***Original article:***

# Clinical Efficacy and Safety of 'Oxy +' in Type 2 Diabetes: A Pilot Study

*Md. Anzar Alam[1], Mariyam Ahad[1], MohdAleemuddin Quamri[1], Fasihur Rehman Ansari[1], Farooqui Shazia Parveen[1]*

**Abstract:**

***Background and objectives*:** Diabetes is a common metabolic disorder.Type 2 diabetes accounts for the vast majority of around 92% of the population worldwide. Long term hyperglycemia leads to macro and microvascular complications. Oxy+ is a nutraceutical capsule which contains mainly Arthrospira (spirulina). Most of the diabetic people use it. Hence a clinical trial was conducted to evaluate the clinical efficacy and safety of Oxy + in Type 2 Diabetes.***Material Methods*:** The study was designed as a single-blind pilot study; 10 eligible patients of type 2 diabetes were allocated. Oxy+ was given in capsule form; 2 capsules twice daily orally for 45 days after the meal. Test drug was evaluated on subjective parameters at 0th, 15th, 30th and 45th days whereas objective parameters were assessed before and after the treatment. The results of the intervention were analyzed using suitable statistical methods.***Results and Observation*:**The study effects on subjective parameters like polyuria, tiredness, polyphagia, polydipsia, and Tingling Sensation were found significantly reduced. The objective parameters were assessed before and after as Mean ± SD for FBS (164.4±36.019 vs 111.1±25.075), PPBS (248.5±51.70 vs 170.1±45.148) and HbA1c (9.14±1.517 vs 6.95±1.224).The results were analyzed after using paired't' test.***Interpretation and Conclusion*:**The findings about both parameters (subjective and objective) that the 'Oxy+' is effective in type 2 diabetes and the cure was considerable. Safety parameters (SGOT, SGPT, Blood Urea, and Serum Creatinine) were remained unchanged. Therefore, it can be concluded that the 'Oxy+' would be safe and effective in the management of type 2 diabetes.

**Keywords:** Type 2 Diabetes; Oxy+; metabolic disorder; nutraceutical; Arthrospira (spirulina).

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## Introduction:

Diabetes mellitus is a group of metabolic diseases characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both.[1]Diabetes mellitus (DM) is probably one of the oldest diseases known to mankind and it was first reported in Egyptian manuscript about 3000 years ago.[2]Type 2 diabetes accounts for the vast majority around 92% of diabetes worldwide.[3]According to IDF (International Diabetes Federation) Atlas 9th edition 2019 worldwide prevalence of Diabetes is 463 million and it is expected to be 700 million in the year of 2045.[4]The estimated global direct health expenditure on diabetes in 2019 is USD 760 billion and is expected to grow to a projected USD 825 billion by 2030 and USD 845 billion by 2045.[5]The main cause is poor glycaemic control which leads to microvascular(Diabetic nephropathy, neuropathy, and retinopathy),[6] and macrovascular (Coronary artery disease, peripheral arterial disease, and stroke) complications.[7]Diabetes can be controlled effectively by reducing overweight and by taking a balanced lifestyle (diet and physical activity) in combination with medication when needed.[8,9]Biguanides,[11] sulfonylureas,[12] thiazolidinediones, α-glucosidase inhibitors, sodium-glucose co-transporter inhibitors,[13]meglitinides, incretins, DPP-4 inhibitors and hormone analoges are commonly used for the treatment of this debilitating disease.[14,15]Long term use of the above-mentioned medications leads to a multitude of complications; hypoglycemia, renal issues, heart problems and GIT disorders.[16,17]

1. Department of Moalajat, National Institute of Unani Medicine, Bangalore, India.

**Correspondence to:** Dr. Md AnzarAlam. Lecturer, Dept. of Moalajat, National Institute of Unani Medicine, Bangalore, India. **E-mail:**dranzarnium@gmail.com

Oxy+ is a natural source of oxygen found in nature and used as a dietary supplement and manufactured in Aruba for lifefactors.[18]It is a richest source of Arthrospira (spirulina) (contain phycocyanin, sulfated polysaccharides, γ-linoleic acid, carotene, iron etc.)[19,20] and which have been reported to be an antioxidant, immuno-modulator, hypoglycemic, anti-dyslipidemic, hepatoprotective, antiviral and anticancer activities.[21,22]Previous pre-clinical,[23] and clinical studies have shown that Arthrospira (spirulina) and its active ingredients can reveal anti-diabetes properties.[24–27] This interpretation led us to substantiate the hypoglycemic activity of Research Drug among diagnosed cases of type 2 diabetes. Therefore, a study was contemplated to evaluate the clinical efficacy and safety of Research Drug (Oxy+) in type 2 Diabetes.

## 2. Materials and Methods:

### 2.1 Participants:

Patients were identified and recruited from different clinics from Bangalore and called to enroll OPD of National Institute of Unani Medicine (NIUM) Bangalore. Inclusion criteria included the diagnosed cases of type 2 DM with Fasting Blood Sugar>126 mg/dl; Postprandial Blood Sugar>200 mg/dl, HbA1c>6.5%, and aged between 30-60 years of both gender, patients willing to participate in the study and ready to follow the instructions.[24,28]Exclusion criteria included pregnant and lactating mother and other complications of diabetes.

### 2.2 Study Design:

Eligible patients with type 2 diabetes were enrolled to participate in this study. At first, all participants were informed about the study protocol by being given a complete description of the objectives, benefits and potential harm of the study. Informed consent was received from each participant who chosen to participate in the study.Total 30 subjects are screened, 18 are excluded, 2 are denied and finally10 subjects who met the inclusion criteria were enrolled for this study. This study was single-blind pilotstudy (Figure 1).

### 2.3 Administration of drug:

Research drug was given twice a day in the form of capsule after meal for the period of 45 days.

### 2.4 Assessments:

All the patients were assessed fortnightly for subjective parameters ($0^{th}$, 15th, $30^{th}$, and $45^{th}$day) whereas objective parameters were assessed before and after the treatment.

### 2.5 Adverse Drug Effect:

Throughout the course of trial, there wasno any adverse effect was reported.

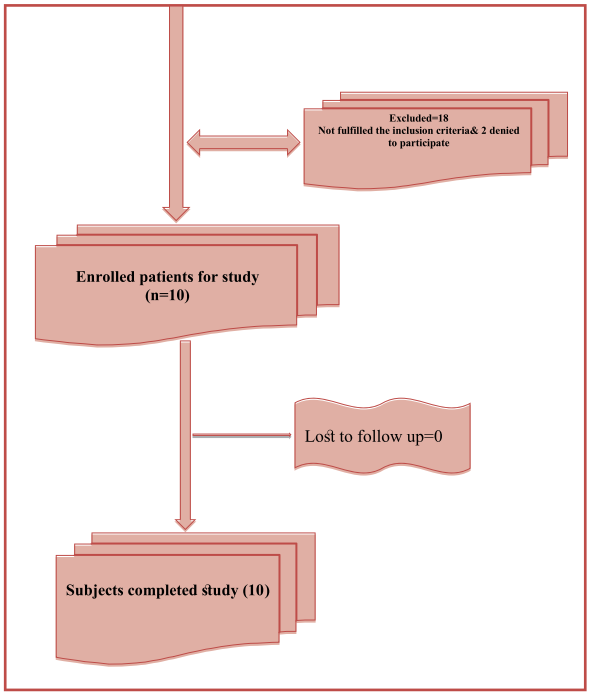


**Figure 1:**Flow diagram of the trial.

### 2.6 Statistical analysis:

Statistical analysis was performed using SPSS 15.0, used to analyze the data and use Microsoft Word and Excel to create graphs, tables etc.The findings were statistically calculated using student t test, combined proportion test and exact Fischer test.Significance is measured at the level of 5%. Results were based on continuous measurements as Mean ± SD (Min-Max).

## 3. Results:

### Baseline characteristics

The demographic characteristics of subjects were in baseline characteristics including age, genders, and dietary habits (Table 1).

**Table 1:** Distribution of the patients according to demographic details.

| Variables | Oxy+ Group | Total (n=10) |
|---|---|---|
| Age in years | | |
| 39-45 | 4 | 4(40%) |
| 46-52 | 1 | 1(10%) |
| 53-60 | 5 | 5(50%) |
| Total | 10 | 10(100%) |
| Mean ± SD | 50.4±7.42 | 50.4±7.42 |
| Gender | | |
| Female | 7 | 7(70%) |
| Male | 3 | 3(30%) |
| Dietary Habits | | |
| Mixed Diet | 9 | 9 (90%) |
| Vegetarian | 1 | 1(10%) |
| Total | 10 | 10(100%) |

[a] Student t test, [b]Fisher Exact Test, [c]Chi-Square Test, *Significant

**Primary Outcome**

The objective parameter was assessed before and after as Mean ± SD for FBS (164.4±36.019 vs 111.1±25.075), PPBS (248.5±51.70 vs 170.1±45.148) and HbA1c (9.14±1.517 vs 6.95±1.224) (Table 2).

**Table 2:** Evaluation of objective variables before and after treatment.

| Variables | Before Treatment | After Treatment | Difference | P value |
|---|---|---|---|---|
| FBS (mg/dl) | 164.4±36.019 | 111.1±25.075 | 53.3 | <0.0012** |
| PPBS(mg/dl) | 248.5±51.70 | 170.1±45.148 | 78.40 | <0.0001** |
| HbA1c (%) | 9.14±1.517 | 6.95±1.224 | 2.19 | <0.0008 |

Student t test (two tailed, dependent) has been used

**Secondary Outcomes**

All safety profile was found safe from baseline to end of the trial without any adverse effect (Table 3).

**Table 3:** Evaluation of safety variables.

| Safety variables | Before Treatment | After Treatment | Difference | P value |
|---|---|---|---|---|
| SGOT (mg/dl) | 26.5±7.82 | 29.9±11.43 | -3.400 | <0.265 |
| SGPT (mg/dl) | 28.4±7.619 | 34.4±9.27 | -6.0 | <0.073 |
| Blood Urea (mg/dl) | 9.14±1.517 | 6.95±1.224 | 2.19 | 0.566 |
| Serum Creatinine (mg/dl)) | 9.14±1.517 | 6.95±1.224 | 2.19 | <0.0008 |

Student t test (two tailed, dependent) has been used

**Discussion**:

Diabetes mellitus has become an observably global public health problem.[29] Migration from rural areas to urbanization and a sedentary lifestyle; changes in food habits may increase the risk of obesity and diabetes.[30] Physical activity increases glycemic regulation and decreases the risk of cardiovascular disease (CVD) and death in type 2 diabetes patients.[31]According to the International Diabetes Foundation (IDF) statistics, presently every seven seconds someone is estimated to die from diabetes or its complications, with 50% of those deaths.[32] A combination of lifestyle changes and pharmacological therapy is required to maintain good metabolic control in diabetes and to keep the patient stable for the long term.[33,34] Hozayen WG *et al*, (2016) reported that, Arthrospira (spirulina) exhibits insulin-mimetic and anti-diabetic activity.[35]

One other study documented that, spirulina is a rich source of fiber contents which may lead to reduced glucose absorption and possible action of peptides, and polypeptides generated by digestion of spirulina protein are responsible for it.[36] Layam A *et al,*[23] Alam *et al*,[24] Park HJ et al,[25] Lee EH et al, [26]Anitha L *et al,*[27] Kumari P *et al*,[37] and Kaur K *et al,*[38] reported that Spirulina exhibits as an anti-hyperglycemic activity. Parikh P *et al,*[36] and Anwer*et al,*[39] reported that Spirulina provides a plentiful source of proteins and it is well recognized that ingestion of protein and amino acids stimulates the secretion of insulin. This effect may be responsible for the reduction in fasting, postprandial blood sugar, and HbA1c.[36,39] Various hypotheses that, about spirulina, which is a rich iron source, led to high hemoglobin levels. The rise in hemoglobin levels may have been attributed to the dropin blood glucose levels, which would also lead to a drop in glycosylated hemoglobin.[23,36,39,40]

**Limitations of the study:**

The limitations of the present study include lack of a control group and blinding. Moreover, it was a small sample size.

**Conclusion**:

Accordingly, it can be concluded that Oxy+ has a beneficial effect on reducing fasting blood sugar (FBS), postprandial blood sugar (PPBS) and glycosylated hemoglobin (HbA1c). Consequently, it can be concluded that the 'Oxy+' would be safe and effective in the management of type 2 diabetes.

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**Conflict of interest** : The authors declare no conflict of interest.

**Ethical approval issue:**Prior ethical approval was taken from Institutional Ethics Committee.

**Authors' contribution:** *Conception and design of the study:* Md AnzarAlam.*Data collection and compilation:* Mariyam andFasihur Rehman Ansari.*Data analysis:* Farooqui Shazia Parveen. *Critical writing, revision and finalizing the manuscript:* MohdAleemuddinQuamri.

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