Acta Scientific NUTRITIONAL HEALTH (ISSN:2582-1423)

Volume 6 Issue 2 February 2022

Research Article

Effect of Flax Seed Powder and Flax Seed Oil Intervention on the Lipid Profile and Anthropometry of the Patients with Dyslipidemia

Deepika Sharma[1]* and Nimali Singh[2]

[1]Research Scholar, Department of Home Science, University of Rajasthan, Jaipur, India

[2]Professor, Department of Home Science, University of Rajasthan, Jaipur, India

***Corresponding Author:** Deepika Sharma, Research Scholar, Department of Home Science, University of Rajasthan, Jaipur, India.

Received: December 24, 2021

Published: January 18, 2022

© All rights are reserved by **Deepika Sharma and Nimali Singh.**

Abstract

Introduction: Dyslipidemia is a medical and social problem, leading to increasing morbidity and mortality worldwide. The major risk factors of dyslipidemia are associated with atherosclerosis and it results in ischemic heart disease and cerebrovascular disease. Omega-3 fatty acids have significant beneficial effects on the physical condition and general wellbeing. The seeds of the some plants such as flax seeds have more than 50% omega 3 and they are easy to ingest and very helpful in dyslipidemic patients. Therefore, the present study is designed to observe the effects of flax seed powder and flax seed oil on the clinical variables associated with dyslipidemia in dyslipidemic patients.

Aim: To compare the effects of administration of flax seed powder and flax seed oil on the nutritional status and lipid profile of the Patients with dyslipidemia.

Methodology: The present study was conducted in a hospital, Galaxy Specialty Centre, Jaipur. There were total 100 patients with dyslipidemia of age between 30 and 55 years. Out of those 150 subjects, 50 patients were provided with flax seed powder 15 grams/d and other 50 subjects were supplemented with flax seed oil 6 grams/d for three months. The lipid profile and anthropometric indices were measured at pre and post study.

Results: After three months of supplementation with flax seed powder, there was significant reduction in weight, body mass index, waist circumference, hip circumference of the dyslipidemic patients however, no change was observed in anthropometric indices in the patients of oil group. The lipid levels of the flax seed powder group were also found to be reduced significantly whereas the changes in the lipid levels of the oil group were not clinically significant. There was increase observed in the levels of high density lipoprotein cholesterol among the subjects of both powder and oil group.

Conclusion: The results suggested that this is an effective intervention. Hence, flax seed powder and flax seed oil may well be considered as a remedial food to control and prevent dyslipidemia.

Keywords: Dyslipidemia; Flax Seed Powder; Flax Seed Oil

Introduction

Dyslipidemia is among one of the chief risk factors for cardiovascular diseases (CVD). CVD's are a major cause of morbidity and contributor to mortality worldwide [1]. Dyslipidemia describes abnormalities in lipoprotein levels, together with elevated total and low density lipoprotein (LDL) cholesterol levels and low levels of high density lipoprotein (HDL) cholesterol. Dyslipidemia is mea-

sured one between the top 5 risk factors of cardiovascular disease, including hypertension, obesity, smoking and diabetes mellitus [2]. Numerous other disease conditions such as myocardial infarction, atherosclerosis, stroke, fatty liver, liver cirrhosis, nephropathy and many other diseases are linked to dyslipidemia. National Cholesterol Education Programme ATP III [3], suggested definition of dyslipidemia.

- Hypertriglyceridemia- serum triglyceride levels ≥ 150 mg/dl (≥1.7 mmol/l).
- Low HDL cholesterol- HDL cholesterol levels <40 mg/dl (<1.04 mmol/l) for men and <50 mg/dl (<1.3 mmol/l) for women.
- High LDL cholesterol- LDL cholesterol levels ≥130 mg/dl (≥3.4 mmol/l) calculated using the Friedewald›s equation.
- High total cholesterol to HDL-C ratio- This is defined as total cholesterol to HDL-C ratio of ≥4.5.

Studies across different populations revealed that those with higher cholesterol levels have more atherosclerosis and coronary heart diseases as compared to those having lower levels. Factors contributing to dyslipidemia are obesity, genetics, poor nutrition, and some pharmacologic agents such as β blockers and diuretics, diabetes mellitus, tobacco consumption and lack of exercise [4]. Substitute for hypolipidemic drugs are some plant seeds and dietary supplements because they offer a good source for reducing lipid levels in blood and they are extensively used in a number of traditional health care systems. A balanced diet with regular physical activity and maintaining an ideal body weight can prevent the onset of dyslipidemia.

Prevalence of dyslipidemia

Global

Hypertension and hypercholesterolemia are important modifiable risk factors of cardio-vascular diseases (CVD). The cases of hypercholesterolemia, hyper triglyceridemia and low levels of high density lipoprotein cholesterol had increased significantly in the last 20 years in professional inhabitants in Beijing [5]. The study described that hypercholesterolemia was observed in 6% of the males and in females it was 2.8% in the age between 20 and 39 years and in 20.2% of males and 38.7% of females of the age group >60 years. The levels of high density lipoprotein cholesterol was found to be very low in 7% of males and 1.6% of females. The increase was noticed to be greater in the age group between 40-59 years [5].

The prevalence of dyslipidemia in the population of Korea was noticed to be increased from 32.4% in 1998 and then in 2001 it was 42.6% and 44.1% in 2005. In comparison with the KNHANES (Korea National Health and Nutrition Survey) in 1998, the occurrence of dyslipidemia was 47%, elevated in 2001 and in 2005, it was found to be increased to 61% higher.

In a study by Lee., *et al*. [6] 2012 in 2005, it was noted that only 9.5% of individuals having dyslipidemia were aware of the disease and 5.2% were using hypolipidemic drugs and 33.2% of patients were on treatment and acquired the treatment goals. To summarize, the prevalence of dyslipidemia in Korea progressively increased from 1998 to 2005.

One another study in Thailand described that urban life style had impact on dyslipidemia. The results of the study suggested that the mean total cholesterol and LDL cholesterol were considerably greater in urban as compared to rural subjects in both men and women. Relocation to urban areas and increase in urban life style was associated with the increasing lipid levels and prevalence of dyslipidemia [7].

India

The incidences of coronary heart disease are increasing in Indians living in urban areas and abnormal lipid levels are the main risk factor. An investigation was done by Estari., *et al*. [8] on serum lipids and the occurrence of dyslipidemia in urban population in Warangal district in Andhra Pradesh. It was summarized from the study that 52.7% of males and 42.9% of females had minimum one lipid abnormality. There was low High density lipoprotein cholesterol among 7% of males and 1.6% of females. And in all the age groups the prevalence of hypercholesterolemia, low levels of high density lipoprotein cholesterol amnd hypertriglyceridemia was noticed to be greater.

A study in Mumbai, India, by Sawant., *et al*. [9] 2008 also summarizes that the incidences of dyslipidemia was high in males as compared to females. Out of all participants with total cholesterol concentration ≥ 200 mg/dl, 23.3% were females and 38.7% were males. The levels of HDL cholesterol were observed to be low in 64.2% males and in females it was noticed to be 33.8%. The cases

of hypercholesterolemia and hyper-triglyceridemia were observed to be higher in age group 31 and 40 years of age group as compared to ≤ 30 years of age group.

One another study done by The Indian Council of Medical Research, India Diabetes (ICMR-INDIAB) on the population of three states in India. These are Tamil Nadu, Maharashtra and Jharkhand and one union territory (Chandigarh). The results of the study demonstrated that among the participants observed, 13.9% had high levels of cholesterol, 29.5% had high levels of triglycerides, 72.3% had low levels of HDL cholesterol, 11.8% had high levels of LDL cholesterol levels and 79% had at least one of the lipid abnormality. Higher rates of hypercholesterolemia was observed in Tamil Nadu (18.3%), highest rates of hyper triglyceridemia in Chandigarh (38.6%), highest rates of low HDL cholesterol in Jharkhand (76.8%) and highest rates of high LDL cholesterol in Tamil Nadu (15.8%). The low levels of HDL cholesterol were the most ordinary lipid deformity (72.3%) in all the regions which were studied [10].

A variety of food sources are currently gaining extensive interest globally for potential health benefits for many diseases, such as dyslipidemia and associated complications. Amongst those dietary sources, flax seed (*Linum usitatissimum* L.) is one of the conventional health food. Flax seeds had been described to own antioxidant properties which act against many diseases like atherosclerosis, hypertension, chronic inflammation, diabetes mellitus and cancer's pre stage. Therefore, the present study is designed to determine whether there is a dose response of flax seed powder and flax seed oil on clinical variables associated with dyslipidemia in dyslipidaemic patients.

Role of flax in management of dyslipidemia

Flax is an annual plant. It belongs to linaceae family. Flax seed is well known as a functional food because it contains alpha-linoleic acid, lignin and polysaccharides, and all these ingredients have positive effects in prevention of many diseases. There is 28% dietary fibre (7-10% soluble dietary fibre, 11-18% insoluble dietary fibre) in whole flaxseeds. Out of total 40% fats in flax seed, 57% is omega 3 fatty acids and there are 21% proteins in whole flax seeds. The chief components which are responsible for hypolipidemic action of flax seeds are dietary fibre, omega 3 fatty acids and lignin. Several studies suggest the beneficial effects of flax seeds on blood lipid levels. A study conducted by Nazni., *et al*. [11] 2005 on flax seed powder showed statistically significant decrease in levels of blood glucose and blood lipid levels. The findings suggested that the mean lipid values were found to be reduced from 224.3 to 167.5 mg/dl for total cholesterol, for triglycerides it was decreased from 178.8 to 150.9 mg/dl and from 157.2 to 128.8 mg/dl for LDL cholesterol and the mean values improved significantly from 36.5 mg/dl to 52.1 mg/dl for HDL cholesterol. The study concluded that the use of flax seed powder had great therapeutic potential.

Flax seeds have unsaturated fatty acids, antioxidants and fibres in abundance and also known to have anti-atherogenic properties. Therefore, a study was done to estimate the effects of flax seeds on serum lipid levels of patients with dyslipidemia. The conclusion of the study suggested that 12 weeks intervention with roasted flax seed chutney powder had a significant improvement in atherogenic indices [12].

Flax seed oil is primarily measured as a healthy food. Fatty acid composition of flax seed oil is unique from other oils available commercially because of its composition of, alpha linolenic acid which is above 50%. Because of the high content of this unique fatty acid, flax seed and flax seed oil are often used as food supplements.

One more study investigated the effect of supplementation with flax seed oil (FO) for 12 weeks, on the risk factors of cardiovascular diseases such as serum low-density lipoprotein concentration. Supplements of 10 g of flax seed oil and 10 g of corn oil having 5.49 and 0.09 g of ALA, respectively were given to the subjects. The data demonstrated that the flax seed oil supplementation decreased low density lipoprotein cholesterol levels by 25.8% and 21.2% at 4 and 12 weeks, respectively. Corn oil supplementation had no outcome on LDL levels. It was concluded from the study that the levels of serum total cholesterol, LDL-cholesterol were significantly decreased in the flax seed oil group [13].

Objectives of the Study

- To assess the nutritional status of dyslipidemic patients with respect to anthropometry and clinical profile.
- To see the impact of flax seeds powder on the blood lipid levels of dyslipidemic patients.
- To observe the effect of supplementation with flax seed oil on the lipid levels of patients with dyslipidemia.
- To evaluate the effectiveness of flax seed powder and flax seed oil on the lipid levels of dyslipidemic patients.

Methodology

The study was done in a hospital "Galaxy Speciality Centre" in Jaipur city. About 100 patients of dyslipidemia in the age group 30-55 years, attending the outpatient department of the hospital was selected for the study. A consent form was taken after getting signed by the patients. For conducting the intervention study, approval from the ethics committee was taken. Out of 100 patients 50 patients were given flax seed powder 15 grams per day along with diet counselling and 50 patients were given 6 grams of flax seed oil along with diet counselling for three months.

- At the baseline, information regarding anthropometric measurements (weight, height, waist hip circumference) and lipid profile was collected.
- At post intervention data was collected on anthropometric measurements (weight, height and waist hip circumference) and lipid profile.

Criteria for sample selection

Inclusion criteria

- Patients of age group ≥ 30 years to ≤ 55 years.
- Patients of both the sexes.
- Patients with body mass index ≥ 20 kg/m^2 to ≤ 35 kg/m^2.
- Presence of 2 indicators given below.
- Patients having total cholesterol ≥ 200 mg/dl.
- Patients with low density lipoprotein cholesterol ≥ 130 mg/dl.
- Patients with high density lipoprotein cholesterol < 40 mg/dl.
- Patients with triglyceride levels ≥ 150 mg/dl.

Exclusion criteria

- Patients suffering from severe diabetic complication as retinopathy, nephropathy, neuropathy etc.
- Patients having severe cardiac complications as ischemic heart disease, myocardial infarction, cardiovascular disease.
- Pregnant or lactating women.
- Patients with known hypersensitivity to the supplement.
- Not willing to participate.

Biochemical tests

The blood samples was collected and analysed. Blood serum was used for the analysis of total cholesterol, HDL cholesterol, LDL cholesterol, triglyceride at baseline (day o) and after 3 months of supplementation. Blood sample was obtained after 12 hour over night fasting.

Statistical analysis

Data was tabulated and computed. Mean and standard deviation was calculated. Difference in the various parameters of intervention was assessed by using 't' test.

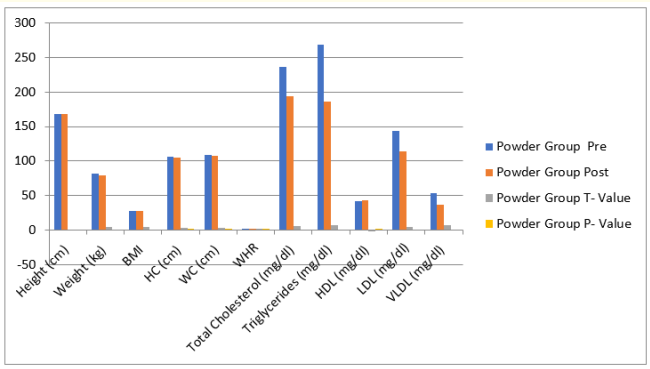
Results

After supplementation for 3 months with flax seed powder there was significant reduction in weight (t-4.647, p < .000), body mass index (t-4.269, p < .000), hip circumference (t-3.462, p < 0.001) and waist circumference (t-3.846, p < .000) of dyslipidemic patients. The reduction in the mean of total cholesterol was from 236.42 to 193.89, triglycerides from 268.53 to 186.30, LDL cholesterol from 143.95 to 114.11 and VLDL cholesterol from 53.70 to 36.98 and mean HDL cholesterol was increased from 41.43 to 42.91 in the powder group.

Powder Group				
	Pre	**Post**	**T- Value**	**P- Value**
Height (cm)	167.88 ± 7.591	167.88 ± 7.591		
Weight (kg)	81.74 ± 15.518	79.67 ± 15.135	4.647	.000
BMI	28.36 ± 5.944	27.68 ± 5.829	4.269	.000
HC (cm)	106.35 ± 11.158	105.26 ± 11.389	3.462	0.001
WC (cm)	109.01 ± 11.713	107.45 ± 11.736	3.846	.000
WHR	1.02 ± 0.048	1.02 ± 0.044	1.481	0.145
Total Cholesterol (mg/dl)	236.42 ± 44.598	193.89 ± 38.546	6.21	.000

Triglycerides (mg/dl)	268.53 ± 88.389	186.30 ± 74.525	7.116	.000
HDL (mg/dl)	41.43 ± 26.603	42.91 ± 6.843	-0.411	0.683
LDL (mg/dl)	143.95 ± 44.624	114.11 ± 33.860	4.646	.000
VLDL (mg/dl)	53.70 ± 17.702	36.98 ± 14.650	7.403	.000

Table 1: Comparison of anthropometric measurements and biochemical values in powder group pre and post study.

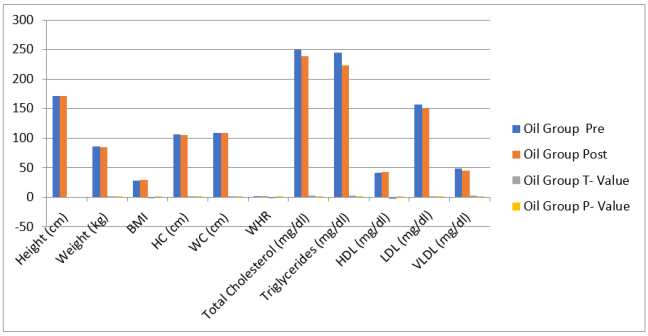


Graph 1: Mean difference between anthropometric measurements and biochemical estimation of powder group pre and post study.

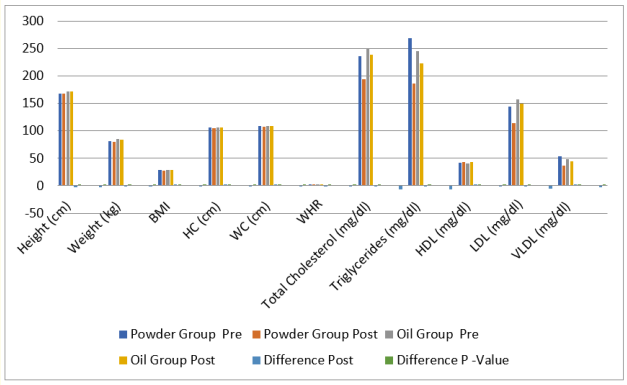
In the oil group no reduction was seen in the anthropometric measurements after three months of supplementation with flax seed oil 6 grams per day. There was reduction seen in biochemical parameters of dyslipidemic patients in the oil group but it was not as much as seen in the powder group. The mean reduction in the of total cholesterol was from 249.13 to 238.28, triglycerides from 244.92 to 223.27, LDL cholesterol from 157.10 to 150.09 and VLDL cholesterol from 48.32 to 44.65 and mean HDL cholesterol was increased from 41.06 to 42.92 in the oil group.

Oil Group				
	Pre	**Post**	**T- Value**	**P- Value**
Height (cm)	171.61 ± 7.632	171.61 ± 7.632		
Weight (kg)	85.34 ± 13.152	84.47 ± 12.375	1.545	.129
BMI	28.25 ± 5.075	28.78 ± 3.223	-0.773	.443
HC (cm)	105.89 ± 8.615	105.68 ± 8.418	1.353	0.182
WC (cm)	108.75 ± 9.090	108.47 ± 8.930	1.817	.075
WHR	1.02 ± 0.016	1.02 ± 0.015	-0.037	0.97
Total Cholesterol (mg/dl)	249.13 ± 28.698	238.28 ± 34.707	2.665	.010
Triglycerides (mg/dl)	244.92 ± 76.895	223.27 ± 65.241	3.234	.002
HDL (mg/dl)	41.06 ±8.417	42.92 ± 6.585	-3.308	0.002
LDL (mg/dl)	157.10 ± 31.114	150.09 ± 34.626	1.837	.072
VLDL (mg/dl)	48.32 ± 16.595	44.65 ± 13.047	2.433	.019

Table 2: Comparison of anthropometric measurements and biochemical values in oil group pre and post study.



Graph 2: Mean difference between anthropometric measurements and biochemical estimation of oil group pre and post study.



Graph 3: Mean difference between anthropometric measurements and biochemical estimation of powder group and oil group pre and post study.

	Powder Group		Oil Group			
	Pre	**Post**	**Pre**	**Post**	**T -Value**	**P -Value**
Height (cm)	167.88 ± 7.591	167.88 ± 7.591	171.61 ± 7.632	171.61 ± 7.632	-2.451	0.016
					-2.450	0.016
Weight (kg)	81.74 ± 15.518	79.67 ± 15.135	85.34 ± 13.152	84.47 ± 12.375	-1.249	0.215
					-1.879	0.063
BMI	28.36 ± 5.944	27.68 ± 5.829	28.25 ± 5.075	28.78 ± 3.223	0.100	0.921
					-1.169	0.245
HC (cm)	106.35 ± 11.158	105.26 ± 11.389	105.89 ± 8.615	105.68 ± 8.418	0.232	0.817
					-0.208	0.835
WC (cm)	109.01 ± 11.713	107.45 ± 11.736	108.75 ± 9.090	108.47 ± 8.930	0.124	0.902
					-0.491	0.625
WHR	1.02 ± 0.048	1.02 ± 0.044	1.02 ± 0.016	1.02 ± 0.015	-0.185	0.853
					-1.037	0.302
Total Cholesterol (mg/dl)	236.42 ± 44.598	193.89 ± 38.546	249.13 ± 28.698	238.28 ± 34.707	-1.695	0.093
					-6.052	0.000
Triglycerides (mg/dl)	268.53 ± 88.389	186.30 ± 74.525	244.92 ± 76.895	223.27 ± 65.241	-1.695	0.093
					-6.052	0.000
HDL (mg/dl)	41.43 ± 26.603	42.91 ± 6.843	41.06 ±8.417	42.92 ± 6.585	0.093	0.926
					-0.008	0.994
LDL (mg/dl)	143.95 ± 44.624	114.11 ± 33.860	157.10 ± 31.114	150.09 ± 34.626	-1.710	0.090
					-5.253	0.000
VLDL (mg/dl)	53.70 ± 17.702	36.98 ± 14.650	48.32 ± 16.595	44.65 ± 13.047	1.569	0.120
					-2.765	0.007

Table 3: Comparison of anthropometric measurements and biochemical values in powder group and oil group pre and post study.

Conclusion

The results of the current trial revealed that after three months of supplementation with flax seed powder, there was remarkable improvement in anthropometric measurements and lipid profile of dyslipidemic patients. Body weight, body mass index, waist circumference and hip circumference of the patients were significantly reduced. A highly significant decrease was noted in total cholesterol, triglycerides, LDL cholesterol and VLDL cholesterol levels in powder group. Wherever, no change was noticed in anthropometric levels in the patients of oil group. The reduction in the lipid levels of the oil group was not clinically significant. The high density lipoprotein cholesterol was found to be increased in both powder and oil group. Therefore, it is summarized from the study that the supplementation of flax seed powder was more effective as compared to flax seed oil. Moreover, Flax seeds are good and proposed to be as alternatives to hypolipidemic drugs.

Bibliography

1. Murray J L and Lopez A D. "Mortality by cause for eight regions of the world: Global burden of disease study". *Lancet* 349 (1997): 1269-1276.

2. Kannel WB., *et al*. "Serum cholesterol lipoproteins and risk of coronary artery disease: The Framingham Study". *Annals of Internal Medicine* 74 (1971): 1-12.

3. National cholesterol education programme (NCEP), Expert panel on Detection, evaluation and treatment of high blood cholesterol in adults (Adult treatment panel III), Final report. National Institute of Health, Pub. No. 02-5215 (2002).

4. Hauston M C., *et al*. "Non pharmacologic treatment of dyslipidemia". *Progress in Cardiovascular Diseases* 52 (2009): 61-94.

5. Zhiyan L I., *et al*. "Serum lipid concentrations and prevalence of dyslipidemiain a large professional population in Beizing". *Clinical Chemistry* 5.11 (2005): 144-150.

6. Lee M H., *et al*. "Prevalence of dyslipidemiaamong Korean adults: Korea National Health and Nutrition Survey 1998-2005". *Diabetes and Metabolism Journal* 36 (2012): 43-55.

7. Chartlet P., *et al*. "Rural urban differences in lipid levels and prevalence of dyslipidemia: A population based study in Khon Kaen province, Thailand". *Journal of the Medical Association of Thailand* 89.11 (2006): 1835-1844.

8. Estari M., *et al*. "The investigation of serum lipids and prevalence of dyslipidemiain urban adult population of Warangal district, Andhra Pradesh". *India Biology and Medicine* 1.2 (2009): 61-65.

9. Sawant A M., *et al*. "Prevalence of dyslipidemiain young adult Indian population". *Journal of the Association of Physicians of India* 56 (2008).

10. Joshi S R., *et al*. "Prevalence of dyslipidemiain urban and rural India". *Plos One* 9.5 (2014): e96808.

11. Nazni P., *et al*. "Impact of flax seeds based therapeutic food on selected type II diabetic patients". *Indian Journal of Nutrition and Dietetics* 43 (2005): 141.

12. Katare C and Saxena S. "Amelioration of selected cardiac risk factors through supplementation of diet with flax seed and soyabeen". *International Journal of Nutrition, Pharmacolgy, Neurological Diseases* 3 (2013): 4.

13. Kawakami Y., *et al*. "Flax seed oil intake reduces serum small dense low density lipoprotein concentrations in Japanese men: a randomized double blind, cross-over study". *Nutrition Journal* 14 (2015): 39.

Assets from publication with us

- Prompt Acknowledgement after receiving the article
- Thorough Double blinded peer review
- Rapid Publication
- Issue of Publication Certificate
- High visibility of your Published work

Website: www.actascientific.com/

Submit Article: www.actascientific.com/submission.php

Email us: editor@actascientific.com

Contact us: +91 9182824667