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Original Research Paper

Effect of Ajowan Seed Powder in Modulating Hyperglycemia Induced Oxidative Stress in Normal and NIDDM Patients- A Prospective Study

Medical Science

KEYWORDS : diabetes, hyperglycemia, Ajowan, oxidative stress.

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ABSTRACT

Background- *Diabetes mellitus is a group of metabolic disorders with one common manifestation: hyperglycaemia. The rationale behind this study is to see the effect of Ajowan seed powder on different oxidative stress parameters in blood/ serum.*

Objective- *To see the effect of Ajowan seed powder on different lipid parameters in blood/ serum and its effects in normal and diabetic patients.*

Methodology- *It was a hospital based prospective study conducted for a period of 8 months. A total of 180 study participants were included in the study. The investigation reports were collected from pathology laboratory of the college. The parameters studied includes catalase, gluthatione peroxidise, glutathione reductase, plasma Maloaldialdehyde , superoxide dismutase. Epi-info software was used. And student't' test were applied for analysis.*

Conclusion- *Significant change in plasma MDA level and increasing anti-oxidant activity which counteracts hyperglycemia when Ajowan powder was administrated.*

Introduction- Diabetes mellitus is a global public health problem of epidemic proportions, and its incidence is on the rise. Diabetes mellitus is a group of metabolic disorders with one common manifestation: hyperglycemia [1]. It is characterized by insulin resistance in peripheral tissue and an insulin secretary defect of the beta cell [2], [3]. A currently favoured hypothesis is that oxidative stress, through a single unifying mechanism of superoxide production, is the common pathogenic factor leading to insulin resistance, β-cell dysfunction, impaired glucose tolerance (IGT) and ultimately to type 2 DM [4] . The body's defence against oxidative stress is accomplished by interconnecting systems of antioxidant micronutrients (vitamins and minerals) and enzymes. In certain medicinal plants like Ajowan [5, 6, 7] have been reported as effective hypolipidemic agent in normal's and diabetes mellitus as well. It's effect on the level of oxidative stress, a positive causative factor for diabetes mellitus and on anti – oxidative defence enzyme system have not been studied thoroughly. Ajowan seed powder in modulating hyperglycemia induced oxidative stress may be responsible for alteration and complications in carbohydrate metabolism and possibly depressed antioxidant defence system in diabetes mellitus. Not many studies have been seen in India showing the effect of Ajowan seed powder on anti-oxidants and no studies were conducted in this region regarding this, Therefore, the rationale behind this study is to see the effect of ajowan seed powder on different oxidative stress parameters in blood/ serum and to correlate its effect on these parameters among diabetic patients.

Materials and Methodology- The methodology of this study is similar to the study conducted previously by the same author [8]. It was a hospital based prospective study conducted for a period of 8 months from September 2013-April 2014 in LLR hospital and diabetic clinic of GSVM medical college, Kanpur (UP). The study participants were taken between the age group of >=18 to 60 years. A total of 180 study participants were included in the study which consists of 90 diabetic patients and 90 healthy individuals. The parameters which were studied are catalase (CAT), gluthatione peroxidise (GPx), glutathione reductase (GR), plasma Maloaldialdehyde (MDA), superoxide dismutase (SOD). These parameters were measured with the suitable method available in the department of biochemistry of medical college. Selected subjects were advised to take Ajowan seed powder from last one month of the study to see its effect.

Statistical analysis- Collected data were consolidated on Excel sheets and further analyzed in Epi-info software. Mean along with standard deviation (SD) were calculated for the different parameters at different days of the study. Paired and unpaired student't' test were employed to analyze the effect of drug between matched and unmatched groups. P value <0.05 is considered statistically significant.

Results and observations-

Table 1- Age and sex wise distribution of study subjects during Ajowan seed powder administration (n=180)

Age (years)	Normal subjects (n=90)		NIDDM subjects (n=90)	
	Male	Female	Male	Female
>=18-29	9	7	2	0
30-39	8	3	2	1
40-49	22	11	17	10
50-60	17	13	37	21
Total	56 (62.2)	34 (37.8)	58 (64)	32 (36)

***values within parenthesis are percentage**

Table 1 shows age and sex wise distribution of study subjects, the subjects were male preponderance 62% in normal while 64% in NIIDM. Among both the subjects the age groups between 50-60 years has maximum number of subjects. Followed by 40-49 years which itself shows either the diabetes was late diagnosed, or the subjects admitted themselves only after symptoms of diabetes.

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Table 2- Effect on values of studied parameters at different days of Ajowan seed powder administration and after withdrawal in Normal subjects.

Sno.	Parameter	0^{th} day	30^{th} day	Last month	15 days after withdrawal
1.	Maloaldaildehyde (MDA)	1.44±3.8	1.183±1.64 (2.7↓) **p= 0.01**	1.15±1.83 (3.4↓) **p=0.02**	1.29±1.32 (6.4↑) **p=0.02**
2.	Glutathione reductase (GR)	16.97±1.43	17.75±2 (4.6↑) **p=0.04**	17.63±1.96 (3.9↑) **p= 0.02**	16.97±0.81 (3.8↓) **p= 0.02**
3.	Superoxide dismutase (SOD)	4.41±0.31	4.9±0.88 (11.1↑) **p= 0.04**	5.09±1.1 (15.4↑) p= 0.0**3**	4.83±1 (5↓) **p=0.03**
4.	Gluthatione peroxidase (GPx)	16.5±1.17	17.27±1.82 (4.2↑) **p=0.02**	17.57±1.94 (6.5↑) **p=0.01**	16.87±1.68 (4↓) **p= 0.01**
5.	Catalase (CAT)	144.87±4.74	145.13±7.4 (3↑) **p=0.01**	150.23±11.51 (5.1↑) p=0.**01**	149.33±8.22 (1.3↓) p>0.05

Table 2 shows the effect of different parameters after continuous Ajowan seed powder administration in normal subjects. The Mean±S.D, μmol/l MDA levels found to be at1.44±3.8 0th day, at 1.18±1.64 30th day and 1.15±1.326 on last month which showed a continuous trend of oxidative stress decline upon feeding of Ajowan seed powder to the normal subjects. This decline was found to be highly significant at different days. Observations suggest that Ajowan seed possess antioxidant property.

The Mean ±S.D, Unit/gmHb specific activity of GR was seen to be 16.97±1.43 at 0th day, 17.75±2.01 on 30th day and 17.63±1.96 on last month. The enzyme activity increased significantly 4.6% on 30th day and 3.9% on last month from the enzyme activity before start of the drug. Observations suggest that Ajowan possess antioxidant property by increasing GR activity.

The Mean ±S.D, Unit/gmHb specific activity of SOD was observed to be 4.41±0.31 at 0^{th} day, 4.9±0.80 on 30th day and 5.09±1.1 on last month. The enzyme activity increased significantly 11.1% on 30th day and 15.4% on last month from the activity before start of the drug. However, it decreased significantly by 5% on 15th day after drug withdrawal from last month. Observations suggest that Ajowan possess antioxidant property by upregulating SOD activity.

The Mean ±S.D, Unit/gmHb specific activity of GPx was found to be 16.5±1.17 at 0th day, 17.2±1.81 on 30th day and 17.57±1.94 on last month. Observations suggest that Ajowan possess antioxidant property by escalating GPx activity.

The Mean ±S.D, Unit/gmHb specific activity of CAT was found to be 144.0±4.18 at 0th day, 147.53±7.96 on 30th day and 150.13±12.14 on last month. Observations suggest that Ajowan may possess antioxidant property by elevating CAT activity.

Table 3- Effect on values of studied parameters at different days of continuous Ajowan seed powder administration and after withdrawal in NIDDM subjects.

Sno.	Parameter	0^{th} day	30^{th} day	Last month	15 days after withdrawal
1.	Maloaldaildehyde (MDA)	2.9±0.68	2.8±0.71 (3.17↓) **p=0.01**	2.68±0.8 (7.1↓) **p= 0.001**	2.7±0.82 (1↑) **p= 0.04**
2.	Glutathione reductase (GR)	13.13±1.56	13.26±1 (2↑) **p=0.02**	13.36±1.48 (1.7↑) **p=0.001**	13.27±1.5 (0.27↑) p>0.05
3.	Superoxide dismutase (SOD)	2.6±4.7	2.6±0.5 (2.8↑) **p=0.04**	2.75±0.5 (5.6↑) p>0.05	2.6±0.5 p>0.05
4.	Gluthatione peroxidase	9.5±1	9.7±1 (2↑) **p=0.001**	10±1.4 (4.8↑) **p=0.001**	9.58±1.13 (3.7↓) **p= 0.03**
5.	Catalase	74.23±9.95	75.84±9.9 (2.2↑) **p=0.01**	77.6±11.1 (4.6↑) **p=0.01**	76.5±12 (1.5↓) p>0.05

Table 3 shows the effect of different parameters after continuous Ajowan seed powder administration in NIDDM subjects. The Mean±S.D, µmol/l MDA levels found to be 2.87±0.0.68 at 0th day, 2.76±0.73 at 30th day and 2.68±0.81 on last month. This showed a continuous trend of oxidative stress decline upon feeding of Ajowan seed powder to the diabetic subjects. Observations suggest that Ajowan seed possess antioxidant property.

The Mean ±S.D, Unit/gmHb specific activity of GR was seen to be 13.13±1.56 at 0th day, 13.26±1.5 on 30th day and 13.36±1.48 on last month. The enzyme activity increased significantly 1% on 30th day and 1.7% on last month from the activity before start of the drug. However, it decreased non-significantly by 0.61% on 15th day after drug withdrawal from last month. Observations suggest that Ajowan may possess antioxidant property by increasing GR activity.

The Mean ±S.D, Unit/gmHb specific activity of SOD was observed to be 2.6±0.47 at 0th day, 2.67±0.47 on 30th day and 2.75±0.51 on last month. The enzyme activity increased significantly 2.7% on 30th day and 5.8% on last month from the enzyme activity before start of the drug. However, it decreased significantly by 5.8% on 15th day after drug withdrawal from last month. Observations suggest that Ajowan possess antioxidant property by elevating SOD activity.

The Mean ±S.D, Unit/gmHb specific activity of GPx was found to be 9.5±0.97 at 0th day, 9.7±0.95 on 30th day and 9.95±1.41 on last month. Observations suggest that Ajowan possess antioxidant property by escalating GPx activity.

The Mean ±S.D, Unit/gmHb specific activity of CAT was found to be 74.23±9.95 at 0th day 75.84±9.9 on 30th day and 77.61±11.13 on last month. Observations suggest that Ajowan possess antioxidant property by rising CAT activity.

Discussion- Diabetes mellitus is a global public health problem of epidemic proportions, and its incidence is on the rise. In our study we showed the effect of Ajowan seed powder administration to see the effect on different parameters in both normal and NIDDM subjects. From the present study it was found that after administration of Ajowan seed powder for last months, the percentage of MDA level declined statistically significant by 3.4% in normal subjects and by 7.13% in diabetic subjects. Our results were similar to studies conducted by [9], [10] on streptozotocin diabetic animals. It was found that Ajowan seed powder can increase level of glutathione reductase statistically significant by 3.9% and by 1.7% in normal and diabetic subjects. Studies were done previously to see these effects [11, 12]. It suggests that Ajowan has property of increasing GR activity level. Antioxidant enzymes activities (GPx and CAT) were observed to be upregulated statistically significant by Ajowan seed powder administration. The specific activity of GPx increased statistically significant by 4.8% in diabetics and by 6.5% in normal subjects. Similarly, the rise of CAT activity statistically significant was 5.1% in normal subjects and 4.1% in diabetic subjects. Our results similar to studies conducted by Sathishsekar D [13], showing significant increase in antioxidant enzymes like catalase and glutathione peroxidase on alloxan diabetic rats when treated ajowan seed powder. In the present study it was suggested that Ajowan possess anti-oxidant property by increasing SOD activity. These results are similar to the study conducted by Sathishsekar. [13]

Conclusion- Based on our results the anti-oxidant property possessed by Ajowan seed powder is due to increasing, up-regulating , escalating the activities of these parameters like MDA, GR,SOD,GPx, CAT which helps in preventing hyperglycemia induced oxidative stress.

Conflict of interest- none declared

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Author's contributions- both the authors have contributed substantially in this study both in concept and design, acquisition of data, or analysis and interpretation of data, collection of data, or general supervision of the research group. Both of them have been involved in drafting the manuscript or revising it critically for important intellectual content; and have given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content.

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