2 increased by increasing the plant extract concentration from 49.5 to 78.36% using concentrations of 0.02% to 0.04% respectively. Complete inhibition of AFB_2 was recorded on applying 0.06% of the plant extract, (Fig. 13).

Data in table (17) showed that using 0.02% of rocket extract showed 53.8% inhibition of aflatoxin G_2 production. Complete inhibition of AFG_2 production was observed on using 0.06% of the plant extract (Fig. 14).

Table (12): Antifungal effect of the essential oil of rocket:

Concentrations % of rocket essential oil	0.005	0.01	0.02	0.04	0.06	0.1	0.2
Inhibition %	85.6±2.88	89.30±1.73	89.30±1.15	92.13±1.15	100±0.0	100±0.0	100±0.0

LSD = 0.018

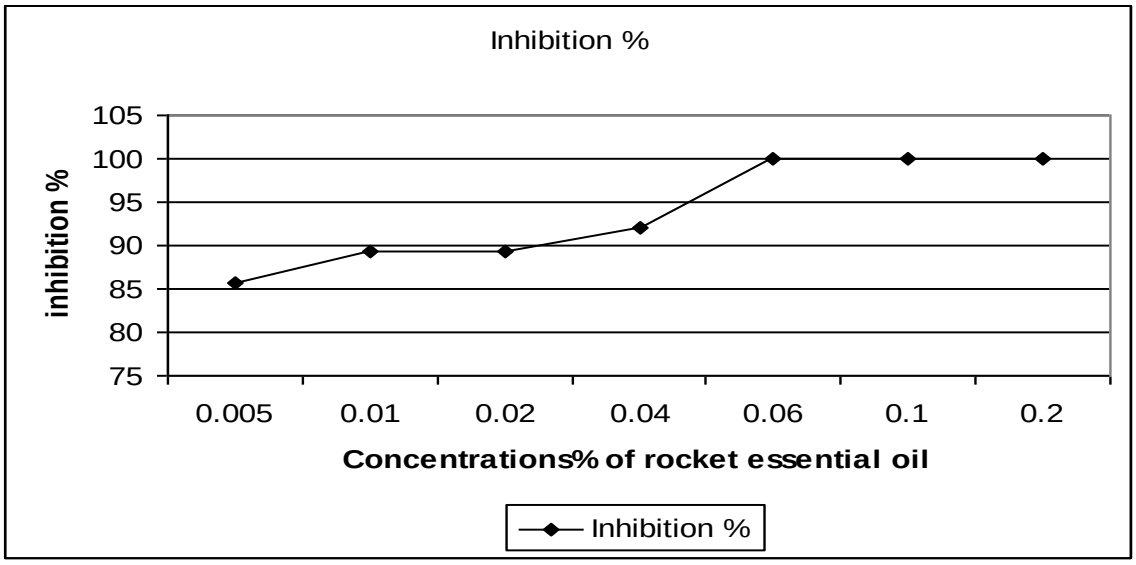

Fig. (9): Antifungal effect of the essential oil of rocket.

Table (13): Antifungal effect of the ethanolic extract of rocket:

Concentration% of rocket ethanolic extract	0.02	0.04	0.06	0.1	0.2	0.4	0.6	1.0	2.0	3.0
Inhibition %	48.1 ±1.15	64.3 ±2.31	100 ±0.0	100 ±0.0	100 ±0.0	100 ±0.0	100 ±0.0	100 ±0.0	100 ±0.0	100 ±0.0

LSD=0.0116

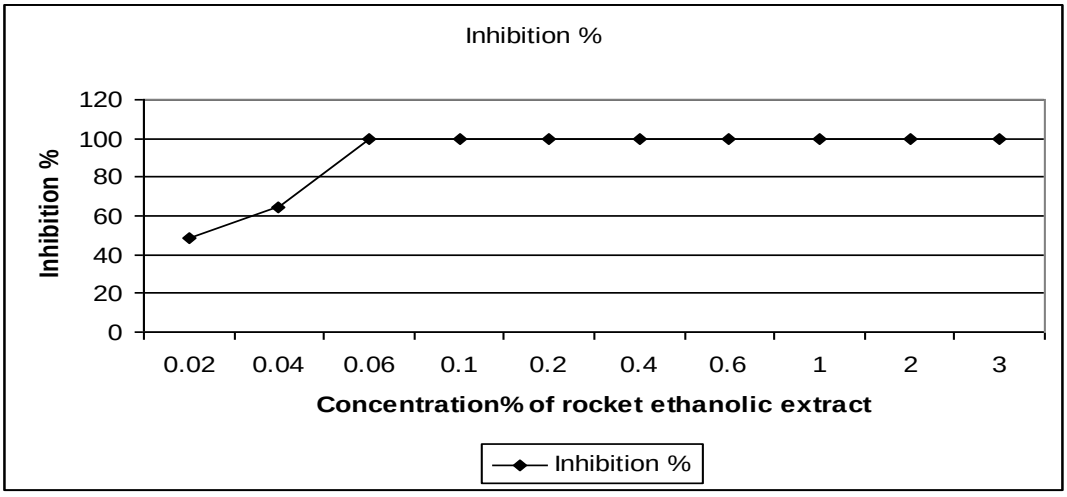

Fig. (10): Antifungal effect of the ethanolic extract of rocket.

Table (14): Effect of rocket ethanolic extract on aflatoxin B_1 inhibition:

Concentration% of rocket ethanolic extract	Dry mycelium weight inhibition %	AFB_1 inhibition %
0.02	48.1±1.15	49.426±3.053
0.04	64.3±2.31	68.42±0.895
0.06	100±0.0	99.963±0.036
0.1	100±0.0	100±0.0
0.2	100±0.0	100±0.0
0.4	100±0.0	100±0.0
0.6	100±0.0	100±0.0
1.0	100±0.0	100±0.0
2.0	100±0.0	100±0.0
3.0	100±0.0	100±0.0

LSD = 0.0218

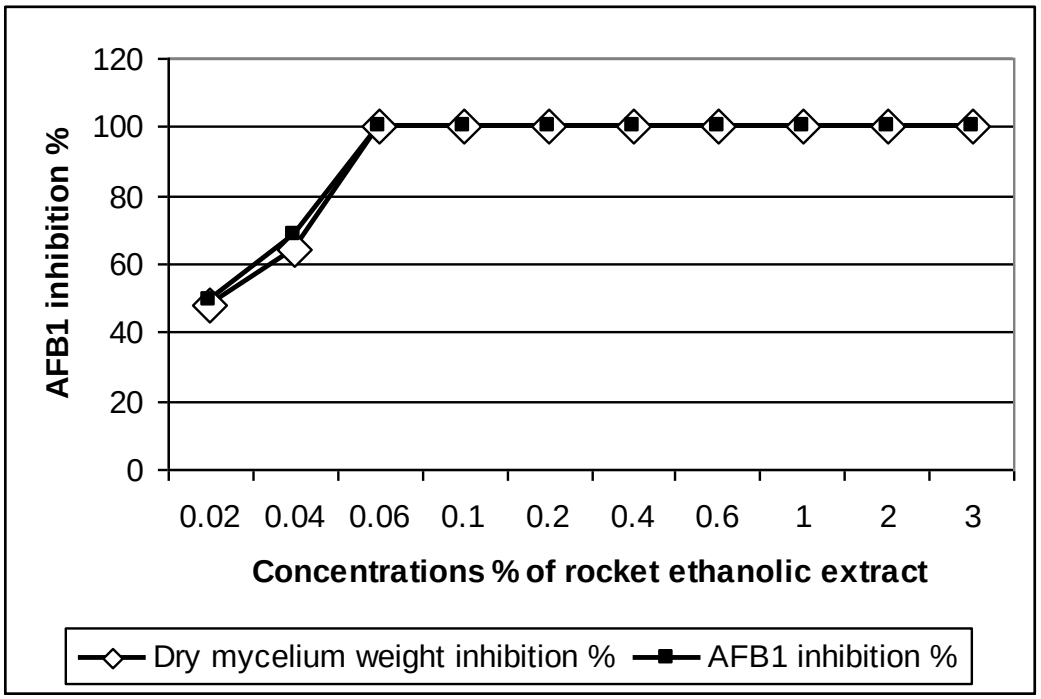

Fig. (11): Effect of rocket ethanolic extract on aflatoxin B_1 inhibition

Table (15): Effect of rocket ethanolic extract on aflatoxin G_1 inhibition:

Concentration% of rocket ethanolic extract	Dry mycelium weight inhibition %	AFG_1 inhibition %
0.02	48.1±1.15	66.473±0.270
0.04	64.3±2.31	85.35±0.716
0.06	100±0.0	99.78±0.22
0.1	100±0.0	100±0.0
0.2	100±0.0	100±0.0
0.4	100±0.0	100±0.0
0.6	100±0.0	100±0.0
1.0	100±0.0	100±0.0
2.0	100±0.0	100±0.0
3.0	100±0.0	100±0.0

LSD = 0.050

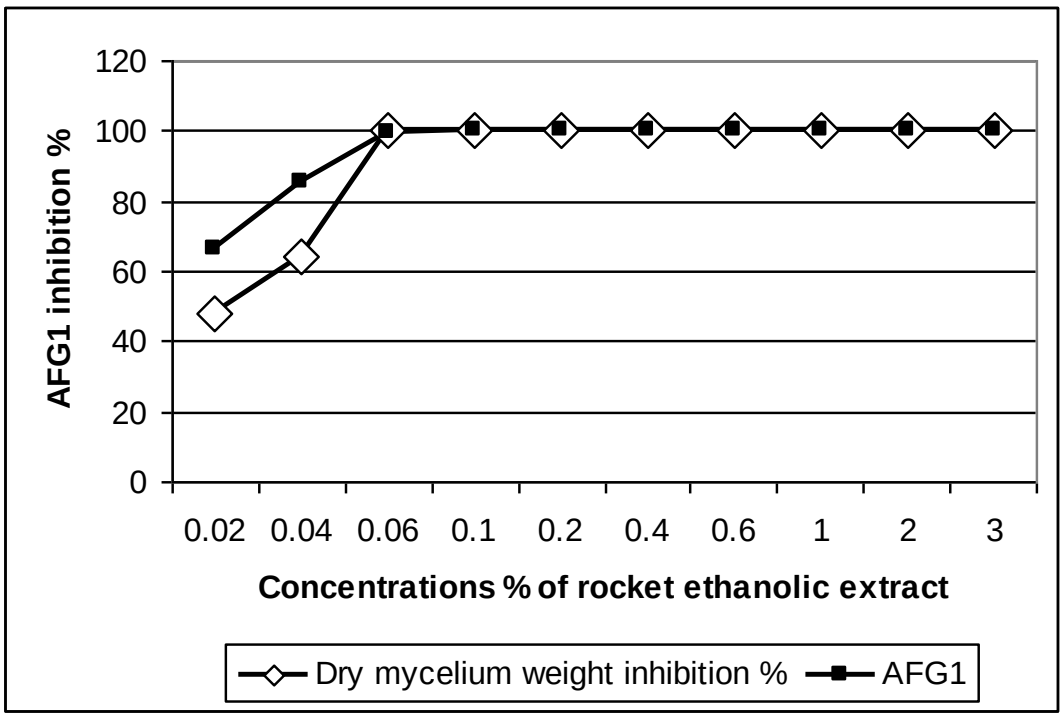

Fig. (12): Effect of rocket ethanolic extract on aflatoxin G_1 inhibition.

Table (16): Effect of rocket ethanolic extract on aflatoxin B_2 inhibition:

Concentration% of rocket ethanolic extract	Dry mycelium weight inhibition %	AFB_2 inhibition %
0.02	48.1±1.15	49.506±2.086
0.04	64.3±2.31	78.36±0.541
0.06	100±0.0	100±0.0
0.1	100±0.0	100±0.0
0.2	100±0.0	100±0.0
0.4	100±0.0	100±0.0
0.6	100±0.0	100±0.0
1.0	100±0.0	100±0.0
2.0	100±0.0	100±0.0
3.0	100±0.0	100±0.0

LSD = 0.0071

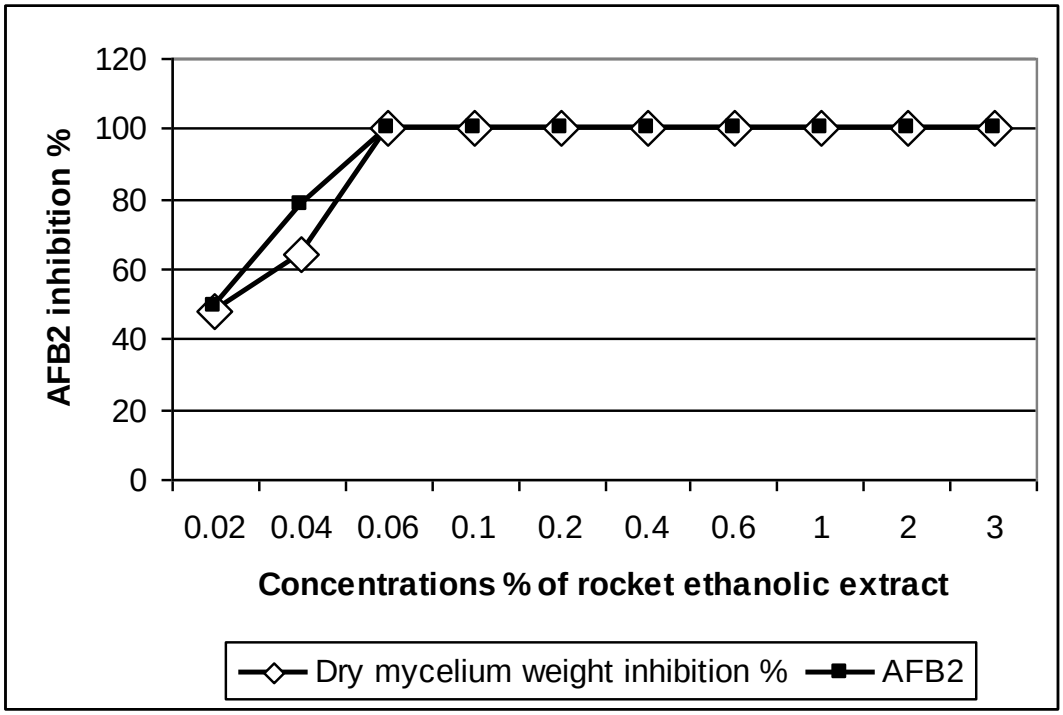

Fig. (13): Effect of rocket ethanolic extract on aflatoxin B_2 inhibition.

Table (17): Effect of rocket ethanolic extract on aflatoxin G_2 inhibition:

Concentration% of rocket ethanolic extract	Dry mycelium weight inhibition %	AFG_2 inhibition %
0.02	48.1±1.15	53.81±0.945
0.04	64.3±2.31	86.63±0.348
0.06	100±0.0	100±0.0
0.1	100±0.0	100±0.0
0.2	100±0.0	100±0.0
0.4	100±0.0	100±0.0
0.6	100±0.0	100±0.0
1.0	100±0.0	100±0.0
2.0	100±0.0	100±0.0
3.0	100±0.0	100±0.0

LSD = 0.039

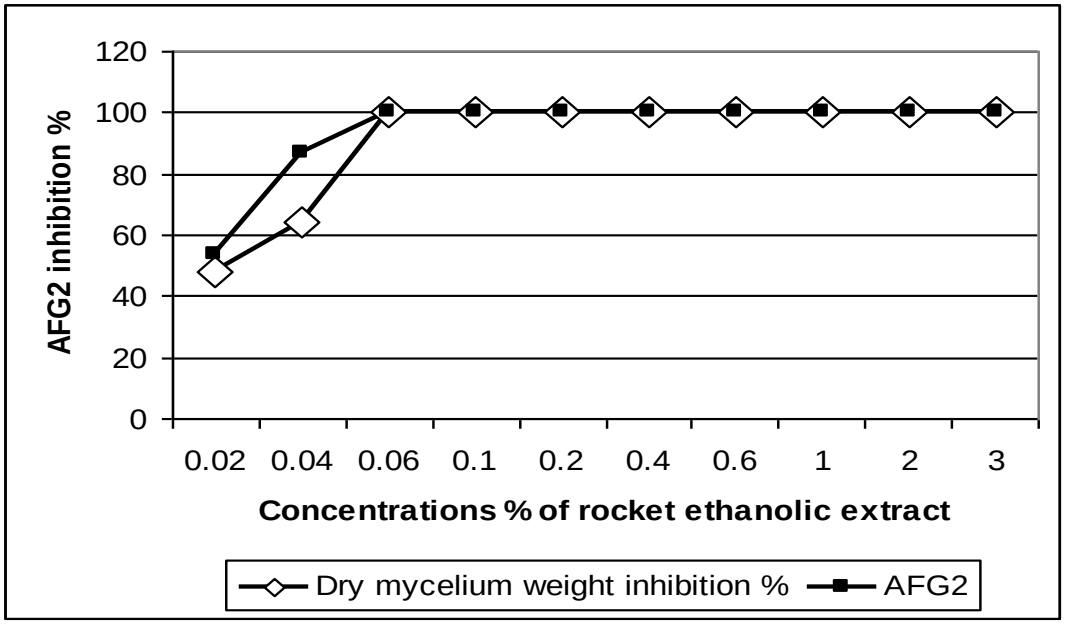

Fig. (14): Effect of rocket ethanolic extract on aflatoxin G_2 inhibition.

e) Antifungal effect of the essential oil and ethanolic extract of turmeric:

Results in table (18) and fig. (15) showed that using different concentrations of turmeric essential oil ranged from 0.02 to 1% led to gradual inhibitory activity on the dry mycillium weight of *A. flavus* ranged from 20.58 to 62.94% inhibition.

Results in table (19) revealed that the inhibitory activity of different concentrations on the dry mycelium weight varied from 14.63% to 50.55% when using 0.02 and 0.6% of turmeric ethanolic extract respectively. Complete inhibition was achieved by using concentration of 1 % (Fig. 16).

f) The effect of ethanolic extract of turmeric on inhibition of aflatoxins:

Results in tables (20) and (21) showed that using different concentrations of turmeric extract ranged from 0.02 to 3% led to gradual inhibitory activity on the ability of *A. flavus* to produce aflatoxin B_1, ranged from 19.47% to 65.27% when using concentrations of 0.02% 0.6% respectively. While aflatoxin G_1 was inhibited by 2.26 to 48.3% using the same concentrations.

Complete inhibition of both AFB_1 and $AFG_1$was observed when using a concentration of 1% of the plant extract (Figs. 17 and 18).

Results in tables (22) and (23) showed that using different concentrations of turmeric extract ranged from 0.02 to 3% caused inhibition aflatoxin B_2, G_2 production ranged from 25.87% to 83.35% and 28.14% to 87.5% when using concentrations of 0.02 to 0.4% respectively.

Complete inhibition of both AFB_2 and AFG_2 was observed when using a concentration of 0.6% of the plant extract (Figs. 19 and 20).

Table (18): Antifungal effect of the essential oil of turmeric:

Concentrations % of turmeric essential oil	0.02	0.04	0.06	0.1	0.2	0.4	0.6	1.0
Inhibition %	20.58 ±1.15	38.97 ±1.15	27.20 ±1.15	35.27 ±2.31	49.66 ±1.15	57.75 ±1.15	59.81 ±1.71	62.94 ±1.15

LSD = 0.0178

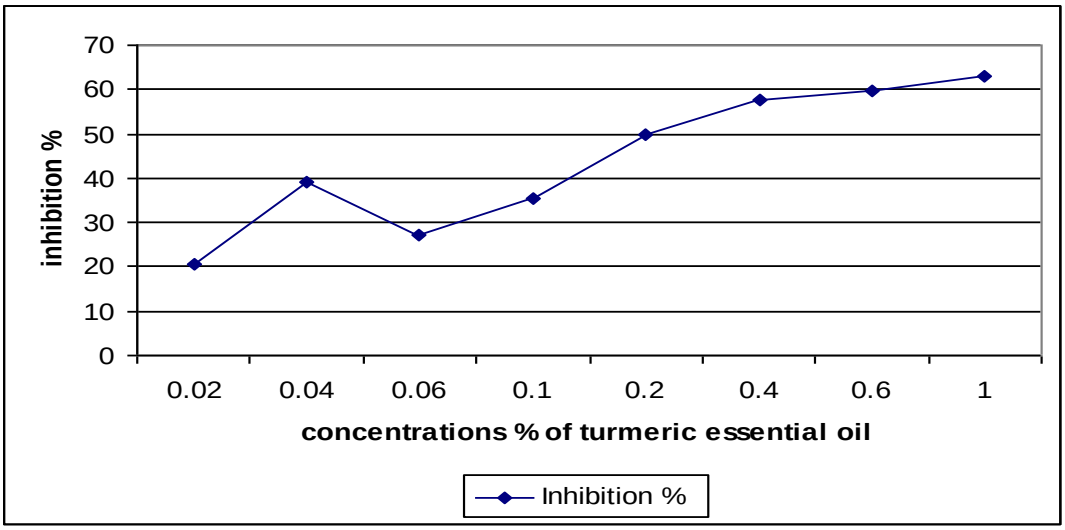

Fig. (15): Antifungal effect of the essential oil of turmeric.

Table (19): Antifungal effect of the ethanolic extract of turmeric:

Concentrations % of turmeric ethanol extract	0.02	0.04	0.06	0.1	0.2	0.4	0.6	1.0	2.0	3.0
Inhibition %	14.63± 0.577	21.14± 0.577	28.76± 1.15	31.61± 0.881	41.82± 1.73	50.55± 1.73	50.55± 1.15	100± 0.0	100± 0.0	100± 0.0

LSD = 0.0636

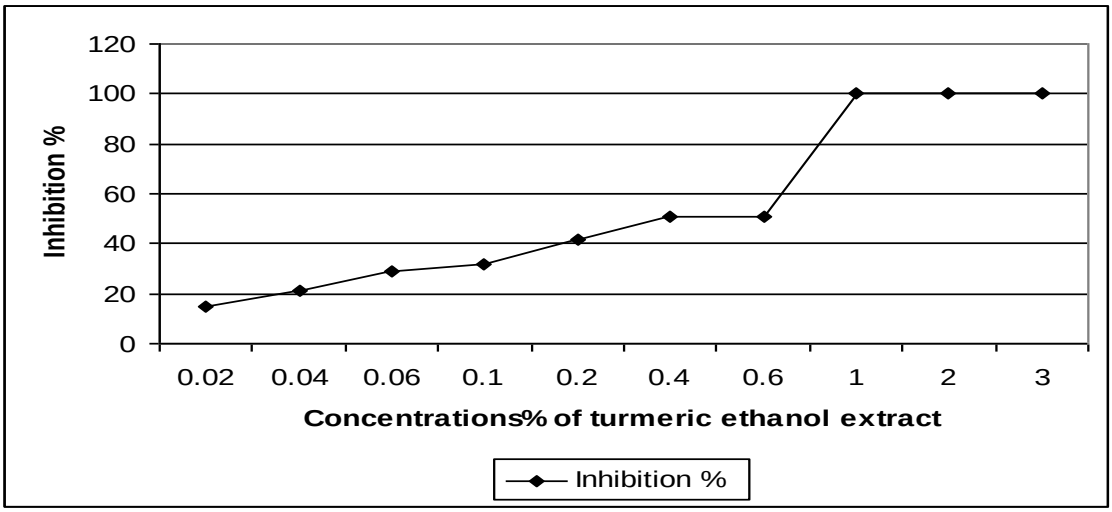

Fig. (16): Antifungal effect of the ethanolic extract of turmeric.

Table (20): Effect of turmeric ethanolic extract on aflatoxin B_1 inhibition:

Concentration % of turmeric ethanolic extract	Dry mycelium weight inhibition %	AFB_1 inhibition %
0.02	14.63±0.577	19.47±0.308
0.04	21.14±0.577	28.31±0.494
0.06	28.76±1.15	32.136±0.553
0.1	31.61±0.881	37.53±0.239
0.2	41.82±1.73	44.40±0.987
0.4	50.55±1.73	53.44±0.842
0.6	50.55±1.15	65.273±0.498
1.0	100±0.0	99.933±0.066
2.0	100±0.0	100±0.0
3.0	100±0.0	100±0.0

LSD = 0.0011

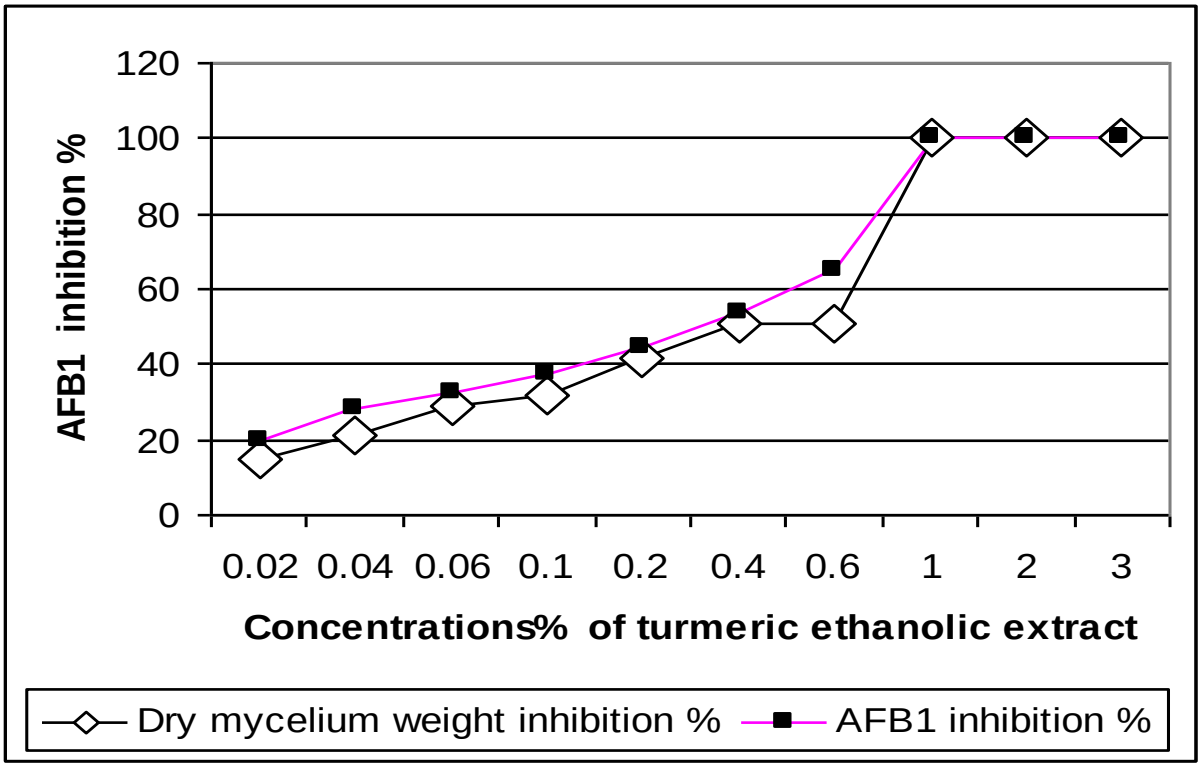

Fig. (17): Effect of turmeric ethanolic extract on aflatoxin B_1 inhibition.

Table (21): Effect of turmeric ethanolic extract on aflatoxin G_1 inhibition:

Concentrations% of turmeric ethanolic extract	Dry mycelium weight inhibition %	AFG_1 inhibition %
0.02	14.63±0.577	2.263±0.274
0.04	21.14±0.577	9.006±0.575
0.06	28.76±1.15	18.823±0.702
0.1	31.61±0.881	24.55±1.831
0.2	41.82±1.73	36.446±1.478
0.4	50.55±1.73	44.123±0.483
0.6	50.55±1.15	48.336±0.759
1.0	100±0.0	98.86±0.796
2.0	100±0.0	100±0.0
3.0	100±0.0	100±0.0

LSD = 0.0013

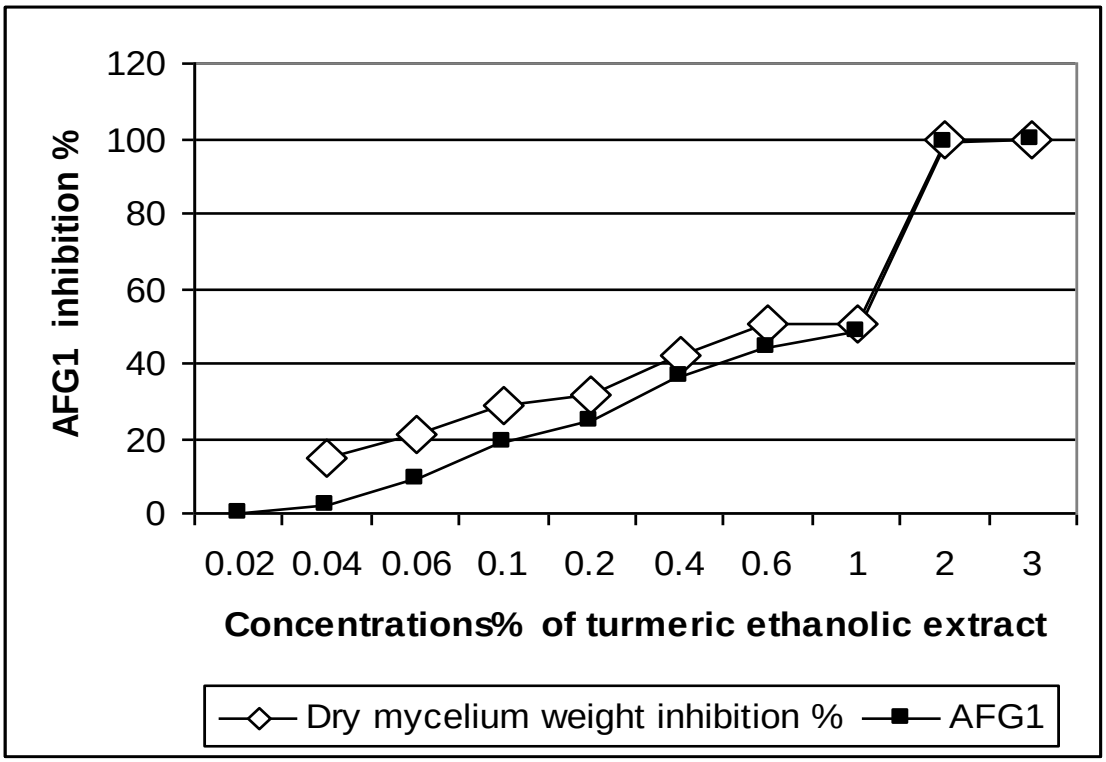

Fig. (18): Effect of turmeric ethanolic extract on aflatoxin G_1 inhibition.

Table (22): Effect of turmeric ethanolic extract on aflatoxin B_2 inhibition:

Concentrations% of turmeric ethanolic extract	Dry mycelium weight inhibition %	AFB2 inhibition %
0.02	14.63±0.577	25.876±1.517
0.04	21.14±0.577	27.34±1.045
0.06	28.76±1.15	34.563±0.812
0.1	31.61±0.881	51.796±2.073
0.2	41.82±1.73	69.81±2.914
0.4	50.55±1.73	83.35±1.328
0.6	50.55±1.15	98.223±0.484
1.0	100±0.0	99.766±0.233
2.0	100±0.0	100±0.0
3.0	100±0.0	100±0.0

LSD = 0.0441

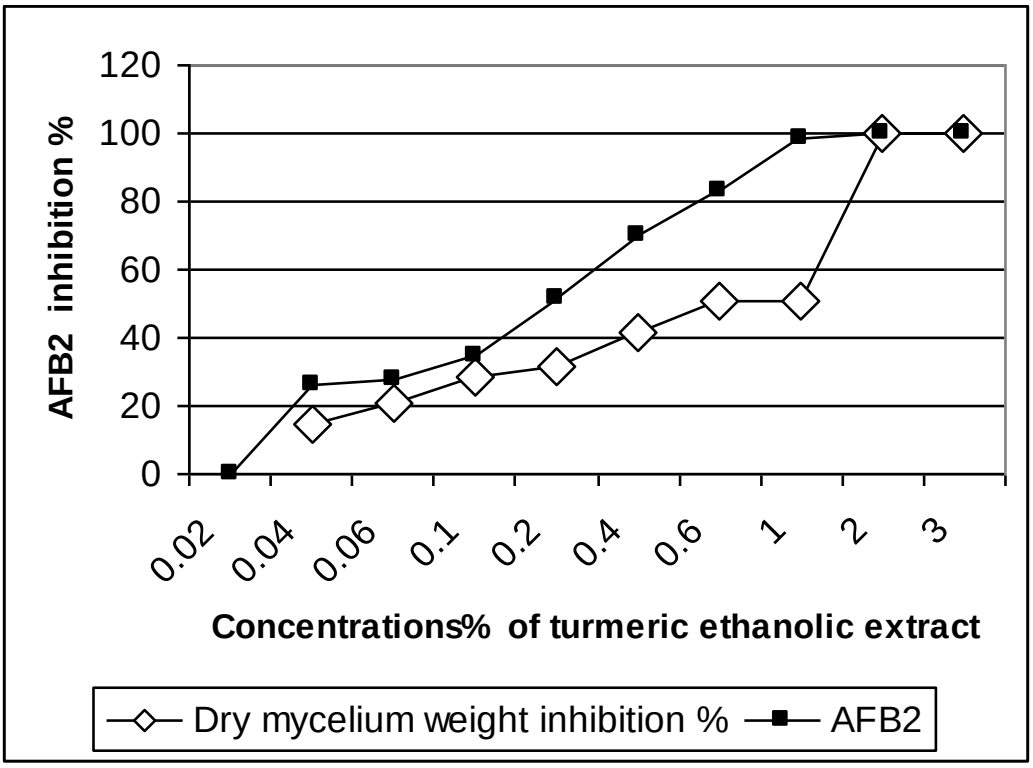

Fig. (19): Effect of turmeric ethanolic extract on aflatoxin B_2 inhibition.

Table (23): Effect of turmeric ethanolic extract on aflatoxin G_2 inhibition:

Concentrations% of turmeric ethanolic extract	Dry mycelium weight inhibition %	AFG_2 inhibition %
0.02	14.63±0.577	28.14±0.488
0.04	21.14±0.577	31.91±0.626
0.06	28.76±1.15	38.24±1.078
0.1	31.61±0.881	56.613±0.660
0.2	41.82±1.73	71.36±0.614
0.4	50.55±1.73	87.573±0.392
0.6	50.55±1.15	99.556±0.370
1.0	100±0.0	100±0.0
2.0	100±0.0	100±0.0
3.0	100±0.0	100±0.0

LSD = 0.0027

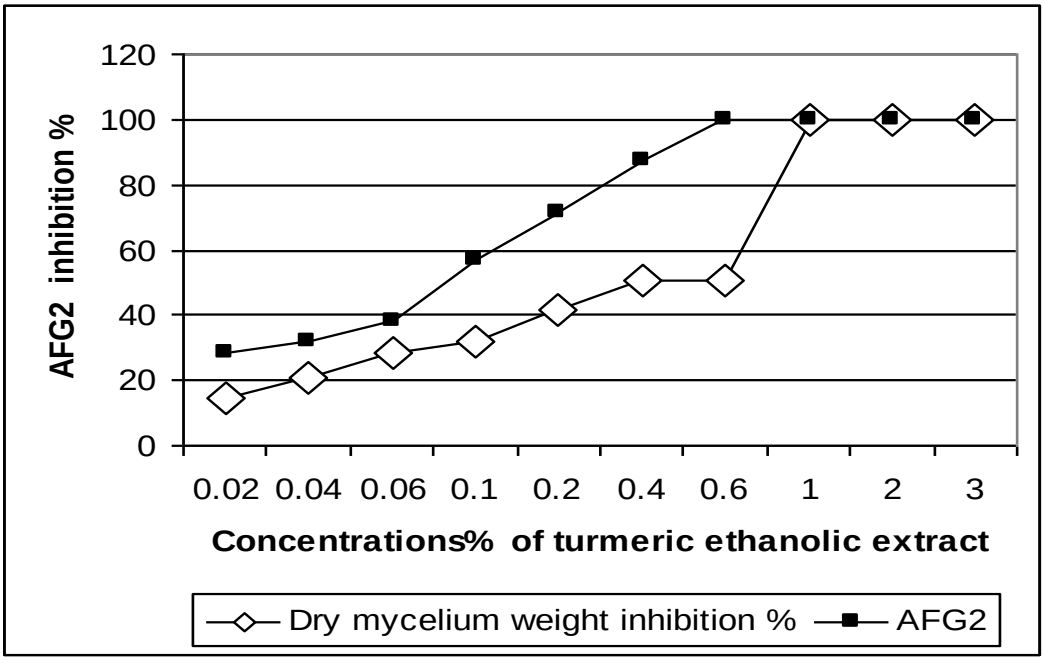

Fig. (20): Effect of turmeric ethanolic extract on aflatoxin G_2 inhibition.

g) Antifungal effect of the essential oil and ethanolic extract of Ginger:

Results in table (24) showed that using different concentrations of ginger essential oil ranged from 0.02 to 1% caused inhibition of *A. flavus* dry mycelium weight ranged from 5.51 to 48.52% (Fig. 21).

The inhibitory activity of different concentrations of ginger extract on the dry mycelium weight varied from 4.06% to 50.427% when using concentrations of 0.02 and 1% respectively (table 25 and Fig. 22). Complete inhibition was achieved by using a concentration of 3%.

h) The effect of ethanolic extract of ginger on inhibition of aflatoxin :

Data in tables (26) and (27) showed that no inhibition was recorded on the ability of *A. flavus* to produce aflatoxin $B_1$and $AFG_{1,}$ when using 0.02% of ginger extract while the inhibition increased gradually by increasing the concentration of the ginger extract to 87.5% using concentrations of 0.6%, while in case of AFG_1 the inhibition 63.03% when using concentrations 0.4% respectively.

Complete inhibition of AFB_1 and AFG_1 was observed on using concentrations of 2% and 0.6% respectively of the ginger extract (Figs. 23 and 24).

Results in tables (28) and (29) showed that using different concentrations of ginger extract ranged 0.02 to 3% led to gradual inhibitory activity on the ability of *A .flavus* to produce either aflatoxin B_2,or aflatoxin G_2 ranged from 0.0% to 62.65% and 28.14% to about 58.6.5% when using concentrations of 0.02% to 0.6% respectively.

Complete inhibition of AFB_2 and AFG_2 was observed using a concentration of 1% of the ginger extract (Fig. 25 and Fig. 26).

Table (24): Antifungal effect of the essential oil of Ginger:

Concentrations % of Ginger essential oil	0.02	0.04	0.06	0.1	0.2	0.4	0.6	1.0
Inhibition%	5.51± 0.577	7.72± 0.577	14.52± 1.15	31.06± 1.73	28.86± 1.15	36.21± 1.15	42.27± 1.15	48.52 ±1.73

LSD = 0.0115

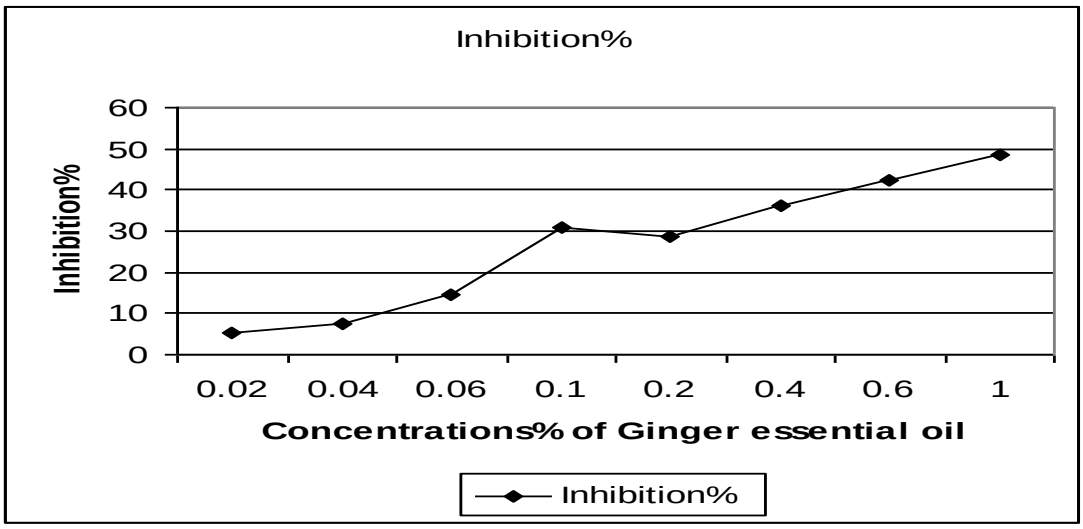

Fig. (21): Antifungal effect of the essential oil of Ginger.

Table (25): Antifungal effect of ginger ethanolic extract:

Concentrations %of ginger ethanol extract	0.02	0.04	0.06	0.1	0.2	0.4	0.6	1.0	2.0	3.0
Inhibition %	4.06± 0.577	6.23± 0.577	11.03± 0.577	18.72± 0.577	21.6± 1.15	25.4± 1.15	36.3± 0.577	50.42± 1.73	100± 0.0	100± 0.0

LSD = 0.0121

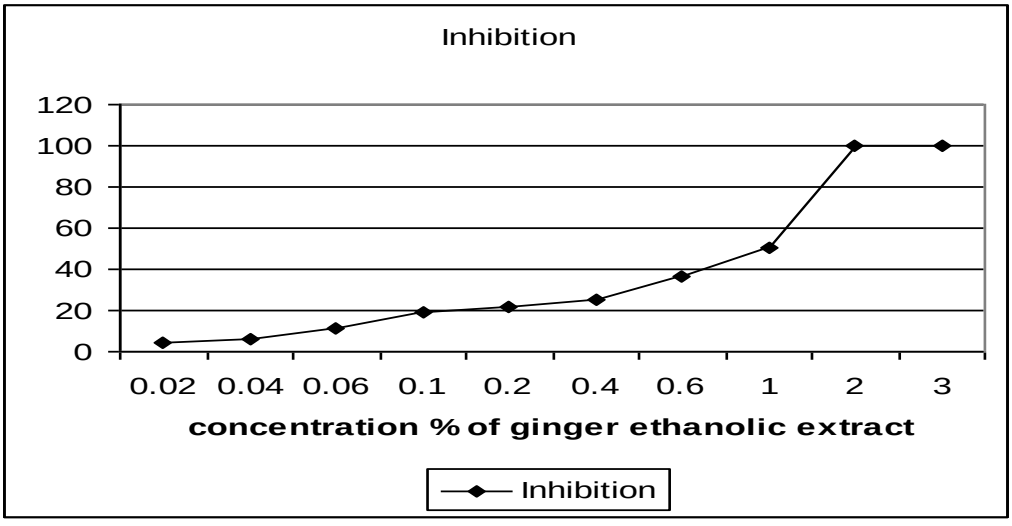

Fig. (22): Antifungal effect of ginger ethanolic extract.

Table (26): Effect of ginger ethanolic extract on aflatoxin B_1 inhibition:

Concentrations %of ginger ethanol extract	Dry mycelium weight inhibition%	AFB_1 inhibition %
0.02	4.06±0.577	0.0±0.0
0.04	6.23± 0.577	0.09±0.09
0.06	11.03±0.577	10.413±0.663
0.1	18.72±0.577	26.356±0.690
0.2	21.6± 1.15	38.72±0.505
0.4	25.4± 1.15	44.4±0.711
0.6	36.3± 0.577	52.61±1.507
1.0	50.42±1.73	87.553±0.350
2.0	100±0.0	99.776±0.223
3.0	100±0.0	100±0.0

LSD= 0.0321

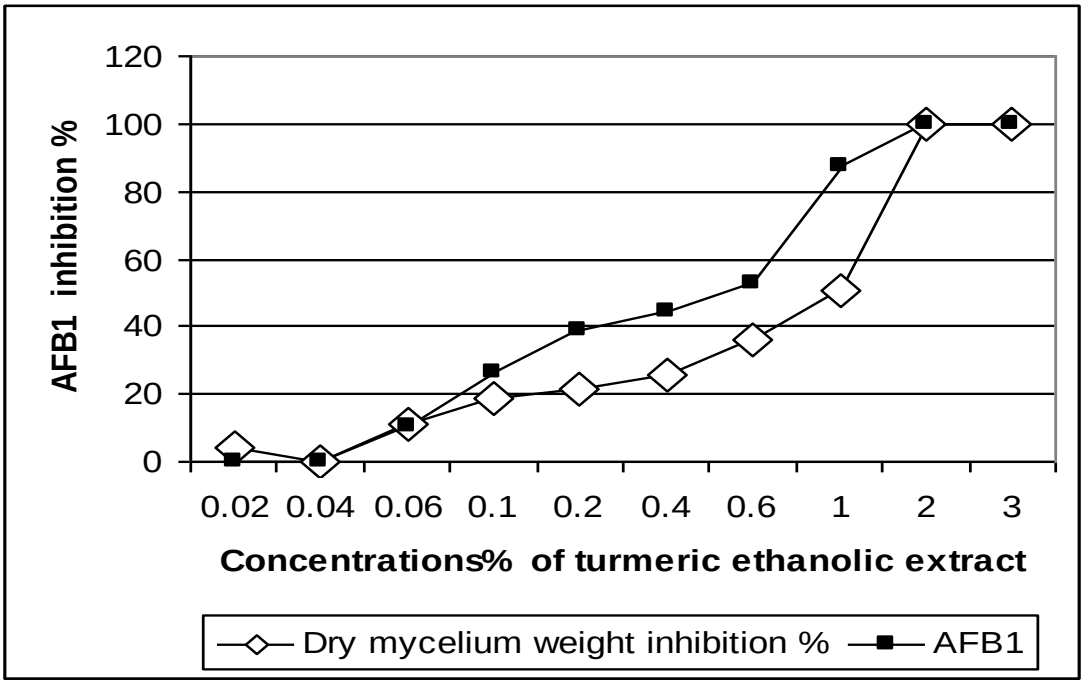

Fig. (23): Effect of ginger ethanolic extract on aflatoxin B_1 inhibition.

Table (27): Effect of ginger ethanolic extract on aflatoxin G_1 inhibition:

Concentrations %of ginger ethanol extract	Dry mycelium weight inhibition%	AFG_1 inhibition %
0.02	4.06±0.577	0.0±0.0
0.04	6.23± 0.577	0.266±0.176
0.06	11.03±0.577	16.4±0.568
0.1	18.72±0.577	31.19±0.576
0.2	21.6± 1.15	46.23±0.517
0.4	25.4± 1.15	63.03±1.739
0.6	36.3± 0.577	98.593±0.951
1.0	50.42±1.73	100±0.0
2.0	100±0.0	100±0.0
3.0	100±0.0	100±0.0

LSD = 0.0497

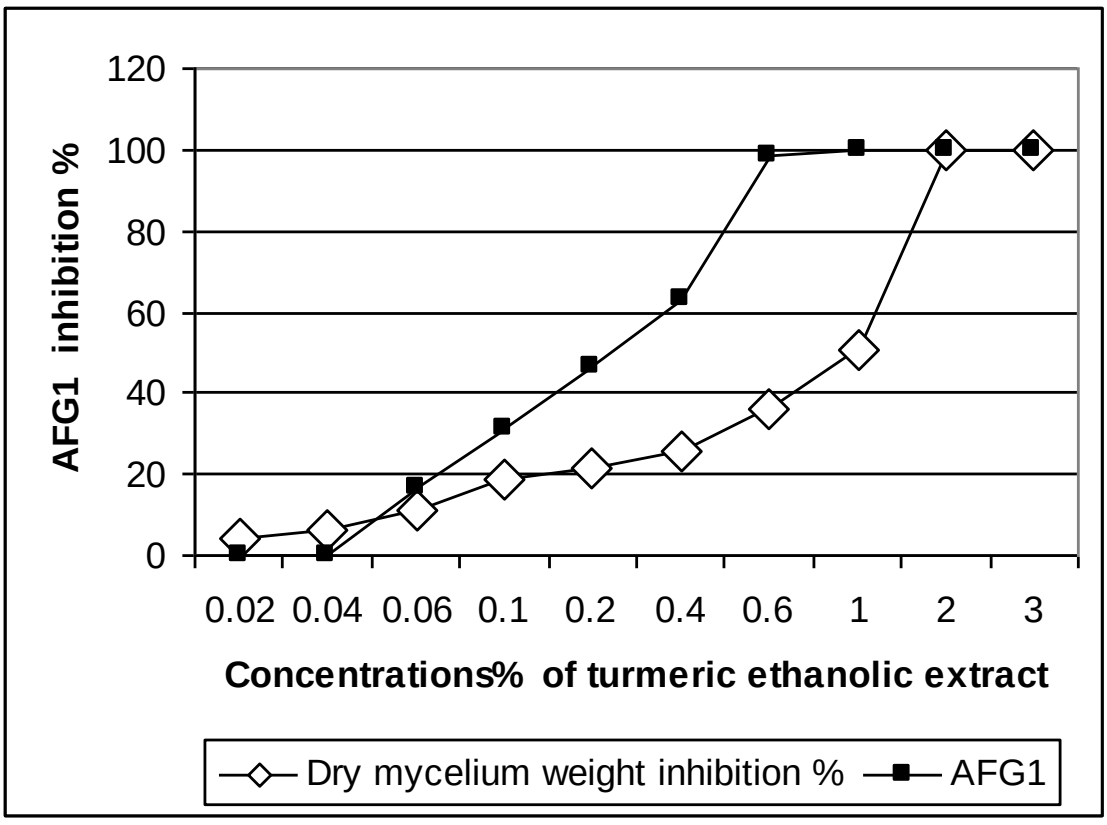

Fig. (24): Effect of ginger ethanolic extract on aflatoxin G_1 inhibition.

Table (28): Effect of ginger ethanolic extract on aflatoxin B_2 inhibition:

Concentrations %of ginger ethanol extract	Dry mycelium weight inhibition%	AFB_2 inhibition %
0.02	4.06±0.577	0.0±0.0
0.04	6.23± 0.577	0.233±0.23
0.06	11.03±0.577	12.06±1.534
0.1	18.72±0.577	27.76±0.742
0.2	21.6± 1.15	40.77±0.77
0.4	25.4± 1.15	54.09±0.70
0.6	36.3± 0.577	62.65±0.91
1.0	50.42±1.73	97.98±0.408
2.0	100±0.0	99.24±0.498
3.0	100±0.0	99.77±0.22

LSD = 0.0078

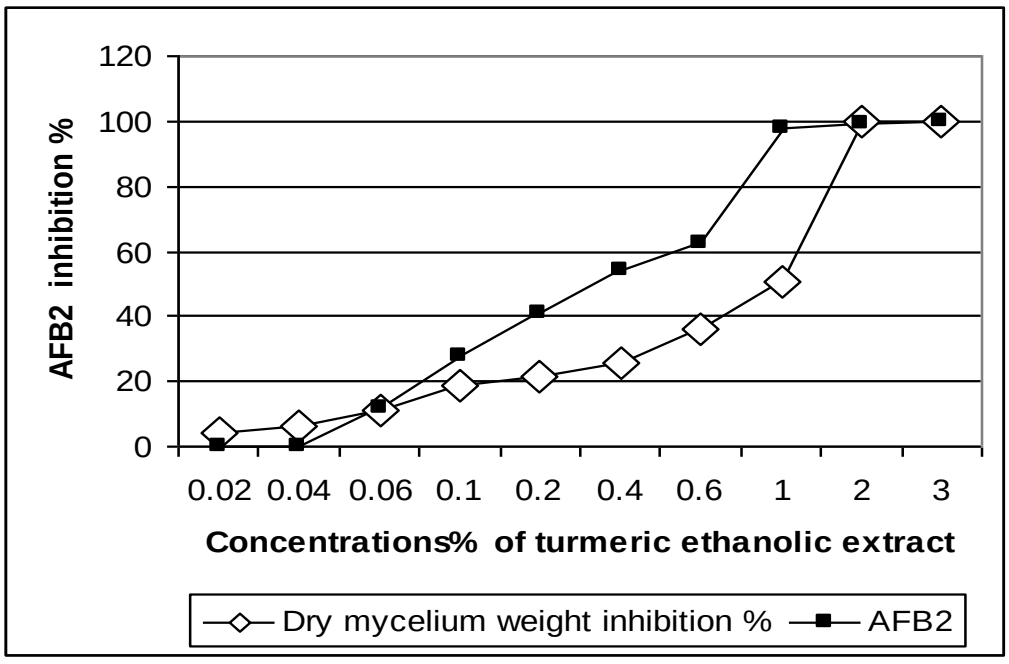

Fig. (25): Effect of ginger ethanolic extract on aflatoxin B_2 inhibition.

Table (29): Effect of ginger ethanolic extract on aflatoxin G_2 inhibition:

Concentrations %of ginger ethanol extract	Dry mycelium weight inhibition%	AFG_2 inhibition %
0.02	4.06±0.577	0.0±0.0
0.04	6.23± 0.577	0.0±0.0
0.06	11.03±0.577	9.433±1.140
0.1	18.72±0.577	23.32±0.90
0.2	21.6± 1.15	37.573±0.265
0.4	25.4± 1.15	46.68±1.457
0.6	36.3± 0.577	58.65±0.353
1.0	50.42±1.73	52.603±1.570
2.0	100±0.0	98.01±1.842
3.0	100±0.0	99.86±0.133

LSD=0.0348

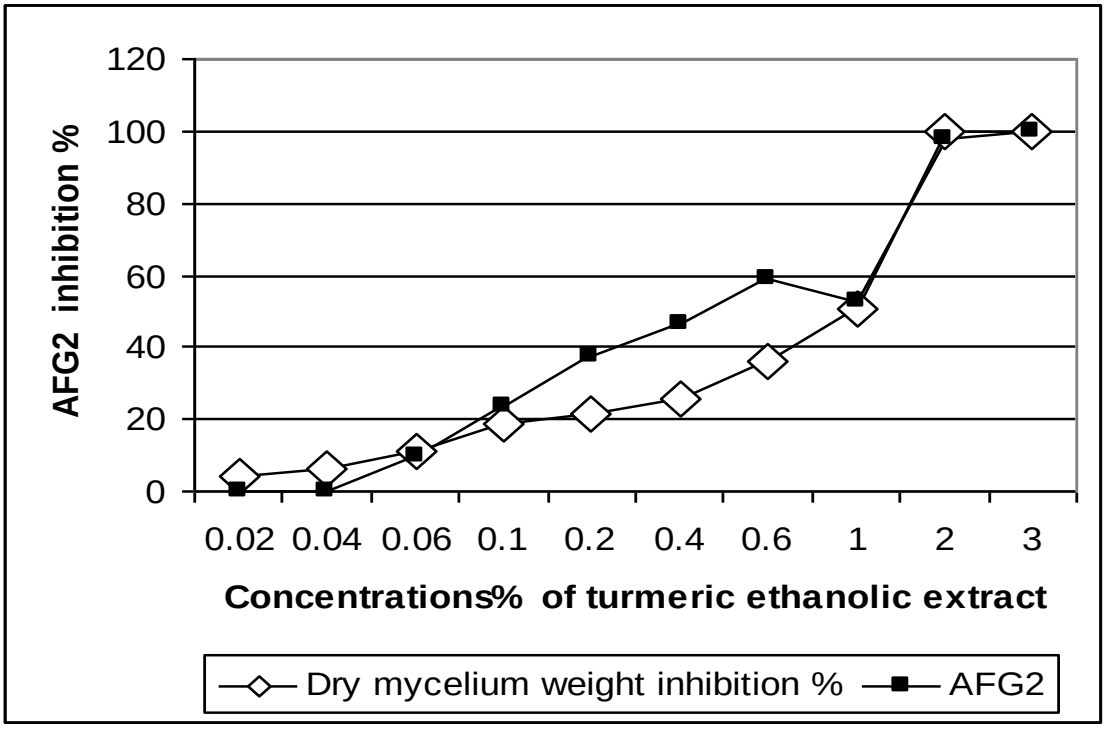

Fig. (26): Effect of ginger ethanolic extract on aflatoxin G_2 inhibition.

21) The antioxidant effect of the essential oil and ethanolic extract of the tested plants:

a) DPPH scavenging inhibition of essential oils:

The antioxidant activity the essential oils of parsley, rocket, turmeric and ginger were evaluated using an *in vitro* (DPPH). Results in table (30) and figure (27) indicated that the standard compound, (TBHQ), gave an 81.75 ± 3.2 % radical scavenging activity at the level of 100 µg/ml. All samples exhibited satisfactory antioxidant activities at the levels tested (50, 100, 200 and 400 µg/ml). Rocket showed the highest antioxidant activity at all concentrations where it gave the maximum effect 83.85±3.1 % at 400µg/ml followed by parsley, ginger and turmeric which gave 80±2.8, 79.64±3.21 and 78.8±2.1% respectively.

b) DPPH scavenging inhibition of ethanol extracts:

The antioxidant activity the ethanolic extracts of parsley, rocket, turmeric and ginger were evaluated using an *in vitro* (DPPH). Results in table (31) and figure (28) indicated that the standard compound, (TBHQ), gave an 81.75% ± 2.8 % radical scavenging activity at the level of 100 µg/ml. All samples exhibited satisfactory antioxidant activities at the levels tested (50, 100, 200 and 400 µg/ml). Rocket extract showed the highest antioxidant activity at all concentrations where it gave the maximum effect 78.9±1.83% at 400µg/ml followed by ginger, parsley and turmeric which gave 77.3±2.4, 75.43±3.2 and 74.03±1.9% respectively..

Table (30): DPPH scavenging inhibition of essential oils.

Samples	50µl(oil)	100µl(oil)	200µl(oil)	400µl(oil)
Turmeric	55.08±1.98	67.01±2.53	72.2±1.8	78.8±2.1
Ginger	31.2±2.34	47.71±3.14	70.17±2.3	79.64±3.21
Parsley	50.87±2.6	64.21±2.92	71.9±2.92	80±2.8
Rocket	57.89±2.82	71.92±2.31	79.64±2.6	83.85±3.1
TBHQ		81.75±3.2		

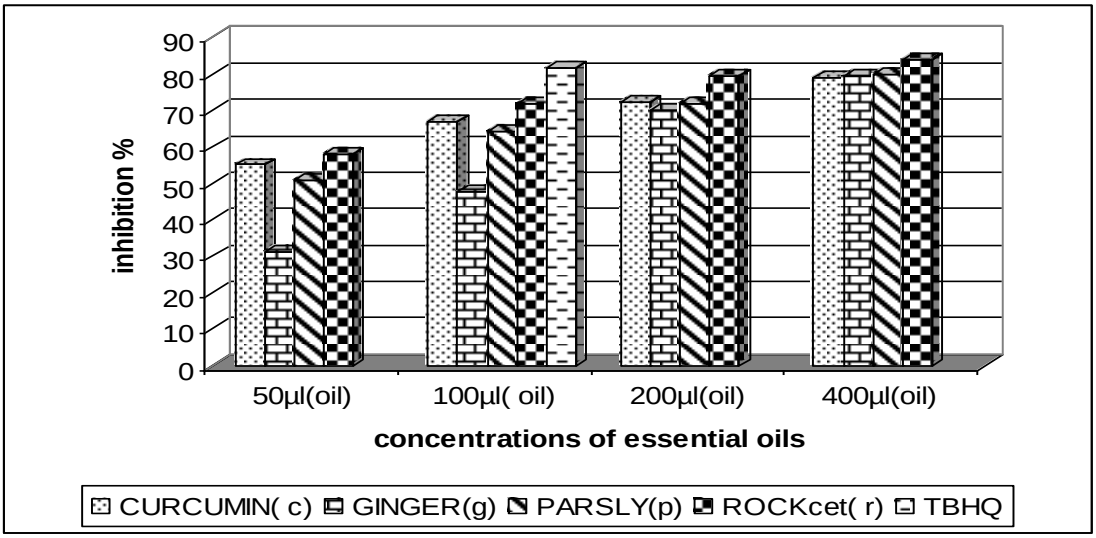

Fig. (27): DPPH scavenging inhibition of essential oils.

Table (31): DPPH scavenging inhibition of ethanol extracts

samples(ethanol extract)	50µl	100µl	200µl	400µl
Turmeric	32.6±2.3	57.89±2.6	64.9±3.1	74.03±1.9
Ginger	35.78±1.82	41.4±3.2	62.1±2.65	77.3±2.4
Parsley	40.35±1.6	53.68±2.86	64.21±2.9	75.43±3.2
Rocket	45.73±2.6	62.1±2.4	70.17±2.64	78.9±1.83
TBHQ		81.75±2.8		

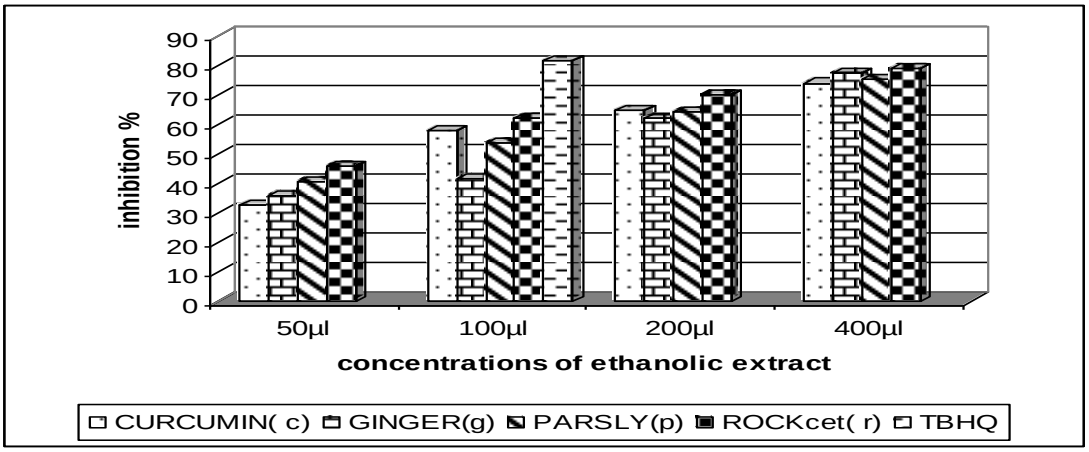

Fig. (28): DPPH scavenging inhibition of ethanol extracts.

c) The bleaching activity of parsley using β- Carotene/linoleic acid assay:

The standard compound, TBHQ, showed 89.9 ± 3.1% antioxidant activity at the level of 100 µg/ml. which indicate that this method is valid.

Table (32) and figure (29) showed the results of antioxidant activity tests conducted by β-carotene bleaching assay. The volatile extract of parsley showed the high antioxidant activity with clear dose dependant responses compared to that of the ethanolic extract. Parsley essential oil bleaching activity reached (66.37 ± 2.8%) while the bleaching activity parsley ethanol extract reached (63.42 ± 2.6%) at 400 µg/ml and also possessed clear dose dependant antioxidant activities (Table 33 and Figure 30).

d) The bleaching activity of rocket using β- Carotene/linoleic acid assay:

Table (34) and figure (31) showed the results of antioxidant activity tests for rocket conducted by β-carotene bleaching assay. The volatile extract (essential oil) of rocket showed the highest antioxidant activity with clear dose dependant responses compared to that of ethanolic extract. Rocket essential oil inhibited the bleaching by 78.00± 2.70% when using the concentration of 400 µg /ml. At the same level (400µg/ml), the rocket ethanol extract showed lower bleaching inhibition (64.70± 2.8%) (Table 35 and Figure 32).

e) The bleaching activity of turmeric using β- Carotene/linoleic acid assay:

Table (36) and figure (33) showed the results of antioxidant activity tests conducted by β-carotene bleaching assay for turmeric. The volatile extract of turmeric showed the high antioxidant activity with clear dose dependant responses compared to that of ethanolic extract. Turmeric essential oil inhibited the bleaching by 65.27±3.2% at a level of 400µg/ml. At the same level (400µg/ml), the turmeric ethanol extract showed lower bleaching inhibition (63.42± 2.6%) (Table 37 and Figure 34).

f) The bleaching activity of ginger using β- Carotene/linoleic acid assay:

Table (38) and figure (35) showed the results of antioxidant activity tests conducted by β-carotene bleaching assay for ginger. The volatile extract of ginger showed higher antioxidant activity than that of ethanolic extract with clear dose dependant responses. Ginger essential oil inhibited the bleaching by 78 ± 3.2% and 64.60 ± 3.1% for ginger ethanol extract at the level of 400µg/ml.

Table (32): The bleaching activity of parsley essential oil using β- Carotene/linoleic acid assay:

Concentration (ppm)	Time(min)							
	0	20	40	60	80	100	120	%
50	1186	1162	1125	1090	1010	982	830	43±2.1%
100	1280	1200	1165	1125	1080	1006	890	48.02±3.2%
200	1420	1380	1246	1195	1120	1086	930	56.60±2.9%
400	1495	1450	1330	1235	1200	1160	975	66.37±2.8%
TBHQ	1690	1540	1512	1500	1489	1480	1026	81.77±3.2%

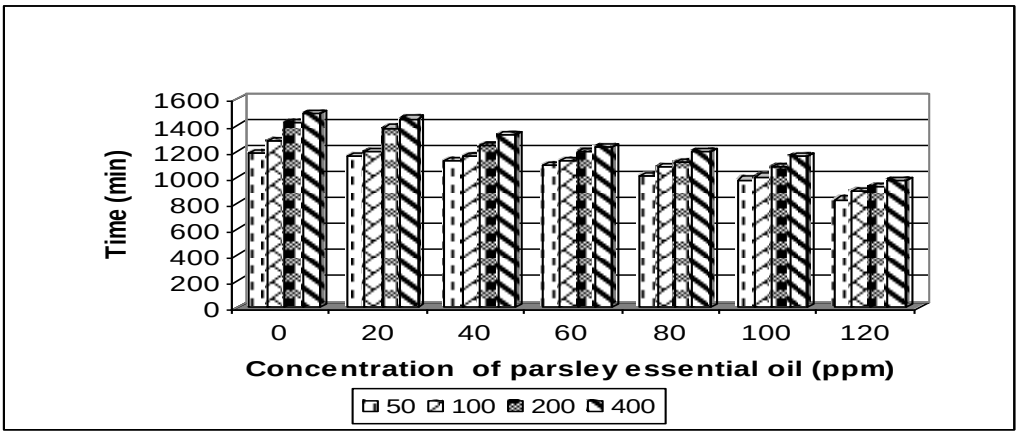

Fig. (29): The bleaching activity of parsley essential oil using β- Carotene / linoleic acid assay.

Table (33): The bleaching activity of parsley ethanolic extract using β- Carotene/linoleic acid assay.

Concentration (ppm)	Time(min)							
	0	20	40	60	80	100	120	%
50	1290	1225	1182	1123	1090	1035	982	38±1.8%
100	1385	1342	1268	1210	1185	1095	1020	44.90±2.1%
200	1485	1442	1380	1302	1225	1187	1051	53.57±2.3%
400	1565	1495	1401	1365	1290	1210	1072	63.42±2.6%
TBHQ	1690	1540	1512	1500	1489	1480	1026	81.77±3.0%

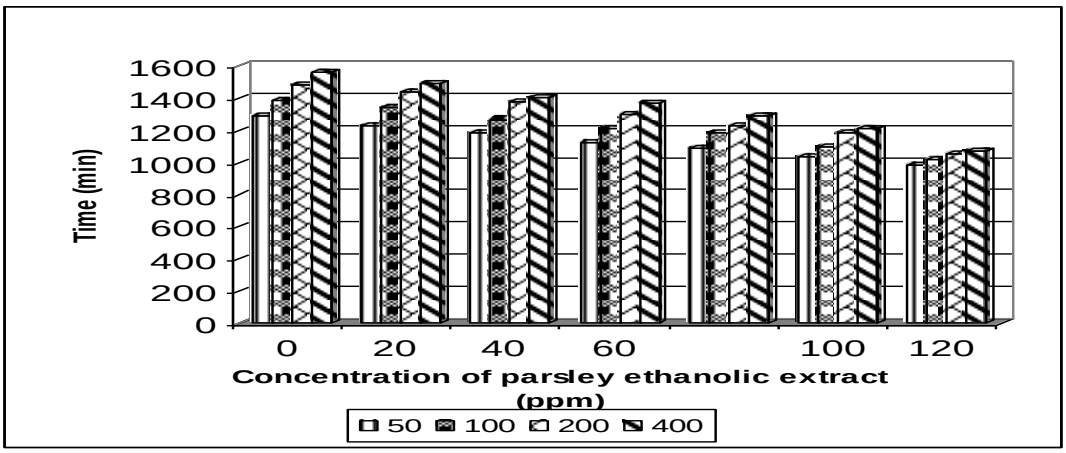

Fig. (30): The bleaching activity of parsley ethanolic extract using β- Carotene / linoleic acid assay

Table (34): The bleaching activity of rocket essential oil using β- Carotene/linoleic acid assay:

Concentration (ppm)	Time(min)							
	0	20	40	60	80	100	120	%
50	1230	1162	1103	1070	993	902	852	47±2.8%
100	1295	1262	1204	1115	1024	982	884	50.60±3.1%
200	1490	1470	1392	1360	1294	1262	912	71.18±2.83%
400	1620	1482	1402	1382	1343	1295	986	78.0±2.70%
TBHQ	1690	1540	1512	1500	1489	1480	1026	81.77±2.92%

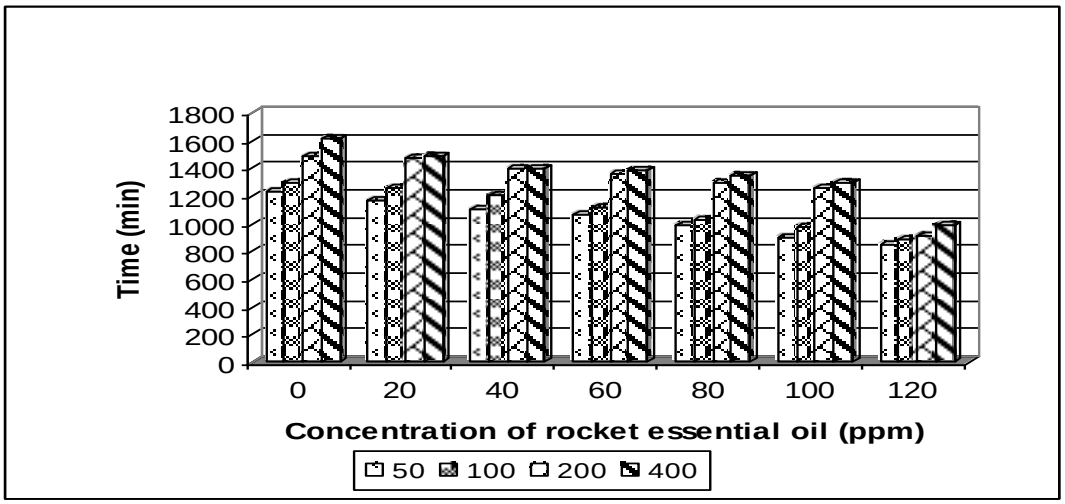

Fig. (31): The bleaching activity of rocket essential oil using β- Carotene/linoleic acid assay.

Table (35): The bleaching activity of rocket ethanolic extract using β- Carotene/linoleic acid assay:

Concentration (ppm)	Time(min)							
	0 time	20	40	60	80	100	120	%
50 µl	1320	1275	1230	1175	1116	1060	1026	36±2.46%
100 µl	1460	1356	1302	1246	1186	1114	1060	49.26±3.23%
200 µl	1580	1502	1389	1316	1264	1198	1120	56.60±2.90%
400 µl	1686	1622	1482	1375	1302	1262	1160	64.70±2.8%
TBHQ	1690	1540	1512	1500	1489	1480	1026	81.77±3.0%

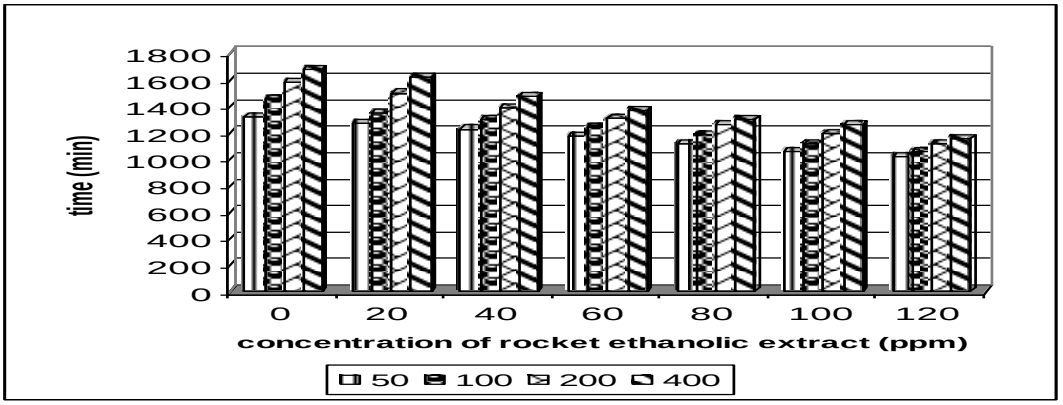

Fig. (32): The bleaching activity of rocket ethanolic extract using β- Carotene/linoleic acid assay.

Table (36): The bleaching activity of turmeric essential oil using β- Carotene/linoleic acid assay:

Concentration (ppm)	Time(min)							
	0	20	40	60	80	100	120	%
50	1170	1156	1092	1020	960	872	780	37±2.3%
100	1260	1213	1185	1110	1015	960	860	49.26±2.9%
200	1360	1320	1219	1160	1070	1006	880	59.11±1.8%
400	1470	1425	1300	1210	1156	1030	920	65.27±3.2%
TBHQ	1690	1540	1512	1500	1489	1480	1026	81.77±2.8%

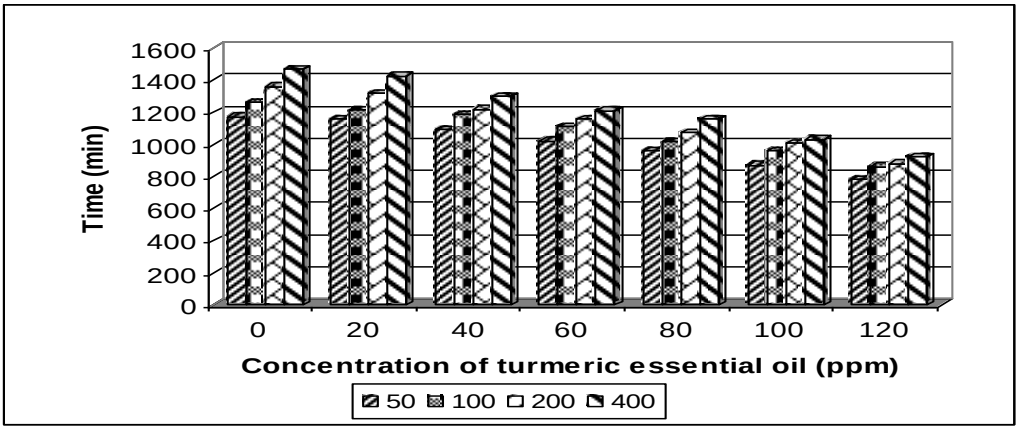

Fig. (33): The bleaching activity of turmeric essential oil using β- Carotene/linoleic acid assay.

Table (37): The bleaching activity of turmeric ethanolic extract using β- Carotene/linoleic acid assay:

Concentration (ppm)	Time(min)							
	0	20	40	60	80	100	120	%
50	1160	1121	1082	1026	990	903	840	39±1.7%
100	1270	1215	1176	1089	1035	970	901	44.30±2.3%
200	1420	1367	1295	1187	1082	1009	940	54.18±2.8%
400	1535	1468	1378	1246	1184	1098	1020	63.42±2.6%
TBHQ	1690	1540	1512	1500	1489	1480	1026	81.77±3.1%

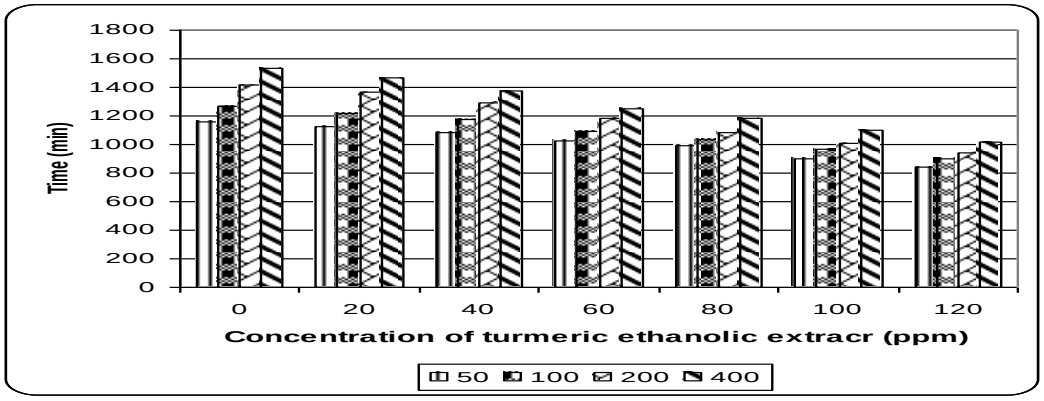

Fig. (34): bleaching activity of turmeric ethanolic extract using β- Carotene/linoleic acid assay.

Table (38): The bleaching activity of ginger essential oil using β- Carotene/linoleic acid assay:

Concentration (ppm)	Time(min)							
	0	20	40	60	80	100	120	%
50	1300	1260	1180	1118	1030	995	942	44±2.3%
100	1389	1318	1245	1180	1121	1086	980	52.80±2.8%
200	1480	1430	1300	1226	1192	1112	1020	56.65±2.9%
400	1560	1490	1410	1346	1250	1180	1035	78.50±3.2%
TBHQ	1690	1540	1512	1500	1489	1480	1026	81.77±3.3%

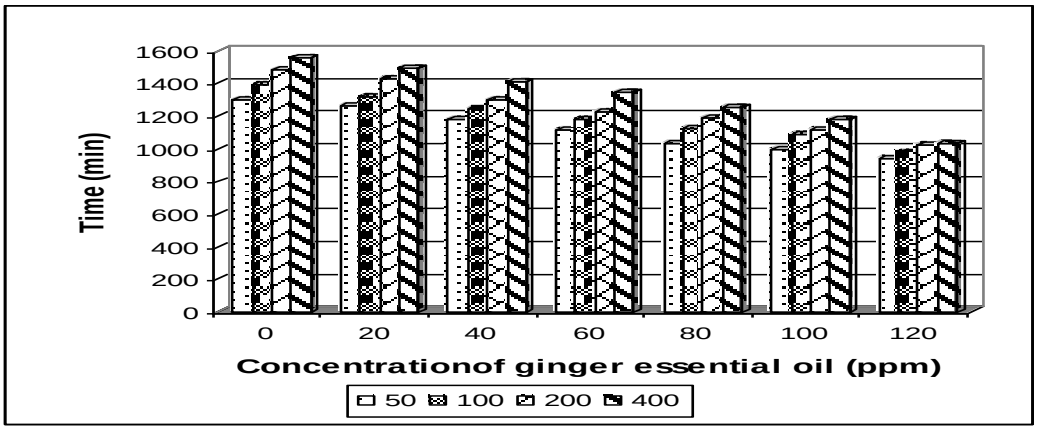

Fig. (35): The bleaching activity of ginger essential oil using β- Carotene/linoleic acid assay.

Table (39): The bleaching activity of ginger ethanolic extract using β- Carotene/linoleic acid assay:

Concentration (ppm)	Time(min)							
	0	20	40	60	80	100	120	%
50	1200	1162	1102	1085	1018	940	880	39±2.8%
100	1280	1212	1170	1112	1082	1004	920	44.30±2.6%
200	1386	1327	1282	1194	1110	1075	965	52.20±2.8%
400	1545	1462	1364	1270	1176	1102	1006	64.60±3.1%
TBHQ	1690	1540	1512	1500	1489	1480	1026	81.77±3.0%

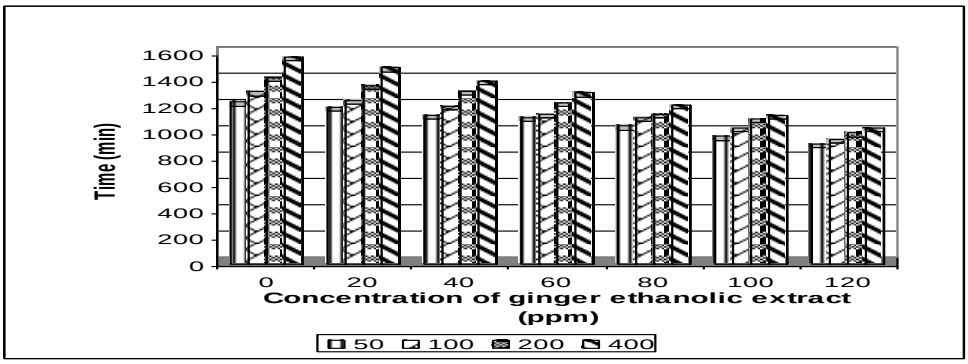

Fig. (36): The bleaching activity of ginger ethanolic extract using β- Carotene/linoleic acid assay

22) Physiological and biochemical effects of parsley and rocket extracts on aflatoxin treated rats:

a) Effect of parsley (40 mg/kg) or rocket (50 mg/kg) extracts on some blood parameters of male albino rats receiving aflatoxin contaminated diet:

Results in tables (40 and 41), and figs. (37 and 38) revealed that the group of animals receiving aflatoxin showed significant decrease in platelets, red blood corpuscles, white blood corpuscles, packed cell volume and hemoglobin content compared to the control group. Parsley or rocket treated groups showed non-significant decrease in all measured parameters compared to control group. On the other hand the group of animals receiving aflatoxin contaminated diet with parsley or rocket showed significant increase in all blood parameters except for hemoglobin content where the increase was insignificant compared to the aflatoxin treated group there were no significant difference between parsley or rocket treated groups with the control group in all the parameter while the group receiving both aflatoxin and parsley reduced significantly than the control group in all the blood parameters except for platelets were the reduction was insignificant. The same was for the group of animals receiving aflatoxin and rocket except for platelets and red blood cells.

b) Effect of parsley (40 mg/kg) or rocket (50 mg/kg) extracts on serum liver enzymes of male albino rats receiving aflatoxin contaminated diet:

Results in tables (42 and 43), and figs. (39 and 40) revealed that the group of animals receiving aflatoxin showed significant increase in serum (AST) and (ALT) levels compared to the control group. Parsley or rocket treated groups showed non-significant decrease in liver enzymes compared to control group. On the other hand the treatment of the group of animals receiving aflatoxin contaminated diet with parsley or rocket led to significant decrease in serum (AST) and (ALT) compared to the aflatoxin treated group, there were no significant difference between parsley or rocket treated groups with the control group. The treatment with parsley or rocket for the group of animals receiving aflatoxin contaminated diet led to significant reduction in serum (AST) and (ALT) levels compared to the aflatoxin group. There was no significant difference the group receiving both aflatoxin and rocket and the control group, in the parsley and aflatoxin treated group ALT was elevated significantly.

Table (40): Effect of parsley extract (40mg/kg) on some blood parameters of male albino rats receiving aflatoxin contaminated diet**:**

Groups	Blood parameters				
	Platelets ($X10^5$)	RBCS ($x10^{6\mu l-1}$)	WBCS($X10^3$)	PCV (%)	HB (g/dl)
Control	4.446 ± 0.038^{A}	6.28± 0.142^{A}	13.14± 0.188^{A}	42.79 ± 0.605^{A}	15.45 ± 0.141^{AB}
Aflatoxin	2.358 ± 0.024^{B}	3.96± 0.095^{C}	7.52 ± 0.162^{C}	27.32 ± 0.860^{C}	11.10 ± 0.131 ^{D}
Parsley	4.185 ± 0.474 ^{A}	5.72± 0.654^{AB}	11.57 ± 1.295^{A}	38.22 ± 4.252^{AB}	13.72 ± 1.550^{BC}
Parsley + aflatoxin	4.005 ± 0.043 ^{A}	5.29± 0.124^{B}	9.34± 0.149^{B}	35.50 ±0.628^{B}	13.21 ± 0.107^{CD}
L.S.D	0.5527	0.8168	1.579	5.181	1.840

Within each column, means superscript with different letter are significantly different ($P \leq 0.05$)

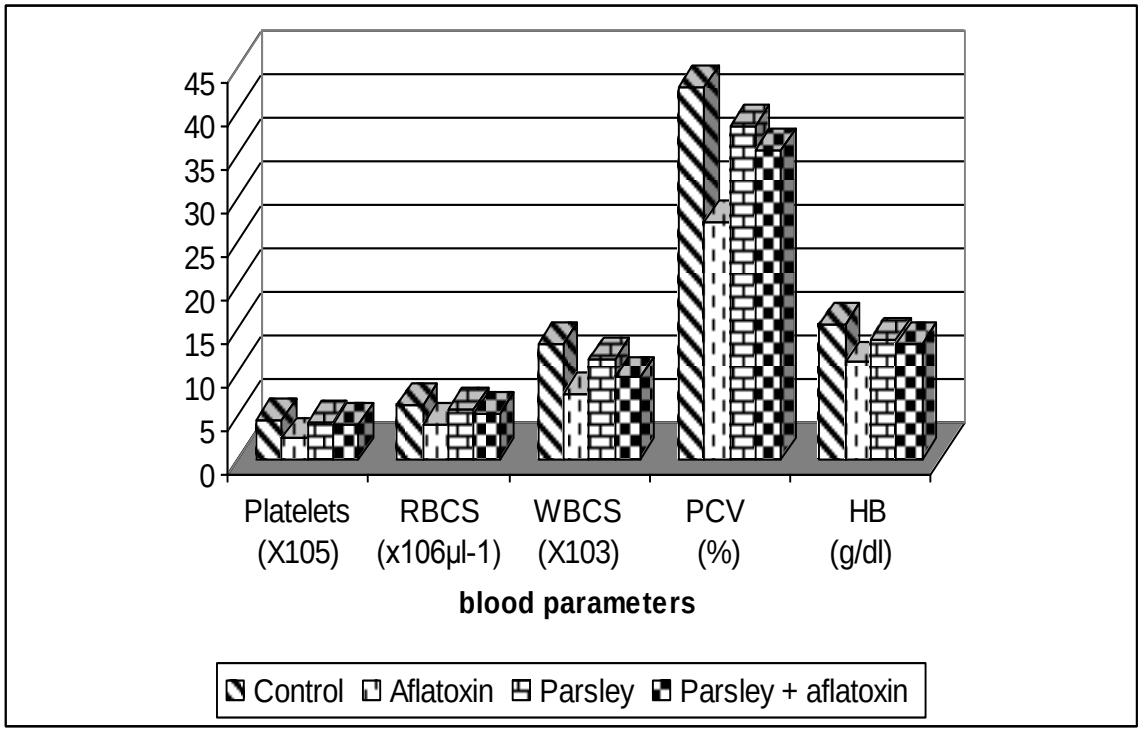

Fig. (37): Effect of parsley extract (40mg/kg) on some blood parameters of male albino rats receiving aflatoxin contaminated diet.

Table (41): Effect of rocket extract (50mg/kg) on some blood parameters of male albino rats receiving aflatoxin contaminated diet:

Groups	Blood parameters				
	Platelets ($X10^5$)	RBCS ($x10^{6}\mu l^{-1}$)	WBCS($X10^3$)	PCV (%)	HB (g/dl)
Control	4.446 ± 0.038^{A}	6.28± 0.142^{A}	13.14± 0.188^{A}	42.79 ± 0.605^{A}	15.45 ± 0.141^{AB}
Aflatoxin	2.358 ± 0.024^{B}	3.96± 0.095^{C}	7.52 ± 0.162^{C}	27.32 ± 0.860^{C}	11.10 ± 0.131 ^{D}
Rocket	4.404 ± 0.056 ^{A}	6.36 ± 0.115^{A}	13.14 ± 0.255^{A}	41.79 ± 0.422^{A}	15.66 ± 0.195^{A}
Rocket + Aflatoxin	4.035 ± 0.039 ^{A}	5.48 ± 0.127^{AB}	9.80 ± 0.180^{B}	33.47 ± 0.526^{B}	12.88 ± 0.192^{C}
L.S.D	0.5527	0.8168	1.579	5.181	1.840

Within each column, means superscript with different letter are significantly different ($P \leq 0.05$)

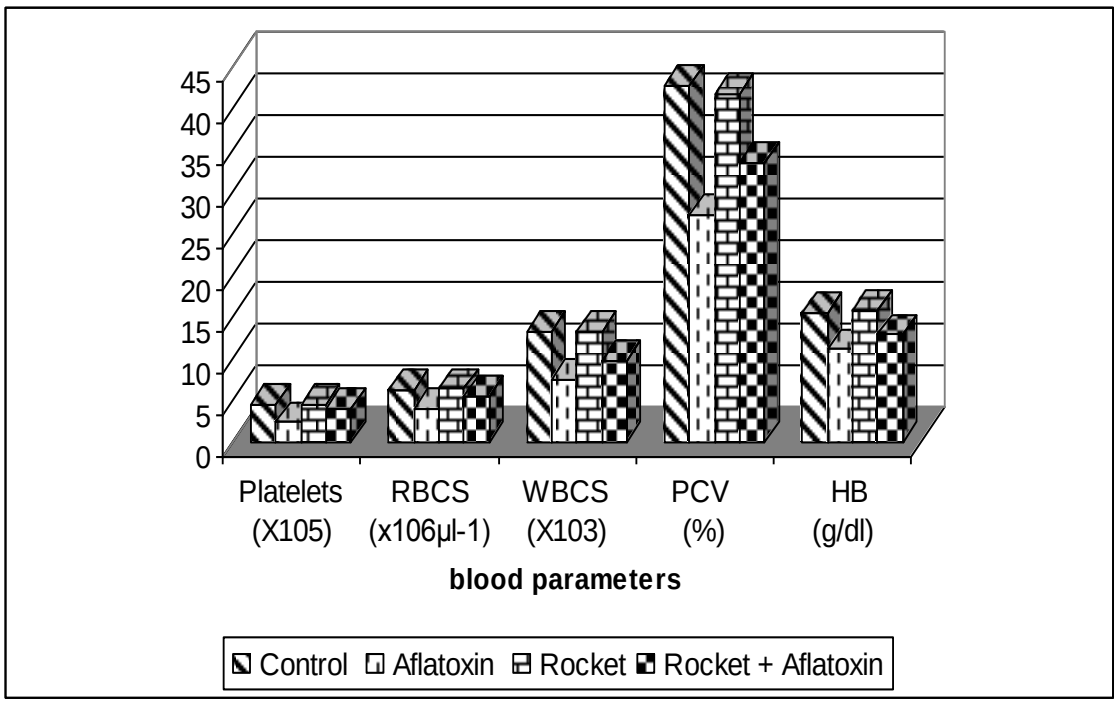

Fig. (38): Effect of rocket extract (50mg/kg) on some blood parameters of male albino rats receiving aflatoxin contaminated diet.

Table (42): Effect of parsley extract (40mg/kg) on serum Liver Enzymes (AST and ALT) of male albino rats receiving aflatoxin contaminated diet:

Groups	Liver enzymes	
	AST (U/L)	ALT (U/L)
Control	20.67 ± 0.518^{B}	21.41 ± 0.747^{CD}
Aflatoxin	29.14 ± 0.757^{A}	30.40 ± 0.354^{A}
Parsley	20.34 ± 2.343^{B}	20.78 ± 2.374^{D}
Parsley + Aflatoxin	22.55 ± 1.103^{B}	25.46 ± 0.745^{B}
L.S.D	3.321	3.283

Within each column, means superscript with different letter are significantly different ($P \leq 0.05$).

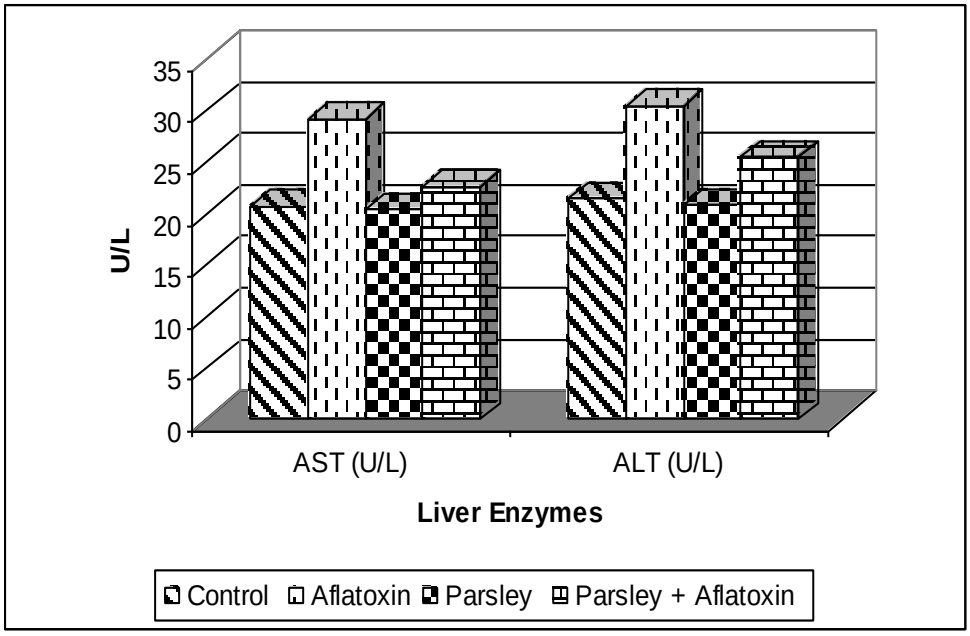

Fig. (39): Effect of parsley extract (40mg/kg) on serum Liver Enzymes (AST and ALT) of male albino rats receiving aflatoxin contaminated diet.

Table (43): Effect of rocket extract (50mg/kg) on serum Liver Enzymes (AST and ALT) of male albino rats receiving aflatoxin contaminated diet:

Groups	Liver enzymes	
	AST (U/L)	ALT (U/L)
Control	20.67 ± 0.518^{B}	21.41 ± 0.747^{CD}
Aflatoxin	29.14 ± 0.757^{A}	30.40 ± 0.354^{A}
Rocket	20.48 ± 0.693^{B}	21.29 ± 0.644^{CD}
Rocket + Aflatoxin	22.95 ± 0.495^{B}	24.42 ± 0.866^{BC}
L.S.D	3.321	3.283

Within each column, means superscript with different letter are significantly different ($P \leq 0.05$).

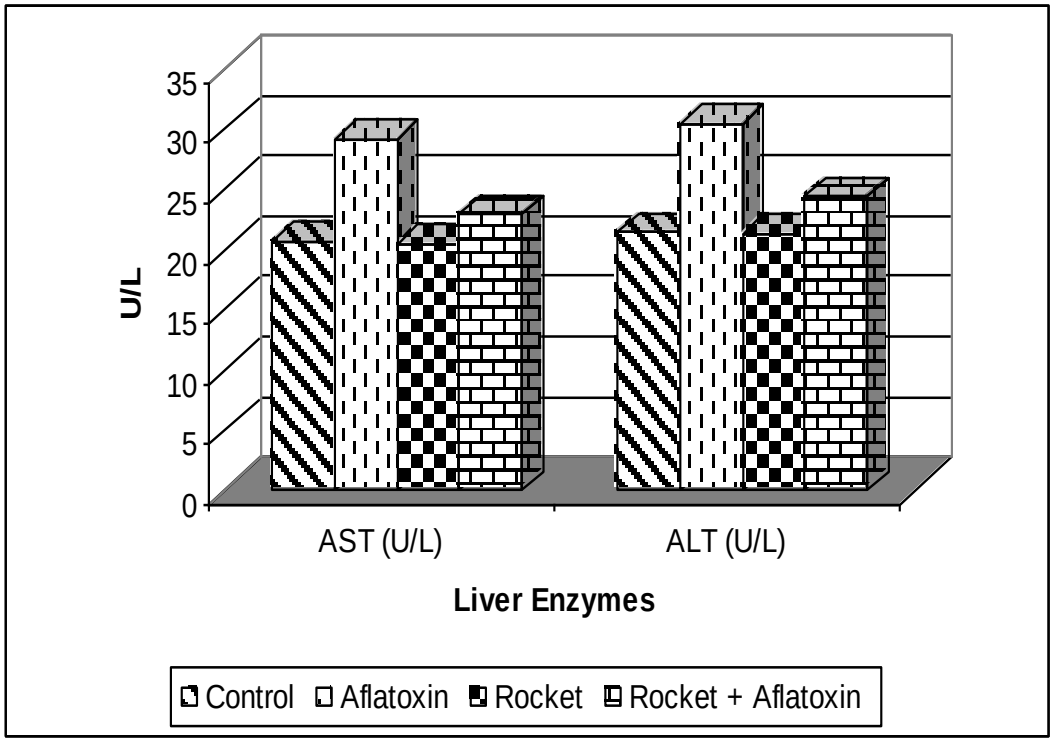

Fig. (40): Effect of rocket extract (50mg/kg) on serum Liver Enzymes (AST and ALT) of male albino rats receiving aflatoxin contaminated diet.

c) Effect of parsley (40 mg/kg**) or rocket (**50 mg/kg**) extracts on Lipid Profile of male albino rats receiving aflatoxin contaminated diet:**

Results in tables (44 and 45) and figs. (41 and 42) revealed that the group of animals receiving aflatoxin showed significant increase in serum cholesterol level, triglycerides and LDL compared with control, while HDL was significantly decreased. On the other hand while the group of animals treated with parsley extract showed significant reduction in both cholesterol and triglycerides levels and insignificant decrease in HDL and LDL the group of animals treated with rocket extract showed insignificant reduction of serum cholesterol, triglycerides, HDL and LDL levels in comparison with the control group. The treatment with parsley or rocket extracts for the group of animals receiving aflatoxin contaminated diet led to significant reduction in serum cholesterol, Triglycerides and LDL and significant increase in HDL levels compared to the aflatoxin group. And while the Levels of serum cholesterol was significantly higher in the parsley + aflatoxin group than the control group, levels of serum triglycerides and LDL showed insignificant elevation but for the rocket+ aflatoxin group only LDL showed significant increase and the elevation was insignificant in the serum cholesterol level, triglycerides and HDL.

d) Effect of parsley (40 mg/kg) **or rocket** (50 mg/kg) **extracts on serum alkaline phosphatase (ALP) and albumin in albino rat:**

Results in tables (46 and 47) and figs. (43 and 44) and (45 and 46) revealed that the group of animals receiving aflatoxin showed significant increase in serum alkaline phosphatase and significant decrease in serum albumin compared with the control group. The group of animals treated with parsley or rocket extracts showed insignificant reduction in both serum alkaline phosphatase and albumin in comparison with the control group. On the other hand the treatment with parsley or rocket extracts for the group of animals receiving aflatoxin contaminated diet led to significant reduction of serum alkaline phosphatase and significant increase of albumin compared with the aflatoxin group. Both aflatoxin + parsley, and aflatoxin + rocket treated groups showed significant elevation in serum alkaline phosphatase and insignificant reduction in serum albumin compared to the control group.

Table (44): Effect of parsley extract (40mg/kg) on serum cholesterol, triglycerides, LDL and HDL of male albino rats receiving aflatoxin contaminated diet:

Groups	Lipid profile			
	Cholesterol (mg/dl)	Triglycerides (mg/dl)	HDL (mg/dl)	LDL (mg/dl)
Control	68.82 ± 1.790^{BC}	77.44 ± 1.700^{C}	39.82 ± 0.464^{A}	32.52 ± 0.830^{D}
Aflatoxin	86.16 ± 1.221^{A}	120.7 ± 2.364^{A}	23.97 ± 0.530^{C}	73.52 ± 1.508^{A}
Parsley	57.11 ± 6.479^{D}	64.75 ± 7.238^{D}	34.54 ± 4.049^{AB}	28.96 ± 3.276^{D}
Parsley + Aflatoxin	75.09 ± 0.918^{B}	91.73 ± 1.383^{B}	33.19 ± 0.939^{B}	51.08 ± 0.827^{B}
L.S.D	8.285	9.517	5.191	4.533

Within each column, means superscript with different letter are significantly different ($P\leq 0.05$).

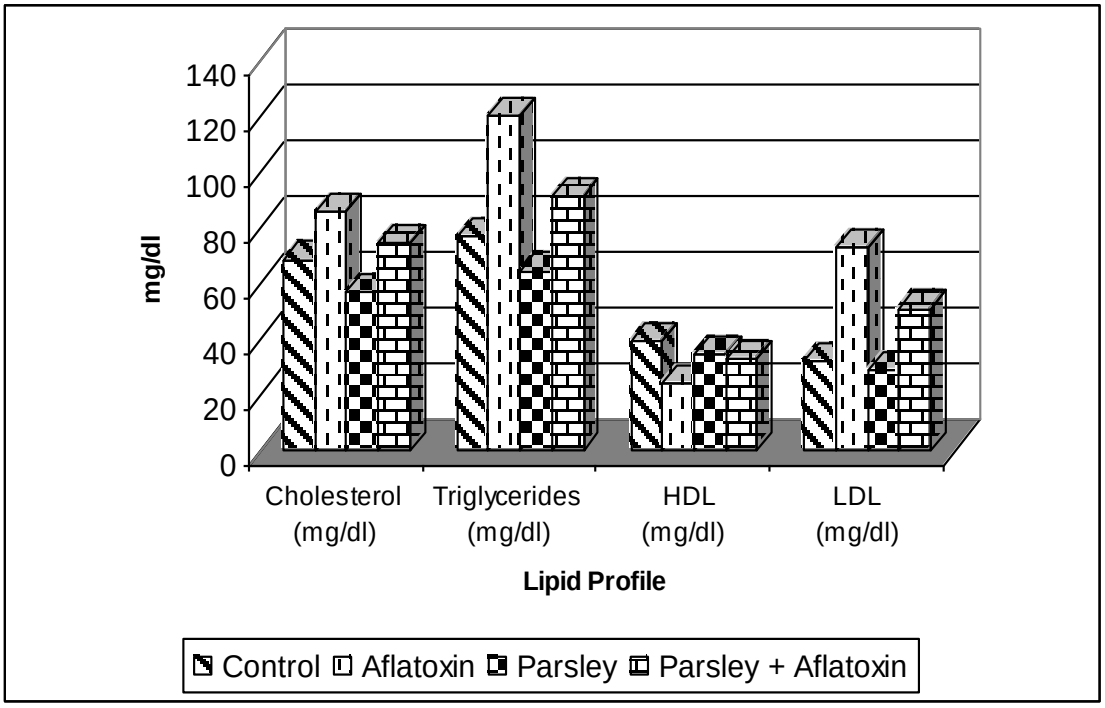

Fig. (41): Effect of parsley extract (40mg/kg) on serum cholesterol, triglycerides, LDL and HDL of male albino rats receiving aflatoxin contaminated diet.

Table (45): Effect of rocket extract (50mg/kg) on serum cholesterol, triglycerides, LDL and HDL of male albino rats receiving aflatoxin contaminated diet:

Groups	Lipid profile			
	Cholesterol (mg/dl)	Triglycerides (mg/dl)	HDL (mg/dl)	LDL (mg/dl)
Control	68.82 ± 1.790^{BC}	77.44 ± 1.700^{C}	39.82 ± 0.464^{A}	32.52 ± 0.830^{D}
Aflatoxin	86.16 ± 1.221^{A}	120.7 ± 2.364^{A}	23.97 ± 0.530^{C}	73.52 ± 1.508^{A}
Rocket	64.51 ± 1.217^{CD}	75.20 ± 1.448^{C}	39.35 ± 0.904^{A}	32.49 ± 0.725^{D}
Rocket + Aflatoxin	75.02 ± 1.493^{B}	81.35 ± 1.646^{C}	34.64 ± 1.230^{AB}	40.33 ± 0.655^{C}
L.S.D	8.285	9.517	5.191	4.533

Within each column, means superscript with different letter are significantly different ($P\leq 0.05$).

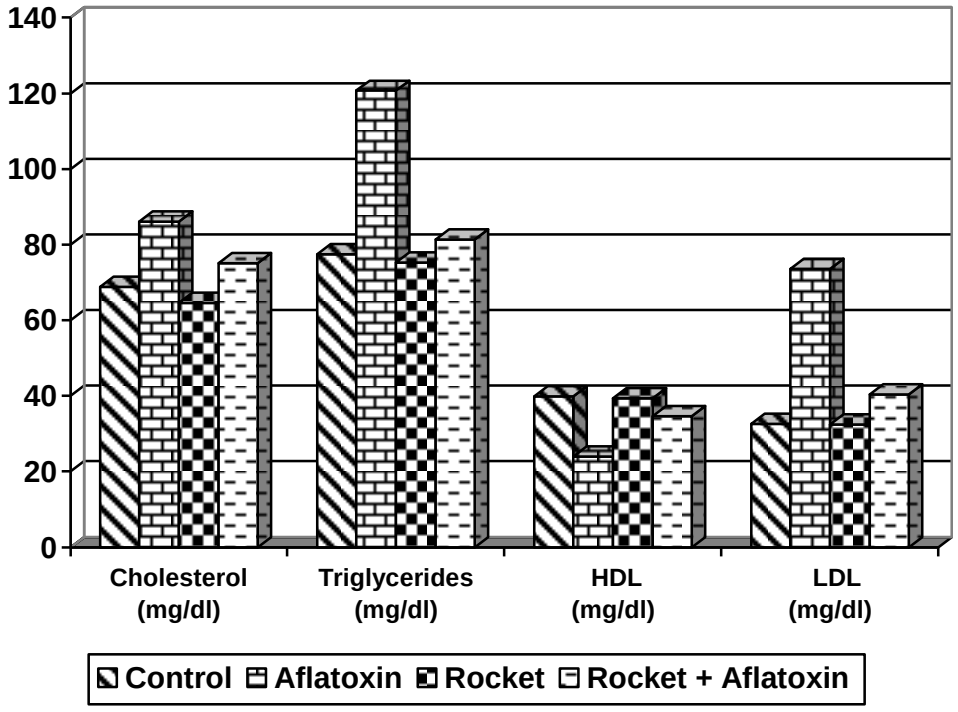

Fig. (42): Effect of rocket extract (50mg/kg) on serum cholesterol, triglycerides, LDL and HDL of male albino rats receiving aflatoxin contaminated diet.

Table (46): Effect of parsley extract (40mg/kg) on serum alkaline phosphatase (U/L) and Albumin (g/dl) of male albino rats receiving aflatoxin contaminated diet:

Groups	Alkaline Phosphatase (U/L)	Albumin (g/dl)
Control	73.54 ± 1.006^{C}	4.031 ± 0.0702^{A}
Aflatoxin	139.6 ± 1.672^{A}	1.431 ± 0.503^{B}
Parsley	66.17 ± 7.424^{C}	3.613 ± 0.420^{A}
Parsley + Aflatoxin	90.98 ± 1.394^{B}	3.641 ± 0.456^{A}
L.S.D	9.350	0.5599

Within each column, means superscript with different letter are significantly different ($P \leq 0.05$).

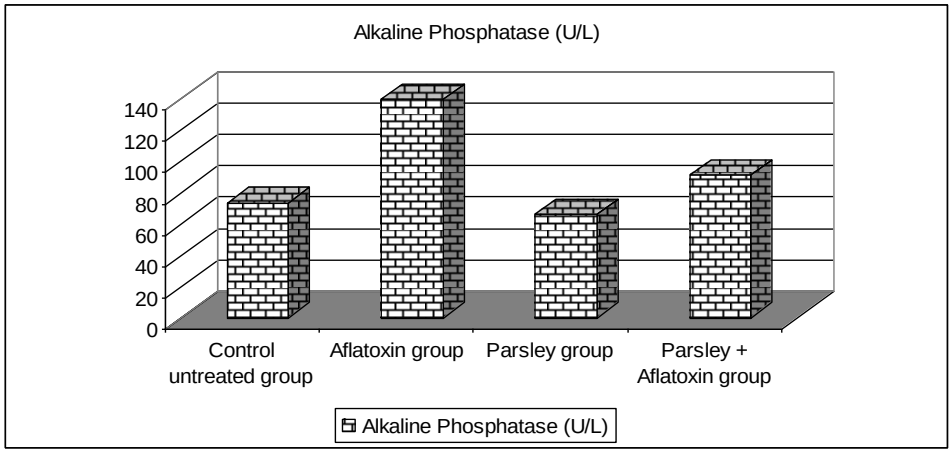

Fig. (43): Effect of parsley extract (40mg/kg) on serum alkaline phosphatase (ALP) of male albino rats receiving aflatoxin contaminated diet.

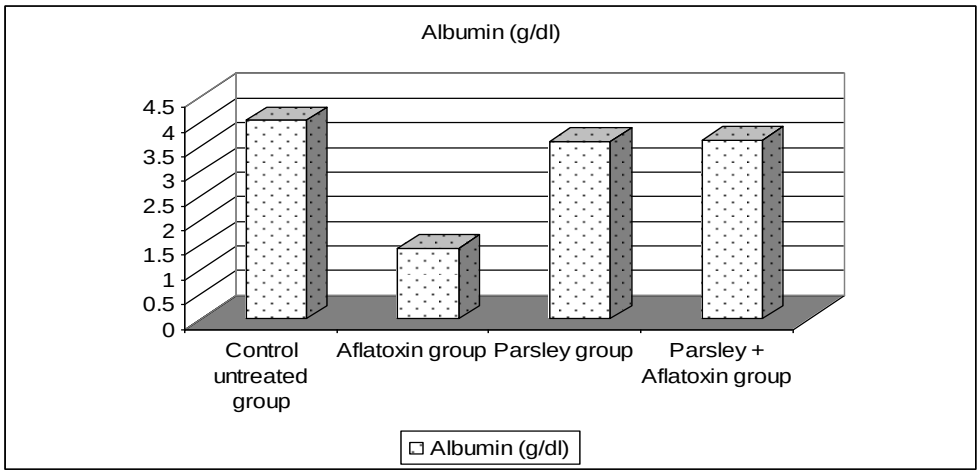

Fig. (44): Effect of parsley extract (40mg/kg) on serum albumin of male albino rats receiving aflatoxin contaminated diet

Table (47): Effect of rocket extract (50mg/kg) on serum alkaline phosphatase (U/L) and Albumin (g/dl) of male albino rats receiving aflatoxin contaminated diet:

Groups	Alkaline Phosphatase (U/L)	Albumin (g/dl)
Control	73.54 ± 1.006^{C}	4.031 ± 0.0702^{A}
Aflatoxin	139.6 ± 1.672^{A}	1.431 ± 0.503^{B}
Rocket	70.64 ± 1.839^{C}	4.031 ± 0.214^{A}
Rocket + Aflatoxin	98.18 ± 0.996^{B}	3.869 ± 0.045^{A}
L.S.D	9.350	0.5599

Within each column, means superscript with different letter are significantly different ($P \leq 0.05$).

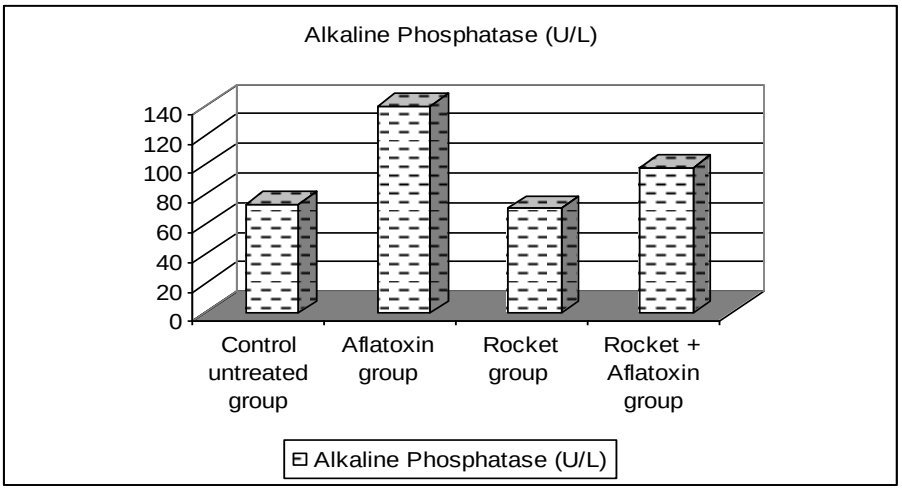

Fig. (45): Effect of rocket extract (50mg/kg) on serum alkaline phosphatase (ALP) of male albino rats receiving aflatoxin contaminated diet.

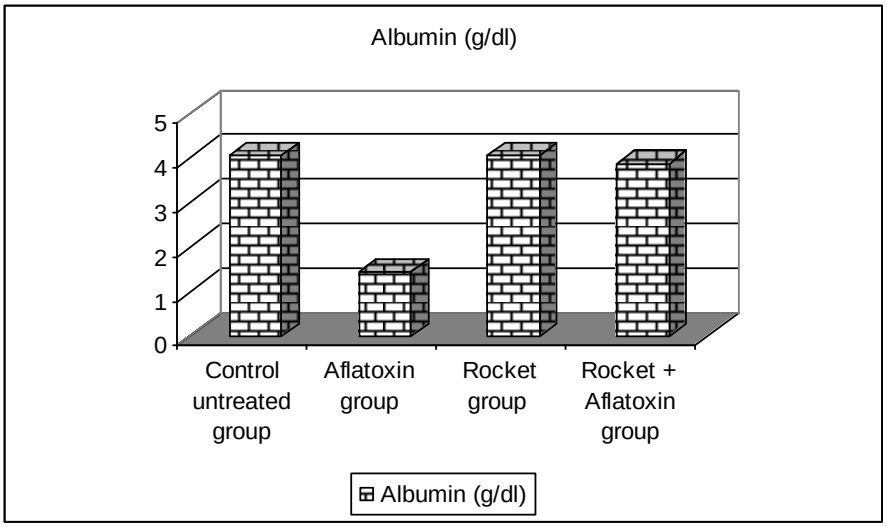

Fig. (46): Effect of rocket extract (50mg/kg) on serum albumin of male albino rats receiving aflatoxin contaminated diet.

e) Effect of parsley (40 mg/kg**) or rocket (**50 mg/kg**) extracts on Kidney Function of male albino rats receiving aflatoxin contaminated diet:**

Results in tables. (48 and 49) and figs. (47and 48) and (49 and 50) revealed that the group of animals receiving aflatoxin showed significant increase in serum createnine, urea and uric acid levels compared with the control group. While, the group of animals treated with parsley extract showed significant reduction in serum createnine and urea and non-significant reduction in uric acid levels while the group of animals treated with rocket extract showed insignificant reduction in serum createnine, urea and uric acid levels in comparison with the control..

On the other hand the treatment with parsley or rocket extracts for the group of animals receiving aflatoxin contaminated diet led to significant reduction in all the measured parameters compared with the aflatoxin group. While in comparison with the control group the levels of serum createnine, urea and uric acid were significantly higher in the groups receiving aflatoxin + parsley or aflatoxin+ rocket extract.

f) Effect of parsley (40 mg/kg**) or rocket (**50 mg/kg**) extract on serum α fetoprotein and carcinoembryonic antigen of male albino rats receiving aflatoxin contaminated diet:**

Results in tables (50 and 51) and figs. (51 and 52) revealed that the group of animals receiving aflatoxin showed significant increase in serum α fetoprotein and carcinoembryonic antigen compared with the control group, while the group of animals treated with parsley extract led to significant reduction in both parameters and the reduction was insignificant in both parameters for the group of animals treated with rocket extract in comparison with the control group.

On the other hand the treatment with parsley or rocket for the group of animals receiving aflatoxin contaminated diet led to significant reduction of both tumor markers compared with the aflatoxin group, and both marker in the groups receiving aflatoxin + parsley or aflatoxin + rocket extract were significantly higher than the control group.

Table (48): Effect of parsley extract (40mg/kg) on serum createnine, urea and uric acid of male albino rats receiving aflatoxin contaminated diet:

Groups	Kidney function		
	Createnine (mg/dl)	Urea (mg/dl)	Uric Acid (mg/dl)
Control	0.473 ± 0.0135^{C}	31.28 ± 0.931^{C}	0.484 ± 0.085^{C}
Aflatoxin	0.831 ± 0.015^{A}	67.75 ± 1.034^{A}	1.699 ± 0.031^{A}
Parsley	0.395 ± 0.045^{D}	$23.73 \pm 2,681^{D}$	0.409 ± 0.046^{C}
Parsley + Aflatoxin	0.611 ± 0.017^{B}	39.48 ± 1.076^{B}	0.587 ± 0.025^{B}
L.S.D	0.06945	4.071	0.07502

Within each column, means superscript with different letter are significantly different ($P \leq 0.05$)

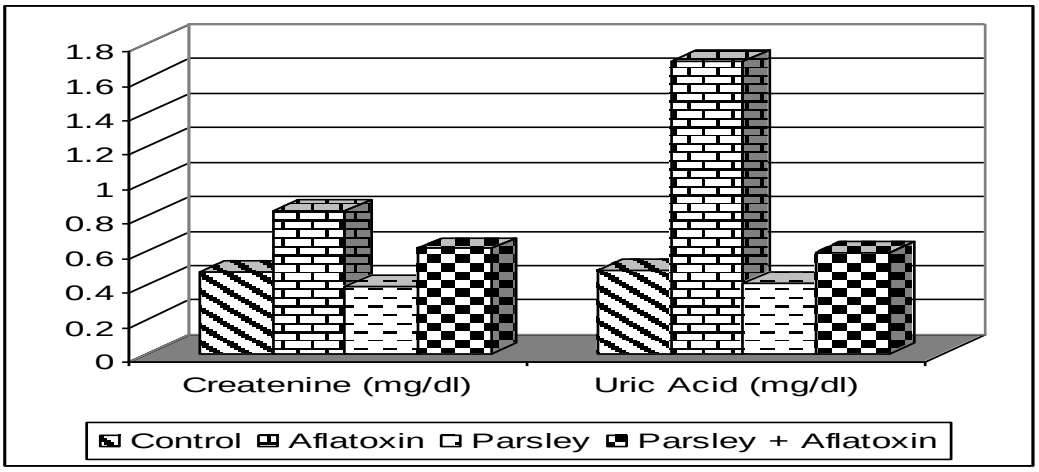

Fig. (47): Effect of parsley extract (40mg/kg) on serum createnine and uric acid of male albino rats receiving aflatoxin contaminated diet

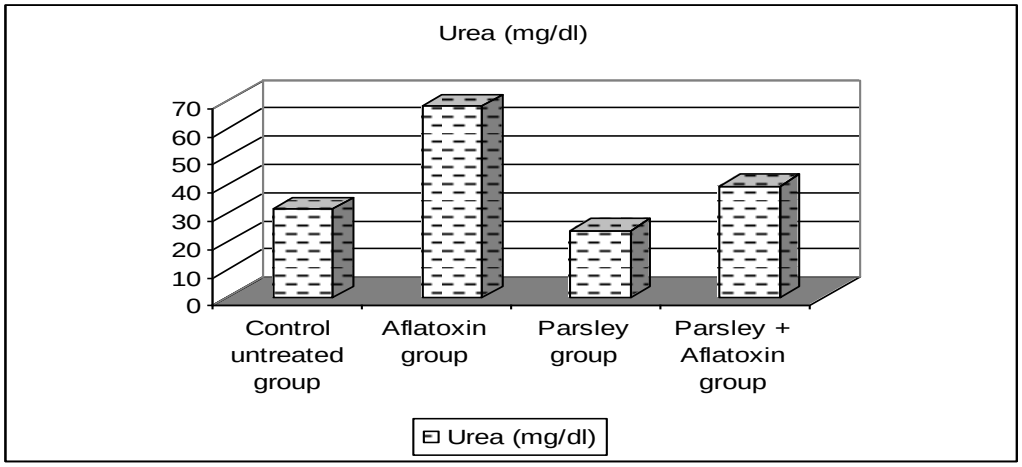

Fig. (48): Effect of parsley extract (40mg/kg) on serum urea of male albino rats receiving aflatoxin contaminated diet

Table (49): Effect of rocket extract (50mg/kg) on serum createnine, urea and uric acid of male albino rats receiving aflatoxin contaminated diet:

Groups	Kidney function		
	Createnine (mg/dl)	Urea (mg/dl)	Uric Acid (mg/dl)
Control	0.473 ± 0.0135^{C}	31.28 ± 0.931^{C}	0.484 ± 0.085^{C}
Aflatoxin	0.831 ± 0.015^{A}	67.75 ± 1.034^{A}	1.699 ± 0.031^{A}
Rocket	0.449 ± 0.023^{CD}	28.30 ± 0.602^{C}	0.478 ± 0.010^{C}
Rocket + Aflatoxin	0.629 ± 0.021^{B}	35.85 ± 1.314^{B}	0.719 ± 0.013^{B}
L.S.D	0.06945	4.071	0.07502

Within each column, means superscript with different letter are significantly different ($P \leq 0.05$)

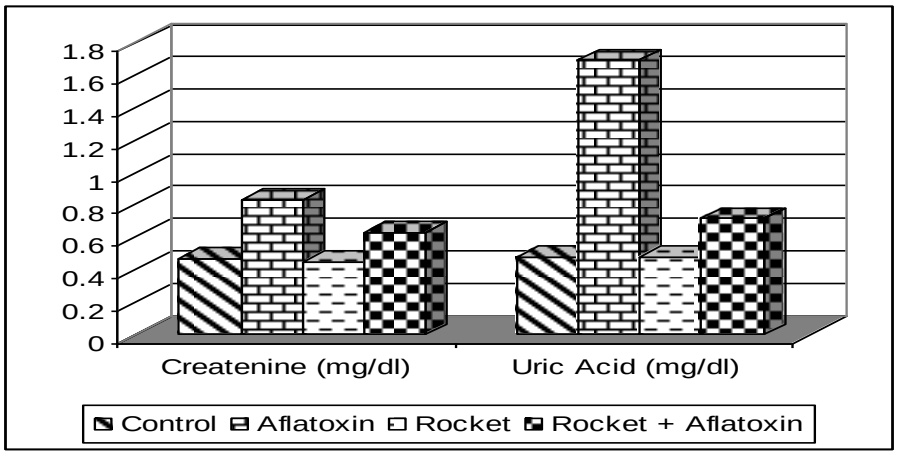

Fig. (49): Effect of rocket extract (50mg/kg) on serum createnine and uric acid of male albino rats receiving aflatoxin contaminated diet.

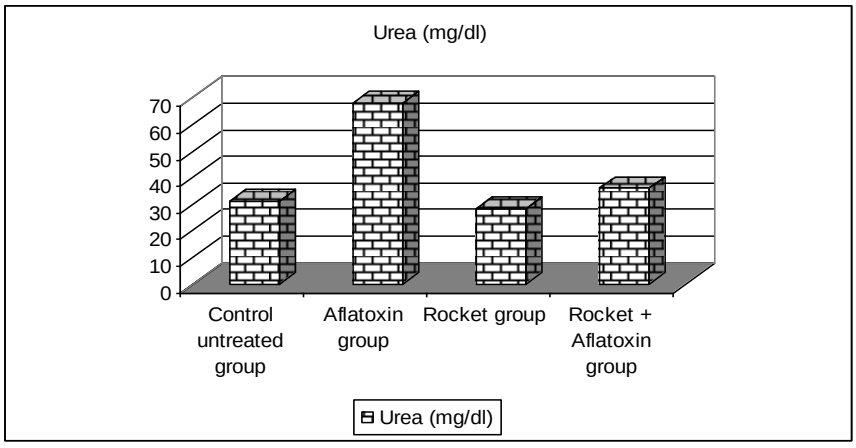

Fig. (50): Effect of rocket extract (50mg/kg) on serum urea of male albino rats receiving aflatoxin contaminated diet.

Table (50): Effect of parsley extract (40mg/kg) on serum α fetoprotein and carcinoembryonic antigen of male albino rats receiving aflatoxin contaminated diet:

Groups	Tumor markers	
	α fetoprotein (ng/ml)	Carcinoembryonic Antigen(ng/ml)
Control	1.479 ± 0.024^{D}	0.546 ± 0.0104^{D}
Aflatoxin	3.745 ± 0.120^{A}	2.611 ± 0.050^{A}
Parsley	1.180 ± 0.134^{C}	0.424 ± 0.048^{C}
Parsley + Aflatoxin	2.831 ± 0.127^{B}	1.463 ± 0.028^{B}
L.S.D	0.2720	0.1022

Within each column, means superscript with different letter are significantly different ($P \leq 0.05$).

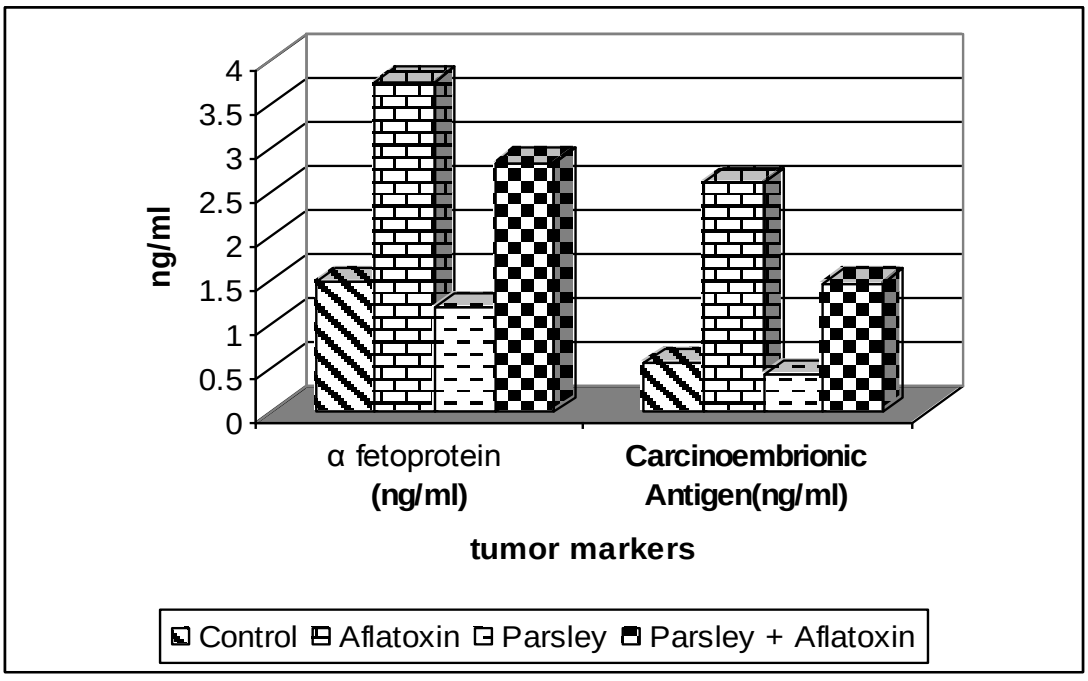

Fig. (51): Effect of parsley extract (40mg/kg) on serum α fetoprotein and carcinoembryonic antigen of male albino rats receiving aflatoxin contaminated diet.

Table (51): Effect of rocket extract (50mg/kg) on serum α fetoprotein and carcinoembrionic antigen of male albino rats receiving aflatoxin contaminated diet:

Groups	Tumor markers	
	α fetoprotein (ng/ml)	Carcinoembrionic Antigen(ng/ml)
Control	1.479 ± 0.024^{C}	0.546 ± 0.0104^{C}
Aflatoxin	3.745 ± 0.120^{A}	2.611 ± 0.050^{A}
Rocket	1.234 ± 0.032^{CD}	0.483 ± 0.011^{CD}
Rocket + Aflatoxin	2.446 ± 0.071^{B}	1.267 ± 0.046^{B}
L.S.D	0.2720	0.1022

Within each column, means superscript with different letter are significantly different (P≤ 0.05).

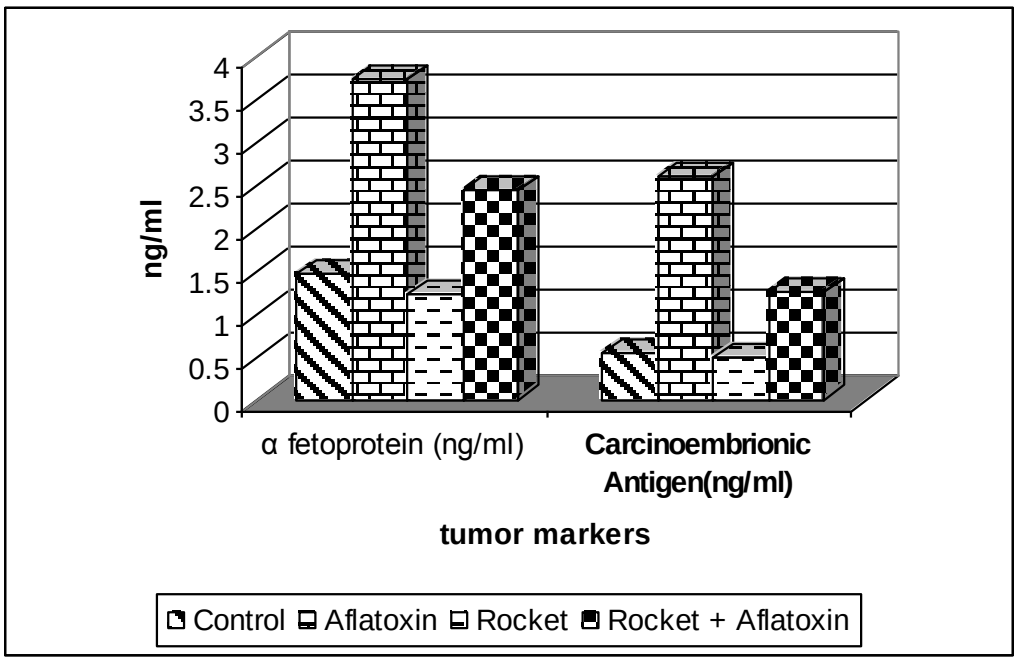

Fig. (52): Effect of rocket extract (50mg/kg) on serum α-fetoprotein and carcinoembrionic antigen of male albino rats receiving aflatoxin contaminated diet.

g) Effect of parsley (40 mg/kg**) or rocket (**50 mg/kg**) extracts on antioxidant parameters of male albino rats receiving aflatoxin contaminated diet:**

Results in tables (52 and 53) and figs. (53 and 54) revealed that the group of animals receiving aflatoxin showed significant increase in serum nitric oxide and malondialdehyde levels while liver superoxide dismutase was significantly decreased compared to the control group. The group of animals treated with parsley extract showed insignificant reduction in serum nitric oxide and liver superoxide dismutase and significant reduction in serum malondialdehyde while the group of animals treated with rocket extract showed insignificant decrease in serum nitric oxide and malondialdehyde levels and also led to significant increase in liver superoxide dismutase in comparison with the control.

On the other hand, the treatment with parsley or rocket extracts for the group of animals receiving aflatoxin contaminated diet led to significant reduction in serum nitric oxide and malondialdehyde and also insignificant increase in liver superoxide dismutase level compared to the aflatoxin group. While serum nitric oxide was significantly in both groups, the elevation in serum malondialdehyde was insignificant for the group receiving aflatoxin + parsley and also the level of liver superoxide dismutase was insignificantly decreased, and for the group receiving aflatoxin + rocket extract significant reduction in liver superoxide dismutase levels and insignificant increase in serum maolndialdehyde was observed compared to the control group.

Table (52): Effect of parsley extract (40mg/kg) on serum nitric oxide, malondialdehyde and liver superoxide dismutase of male albino rats receiving aflatoxin contaminated diet:

Groups	Antioxidant parameters		
	Nitric Oxide (mol/l)	Superoxide Dismutase (µg/mg)	Malondialdehyde (ng/g)
Control	30.25 ± 0.732^{C}	101.6 ± 0.631^{B}	175.1 ± 1.970^{BC}
Aflatoxin	61.50 ± 1.422^{A}	74.33 ± 2.093^{A}	218.3 ± 3.585^{A}
Parsley	26.97 ± 3.151^{C}	95.82 ± 1.731^{BC}	148.8 ± 6.685^{D}
Parsley + Aflatoxin	52.28 ± 1.099^{B}	87.74 ± 1.575^{ABC}	194.6 ± 1.334^{B}
L.S.D	4.750	13.28	20.34

Within each column, means superscript with different letter are significantly different ($P \leq 0.05$).

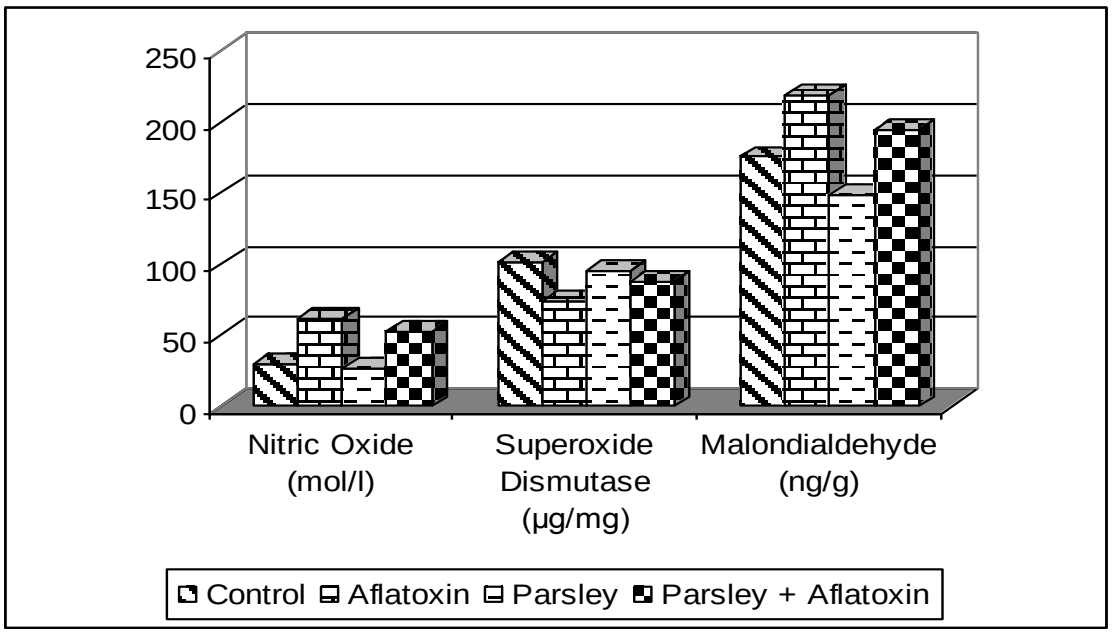

Fig. (53): Effect of parsley extract (40mg/kg) on serum nitric oxide, malondialdehyde and Liver superoxide dismutase of male albino rats receiving aflatoxin contaminated diet.

Table (53): Effect of rocket extract (50mg/kg) on serum nitric oxide, malondialdehyde and liver superoxide dismutase of male albino rats receiving aflatoxin contaminated diet:

Groups	Antioxidant parameters		
	Nitric Oxide (mol/l)	Superoxide Dismutase (µg/mg)	Malondialdehyde (ng/g)
Control	30.25 ± 0.732^{C}	101.6 ± 0.631^{B}	175.1 ± 1.970^{BC}
Aflatoxin	61.50 ± 1.422^{A}	74.33 ± 2.093^{D}	218.3 ± 3.585^{A}
Rocket	28.60 ± 1.681^{C}	114.8 ± 2.178^{A}	157.3 ± 3.016^{CD}
Rocket + Aflatoxin	50.06 ± 0.564^{B}	86.78 ± 2.106^{CD}	186.1 ± 1.642^{B}
L.S.D	4.750	13.28	20.34

Within each column, means superscript with different letter are significantly different ($P \leq 0.05$).

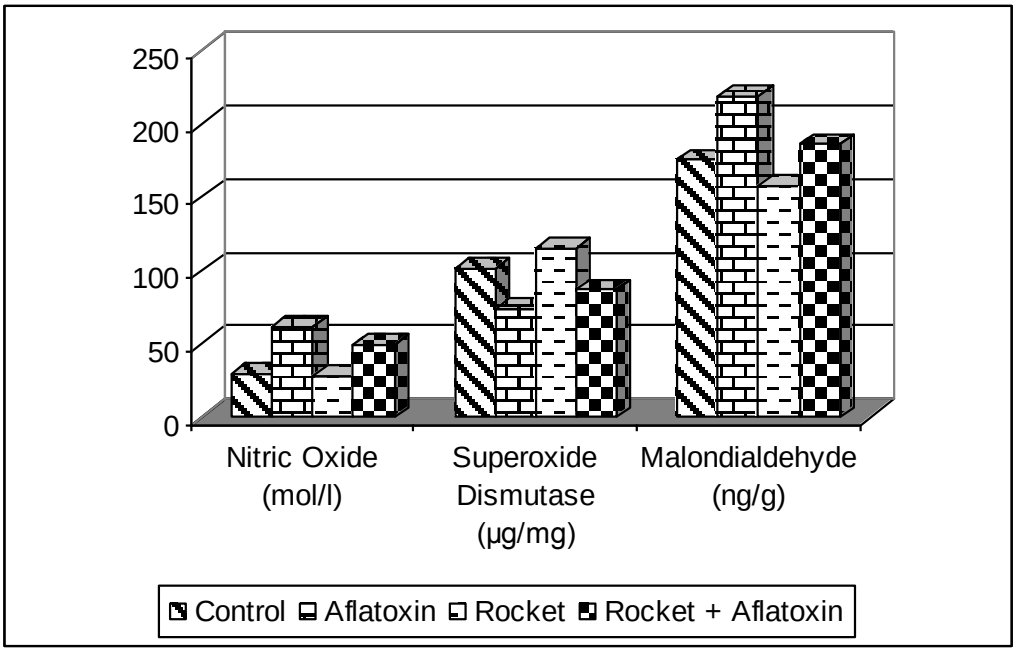

Fig. (54): Effect of rocket extract (50mg/kg) on serum nitric oxide, malondialdehyde and Liver superoxide dismutase of male albino rats receiving aflatoxin contaminated diet.