

**Research Article**

## **EFFECTS OF *SPIRULINA FUSIFORMIS* ON BLOOD PRESSURE LEVELS OF HYPERCHOLESTEROLEMIC PATIENTS**

**\*A. Sharma**

Department of Botany, Vardhaman Mahaveer Open University, Kota, Rajasthan, India

\*Author for Correspondence

### **ABSTRACT**

In the present study, impacts of *Spirulina fusiformis* on blood pressure (BP) of hypercholesterolemic patients were studied. This systematic clinical study included agewise and genderwise effects. Statistical analysis of the results revealed that it is profoundly effective in lowering the systolic BP level of the patients and showed very significant reduction in BP of female patients as compared to their counterparts. Agewise study showed that in all the three age groups its administration was equally effective. BP lowering effects of *Spirulina fusiformis* might be due to the high potassium and  $\gamma$  - linolenic acid content.

**Key Words:** Blood Pressure, Diastolic BP, *Spirulina fusiformis*, Systolic BP

### **INTRODUCTION**

In India the reference to the curative properties of some herbs, as mentioned in the Rigveda, seem to be the earliest records of use of plants in medicine. A more detailed account is available in the Atharvaveda. With the passing of time more & more plants found recognition and entry into the native system of medicinal herbs (Iyer 1988). In the same concern, nowadays importance of cyanobacterium *Spirulina* is brightened due to its pharmaceutical properties. Its tremendous nutritional potential and therapeutic impacts have led to several clinical studies on its different chemopreventive effects.

BP lowering property of *Spirulina* was reported by Iwata *et al.* (1990) and Sudha *et al.* (2011) in animal samples. Rats were used by them as the experimental object. BP lowering property of *Spirulina* in human objects was reported by Anuradha & Gayathri (1999) and Torres-Duran *et al.* (2007). But they did not take account the age & gender of the human population.

The present study deals with the effect of *Spirulina fusiformis* administration on BP of hypercholesterolemic patients. In this systematic clinical study effects were studied agewise and genderwise.

### **MATERIALS AND METHODS**

The study was carried out on hypercholesterolemic patients of the age group falling between 40-70 years. Patients suffering with the serious heart disease and women undergoing pregnancy were excluded from this study. Patients with high BP were registered for their initial check-up. Patients with cholesterol levels higher than the permissible limit (W.H.O. 1999) were accepted for *Spirulina* administration orally.

168 patients were considered to perform clinical study. Patients were dividing into the range of different groups.

- (i) Patients in 40-49 yrs of age.
- (ii) Patients in 50-59 yrs of age.
- (iii) Patients in 60-69 yrs of age.

In each age group, 4 sets of patients were present and each set have 7 males & 7 females. One week of wash out period given to the patients.

One gram *Spirulina fusiformis* per day administered orally to the hypercholesterolemic patients for a period of 30 days. Patients took regular dose of *Spirulina fusiformis*, before every meal & they did not change their habit. Initially, 12-14 hr. fasted blood samples were collected from patients and BP were measured at 0, 15<sup>th</sup> & 30<sup>th</sup> day of *Spirulina fusiformis* administration.

**Research Article**

**Table 1: Impact of *Spirulina fusiformis* Administration on Blood Pressure of Hypercholesterolemic Patients**

Groups Compared  Parameters	Gross Study			Genderwise Study			Age Group wise study					
	Before Admin.	After Admin.	T-Test Results	Male	Female	T-Test Results	A 40-49 Yrs.	B 50-59 Yrs.	C 60-69 Yrs.	T-Test Results		
										Av/sB	Bv/sC	Cv/sA
Systolic Blood Pressure	160 ± 0.471	152.6 ± 0.721	††	157 ± 1.415	148 ± 1.475	††	156.5 ± 0.3536	156 ± 1.414	152.5 ± 5.304	*	*	*
Diastolic Blood Pressure	92.513 ± 3.587	85.573 ± 1.151	*	85.2 ± 1.361	84.5 ± 2.39	††	85.6 ± 1.414	81 ± 0.707	88 ± 1.414	*	*	*

\* No Significant Difference

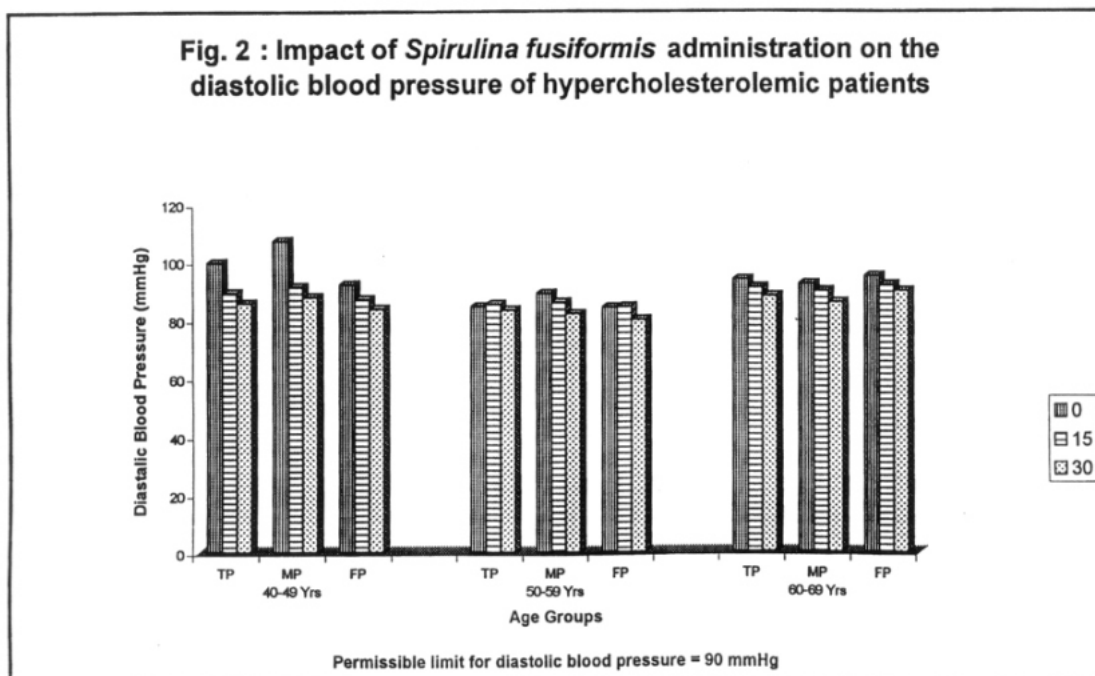
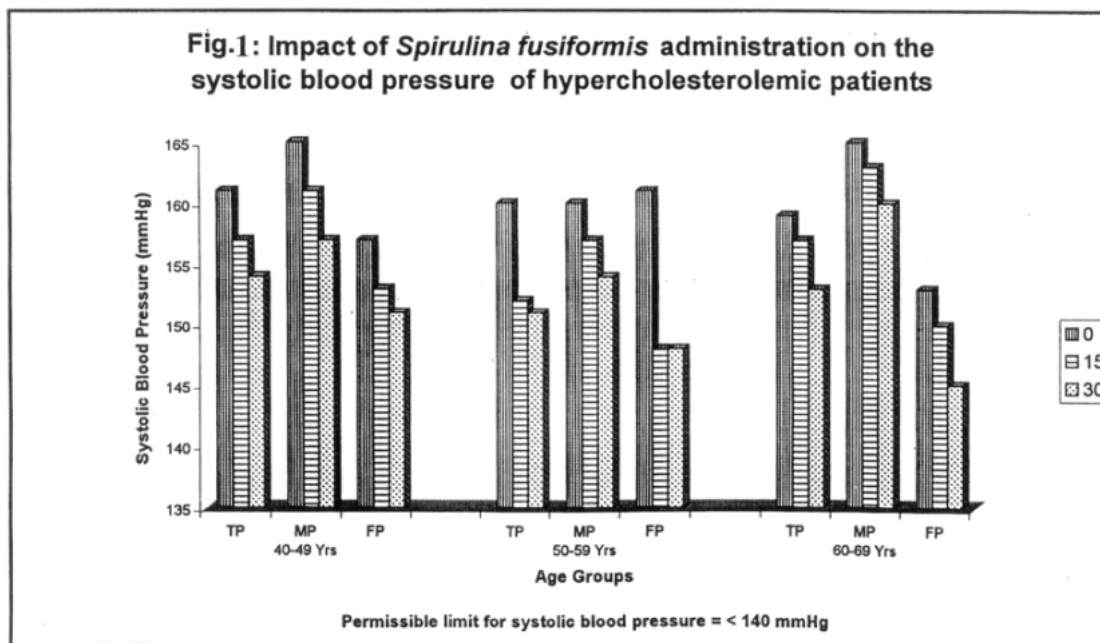
†† Highly Significant Difference

At 0.05% Probability

## Research Article

### RESULTS & DISCUSSION

After the administration of cyanobacteria *Spirulina fusiformis* to the hypercholesterolemic patients, a considerable reduction was recorded in the systolic and diastolic BP levels (Fig.1 & 2).



Observation during the present study revealed that in the age group of 50-59 and 60-69 yrs of patients females showed more reduction in their systolic BP as compared to males, while the male patients of age group 40-49 yrs showed more reduction in their systolic BP, if compared with the females. Maximum reduction in systolic BP levels was noted in the age group of 40-49 yrs of males and 50-59 yrs of females.

### Research Article

However in the case of diastolic BP, males of all the three group showed more reduction, while maximum reduction was noted in the age group of 40-49 yrs of both male & females. Outcome of these results was that *Spirulina fusiformis* administration was profoundly effective in lowering the BP levels of the hypercholesterolemic patients of the age group of 40-49 yrs except the systolic BP levels in females, where it was effective in the age group of 50-59 yrs. These results are in agreement with those of Anuradha & Gayathri (1999) and Becker *et al.* (1986); however they did not take the age of the patients into account.

Studies have shown that small decrease in systolic BP (3-5 mm Hg), are associated with a decrease in the risk for stroke of around 10% (Law & Wald 2002, Law *et al.*, 2003, Mac Mahon & Rodgers 1994, Mac Mahon *et al.* 1990 and Prospective Studies 1995). Statistical analysis revealed that *Spirulina fusiformis* is very useful and inflicted a considerable effect on the systolic BP (7mm Hg reduction) (Table-1).

Statistically genderwise effect showed very significant reduction in BP of female patients as compared to their counterparts. While age wise effect revealed that it is equally effective among all the three age groups (Table-1).

BP is the lateral pressure exerted by a column of blood on the walls of blood vessels. During the cardiac cycle a period of contraction is called systole and the maximum pressure that was recorded during systole of the heart is known as systolic pressure. However diastole is a period of cardiac cycle when there is recoil of vessels to their original position and it is relaxation phase. The lateral pressure recorded during this position is called diastolic BP. Generally BP is seen increasing with the age and it can damage the delicate inner lining of arteries.

High BP is an established independent risk factor for coronary heart disease (CHD), heart & kidney failure & stroke and small reductions in blood pressure can have significant benefits at a population level. Garlic, vitamin-C, vegetarian diet, saturated fatty acid and  $\omega$ -3, fatty acids have been found to be helpful in lowering the BP level. Studies of Duan *et al.* (2001) revealed that higher microelement content of *Spirulina fusiformis* has a certain inhibition from high BP & hasten body to absorb Se and Mo, and is of benefit to cardiac muscles. Potassium also played an important role in maintenance of normal BP (Anuradha & Gayathri, 1999 and Guan *et al.*, 2007) and *Spirulina fusiformis* contained 1.79% of potassium, which is 10 times higher than in common vegetables (Henrikson, 1989). Besides *Spirulina fusiformis* is also a rich source of  $\gamma$ -linolenic acid (GLA) (Grattan 1989). This played a key role in prostaglandin (PGE) synthesis. Prostaglandins are short lived hormones of PGE<sub>2</sub> is helpful in getting down the BP (Power & Chatwal 1997). So higher microelement content especially potassium and  $\gamma$ -linolenic acid (GLA) might be the reasons of marked decrease in the BP, after the administration of *Spirulina fusiformis* capsules.

### REFERENCES

- Anuradha V and Gayathri KN (1999). Effect of *Spirulina* on blood pressure levels of selected hypertensive in Coimbatore city. *The Indian Journal of Nutrition and Dietetics* **36**(3) 63-66.
- Becker EW, Jakober B, Left D and Schmullling RM (1986). Clinical and biochemical evaluations of alga *Spirulina* with regard to its application in the treatment of obesity: A double-blind cross over study. *Nutrition Report International* **33**(4) 565-574
- Duan M, Ma WX, Li L and Sun XT (2001). Determination of micro-elements in natural *Spirulina* using FAAS. *Guang Pu Xue Yu Guang Pu Fen Xi* **21**(6): 868-70.
- Grattan RP (1989). *Spirulina*: A sources of dietary gamma lionlenic acid (guerry). *Journal of the Science of Food and Agriculture* **47**(1) 85-93.
- Guan Y, Zhao HY, Ding XF, Zhu YY (2007). Analysis of the contents of elements in *Spirulina* from different producing areas. *Guang Pu Xue Yu Guang Pu Fen Xi* **27** 1029-1031.
- World Health Organization – International Society of Hypertension definition and classification of blood pressure levels (mmHg) (1999). Guidelines for the Management of Hypertension, Guidelines Subcommittee *Journal of Hypertension* **17**(2) 151-83

### Research Article

**Henrikson R (1989).** Earth Food *Spirulina*. Ronore Enterprises Raguna Beach California Inc. Launabeach 84-85.

**Iwata K, Iwata K, Inayama T, Kato T (1990).** Effects of *Spirulina* on plasma lipoprotein lipase activity in fructose-induced hyperlipidemia in rats. *Journal of Nutritional Science and Vitaminology* **36** 165-171.

**Iyer, RS (1988).** Taxonomical, Physiological and Paramedical Studies of Fungi, causing superficial infections in Mammalian Species. *Ph. D. Thesis*, University of Rajasthan.

**Law MR and Wald NJ (2002).** Risk factor thresholds: their existence under scrutiny. *British Medical Journal* **324** 1570-6.

**Law M, Wald N and Morris J (2003).** Lowering blood pressure to prevent myocardial infarction and stroke: a new preventive strategy. *Health Technology Assessment* **7** 1-94

**MacMahon S, Peto R, Cutler J, Collins R, Sarlie P and Neaton J (1990).** Blood pressure, stroke and coronary heart disease. Part-I, Prolonged differences in blood pressure: prospective observational studies corrected for the regression dilution bias. *Lancet* **335** 765-74

**MacMahon S and Rodgers A (1994).** Antihypertensive treatment and stroke risk. *Journal of Hypertension Supplement* **12(S)** 5-14.

**Power CB and Chatwal GR (1997).** *Biochemistry*. Himalya Publishing house. Bombay, 31 & 323.

**Prospective Studies (1995).** Cholesterol, diastolic blood pressure, and stroke: 13000 strokes in 45000 people in 45 prospective cohorts. *Lancet* **346** 1647-53.

**Sudha SS, Karthic R, Naveen, Rengaramanujam J. (2011).** Anti hyperlipidemic activity of *Spirulina platensis* in Triton x-100 induced hyperlipidemic rats. *Hygeia-Journal for Drugs and Medicines* **3(2)** 32-37.

**Torres-Duran PV, Ferreira-Hermosillo A and Juarez-Oropeza MA (2007).** Antihyperlipemic and antihypertensive effects of *Spirulina maxima* in an open sample of mexican population: a preliminary report. *Lipids in Health and Disease* **6** 33