RESEARCH ARTICLE — FOOD SCIENCE RESEARCH JOURNAL — Volume 3 | Issue 2 | October, 2012| 125-132

Impact of supplementation of *Aloe vera* L. gel powder and nutrition counseling on dietary intake and anthropometry of non-insulin dependent diabetics

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Ninety non - insulin dependent diabetic male patients in the age group of 35-65 years free from serious complications of diabetes were selected from the Punjab Agricultural University and Civil hospitals of Ludhiana. The selected subjects were given two treatments. In first treatment, the subjects were supplemented with 100 mg and 200 mg of *Aloe vera* L. gel powder for a period of three months and in second treatment *i.e.* nutrition intervention, supplementation was continued along with nutrition counseling for the next three months. Data regarding anthropometric measurements and dietary intake was recorded. The mean daily intake of green leafy vegetables, other vegetables and fruits increased significantly ($P \leq 0.01$) and the mean energy, carbohydrates, protein and fat intake decreased significantly ($P \leq 0.01$) in the selected subjects. There was a significant reduction ($p \leq 0.01$) in body mass index (BMI), mid upper arm circumference (MUAC) and triceps skin fold thickness (TFST) of the subjects after nutrition intervention. Supplementation of 100mg and 200mg of *Aloe vera* L. gel powder along with nutrition counseling improved the food intake, anthropometric measurements and total knowledge scores of selected subjects.

Key Words : *Aloe vera* L., Supplementation, Anthropometry, Dietary intake, Nutrition counseling

How to cite this article : Choudhary, Monika and Kochhar, Anita (2012). Impact of supplementation of *Aloe vera* L. gel powder and nutrition counseling on dietary intake and anthropometry of non-insulin dependent diabetics. *Food Sci. Res. J.,* **3**(2): 125-132.

INTRODUCTION

Diabetes is a chronic disease marked by the higher level of blood glucose from defects in insulin production, insulin action or both. Diabetes is fast becoming a leading cause of morbidity, mortality and disability across the world. Diabetes is a global metabolic epidemic affecting essential biochemical activities in almost every age group (Gupta *et al*., 2008). The prevalence of diabetes has drastically increased in the latter half of the 20th century, largely due to the ready availability of large quantities of calorie rich foods and the technology driven reduction in routine daily exercise. According to International Diabetes Federation, diabetes currently affects 366 million people worldwide and India has the largest number of people with diabetes *i.e.* 61.3 million. India has been declared as the "Diabetic capital of world". By 2030 there would be 552 million diabetics throughout the world and 101.2 million diabetics would be in India alone (IDF, 2011). Obesity and physical inactivity independently contribute to the development of type 2 diabetes. However, the magnitude of risk contributed by obesity is much greater than that imparted by lack of physical activity (Rana *et al.,* 2006).

These days great attention is being given to management of diabetes with medicinal plants along with dietary restriction (Thorfeldt, 2005). Being a medicinal plant, *Aloe vera* L. has been used for many centuries for its curative and therapeutic properties. *Aloe vera* is a perennial succulent xerophyte, which develops water storage tissue in the leaves to survive in dry areas of low or erratic rainfall. The aloe leaf can be divided into two major parts, namely the outer green rind, including the vascular bundles, and the inner colourless parenchyma containing the aloe gel. The ten main areas of chemical constituents of *Aloe vera* include: amino acids, anthraquinones,

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enzymes, minerals, vitamins, lignins, monosaccharide, polysaccharides, salicylic acid, saponins, and phytosterols (Surjushe *et al.,* 2008). Aloe contains high amounts of the protein, collagen. The body has to spend extra energy to assimilate the collagen protein in the body. The expenditure of all that additional energy helps in weight loss, at the same time due to the collagen protein, it also supports muscle development. Aloe vera also has laxative properties, due to which food is forced out of the colon faster. Consequently, less energy is absorbed from the food (Reynolds, 2004; Jones, 2007; Joseph and Raj, 2010). Keeping in view the beneficial effects of Aloe vera the present study was undertaken to study the impact of supplementation of *Aloe vera* L. gel powder and nutrition counseling on dietary intake and anthropometry of non- insulin dependent diabetics.

METHODOLOGY

Ninety non - insulin dependent diabetic male patients in the age group of 35-65 years free from serious complications of diabetes were selected from the Punjab Agricultural University and Civil hospitals of Ludhiana. The selected subjects were divided into three groups *viz.,* group I, II and III, each group having thirty subjects each. The subjects of group I was given no treatment. The subjects of group II and III were given two treatments. In first treatment, the subjects of group II and III were supplemented with 100 mg and 200 mg of *Aloe vera* L. gel powder respectively for a period of three months and in second treatment *i.e.* nutrition intervention, supplementation was continued along with nutrition counseling for the next three months. The nutrition education was given for three months after fifteen days interval to the subjects of group II and III through individual and group contact. Feeding trials were carried out for a period of six months with daily dosage of two capsules containing 50 mg powder each to group II and 100 mg powder each to group III. One capsule was given immediately on rising and another after dinner.

An open ended preliminary interview schedule was drafted to elicit information pertaining to background information, dietary intake, physical activity, and anthropometric measurements etc. of the subjects. A multiple choice questionnaire was designed to test the knowledge regarding aloe vera, diabetes and diet. Various anthropometric parameters *viz.,* height, weight, body mass index (BMI), mid upper arm circumference and triceps skin fold thickness were recorded using standard method given by Jellife (1966). BMI was categorized according to the classification given by Anonymous (2005). Dietary intake of subjects was recorded for three consecutive days by "24 hours recall cum weightment method", using standardized containers, both before and after the experimental period. The average daily nutrient intake of diet was calculated by using MSU nutriguide computer programme (Song *et al.,* 1992).

Statistical analysis:

The data on all the parameters *viz.,* food and nutrient intake, anthropometric measurements and nutritional knowledge was analyzed statistically. The mean, standard error, percentages, analysis of variance, CD value, paired t- test and their statistical significance was ascertained using a computer programme package.

OBSERVATIONS AND ASSESSMENT

General information of the subjects showed that majority of the subjects belonged to the age group of 35-45 years and studied up to high school (Table 1). Most of them had their own business (Table 1). Majority of the subjects belonged to Sikh religion and had joint family with a family size of 5-6 members (Table 1). The most common reason for diabetes among the selected subjects was obesity (Table 2). Obesity

Table 1. General information of the subjects

Characteristics	Group I	Group II	Group III
Age (years)			
35-45	15(50.0)	16(53.3)	16(53.3)
46-55	10(33.3)	8(26.7)	10(33.3)
56-65	5(16.7)	6(20.0)	4(13.3)
Religion			
Hindu	12(40.0)	14(46.7)	10(33.3)
Sikh	18(60.0)	16(53.3)	20(66.7)
Education			
Illiterate	2(6.7)	3(10.0)	1(3.3)
High school	20(66.7)	16(53.3)	22(73.3)
Higher secondary	7(23.3)	3(10.0)	6(20.0)
Graduate	1(3.3)	8(26.7)	1(3.3)
Occupation			
Business	25(83.3)	21(70.0)	28(93.3)
Service	5(16.7)	9(30.0)	2(6.7)
Marital status			
Married	30(100.0)	30(100.0)	30(100.0)
Type of family			
Nuclear	8(26.7)	11(36.7)	7(23.3)
Joint	22(73.3)	19(63.3)	23(76.7)
Family size			
2-4	8(26.7)	11(36.6)	7(23.3)
5-6	17(56.7)	13(43.3)	19(63.3)
7-8	5(16.7)	6(20.0)	4(13.3)

Figures in parenthesis are percentages

Table 2. Causes of disease

Factors	Group I	Group II	Group III
Heredity	12(40.0)	14(46.7)	9(30.0)
Obesity	16(53.3)	13(43.3)	19(63.3)
Others	2(6.7)	3(10.0)	2(6.7)

Table 3. Physical activity pattern of the subjects

	Group I			Group II			Group III		
	Before	After		Before	After		Before	After	
		3 months	6 months		SA	NI		SA	NI
Physical exercise									
Yes	5(16.7)	5(16.7)	5(16.7)	3(10.0)	3(10.0)	8(26.7)	9(30.0)	9(30.0)	14(46.7)
No	25(83.3)	25(83.3)	25(83.3)	27(90.0)	27(90.0)	22(73.3)	21(70.0)	21(70.0)	16(53.3)
Type of exercise									
Walking	3(10.0)	3(10.0)	3(10.0)	2(6.7)	2(6.7)	6(20.0)	5(16.7)	5(16.7)	10(33.3)
Yoga	2(6.7)	2(6.7)	2(6.7)	1(3.3)	1(3.3)	2(6.7)	4(13.3)	4(13.3)	4(13.3)

Figures in parenthesis are percentages SA= Supplementation of *Aloe vera* L. NI- Supplementation of *Aloe vera* L.+ Nutrition counseling

Table 4. Mean daily food intake of the subjects before and after supplementation of *Aloe vera* L. and nutrition intervention

Food group (g/day)	Before	After		CD	% change		Paired t-value		Suggested intake
	1	2 3 months	3 6 months		Between 1 and 2	Between 1 and 3	Between 1 and 2	Between 1 and 3	
Control									
Group I									
Cereals	298.3±4.2	296.1±2.7	296.1±2.8	1.2••	0.7	0.8	0.5 NS	0.5NS	225*
Pulses	71.8±1.3	71.6±1.3	70.7±0.9	NS	0.3	1.6	1.3 NS	2.7 NS	60*
Green leafy vegetables	39.3±0.7	39.6±1.1	39.7±0.7	NS	0.8	1.1	0.3NS	1.1NS	200*
Other vegetables	64.9±0.9	64.9±0.9	65.9±1.0	NS	0.1	1.5	1.0 NS	1.3 NS	200*
Roots/tubers	66.5±1.1	66.4±1.1	65.3±1.4	NS	0.2	1.8	1.0 NS	1.8 NS	100*
Fruits	54.6±2.4	54.8±0.4	55.6±0.3	NS	0.3	1.9	0.9 NS	2.5 NS	100*
Milk and milk products	315.4±0.4	315.2±0.5	313.8±0.5	1.1••	0.1	0.5	0.8 NS	2.7 NS	300*
Meat/poultry	43.5±1.7	42.7±1.9	42.6±1.5	NS	1.8	1.9	1.2NS	1.7 NS	30#
Fats/oils	36.1±0.2	35.9±0.3	35.4±0.3	NS	0.6	1.8	1.1NS	2.3 NS	15*
Sugar/jaggery	37.1±0.3	36.9±0.3	36.6±0.3	NS	0.7	1.4	1.6NS	2.7 NS	NA
Experimental		SA	NI						
Group II									
Cereals	303.1±0.9	299.2±1.4	275.9±1.7	3.2••	1.3	9.0	1.9 NS	13.1•	225*
Pulses	76.8±1.0	74.6±1.3	65.5±1.1	2.6••	2.9	14.7	2.0 NS	9.1•	60*
Green leafy vegetables	45.1±0.4	46.5±0.8	54.9±0.6	1.4••	3.2	18.0	1.9 NS	13.2•	200*
Other vegetables	78.6±1.7	81.4±2.1	110.9±1.1	3.8••	3.4	29.1	2.0 NS	19.0•	200*
Roots/tubers	64.7±0.7	63.0±1.2	44.4±1.1	2.4••	2.5	31.3	1.7 NS	14.5•	100*
Fruits	62.9±1.0	65.3±1.4	79.6±1.1	2.7••	3.6	20.9	2.0 NS	15.1•	100*
Milk and milk products	343.7±0.4	339.1±1.8	320.9±0.4	2.5••	1.3	6.6	2.3 NS	11.3•	300*
Meat/poultry	49.2±1.8	47.6±1.3	44.5±1.9	3.9••	3.3	9.6	1.6NS	5.6•	30#
Fats/oils	34.5±0.2	34.1±0.4	29.8±0.4	0.9••	1.3	13.6	1.4NS	16.7•	15*
Sugar/jaggery	35.4±0.3	34.6±0.4	29.5±0.4	0.9••	2.2	16.6	2.1NS	9.7•	NA
Group III									
Cereals	308.8±1.3	303.1±3.0	274.9±1.2	4.5••	1.8	10.9	1.8 NS	19.1•	225*
Pulses	72.8±0.6	70.8±0.9	63.2±0.8	1.8••	2.7	13.1	2.1 NS	11.3•	60*
Green leafy vegetables	50.2±1.5	52.3±2.2	62.2±1.1	3.7••	4.1	19.3	1.5 NS	11.7•	200*
Other vegetables	91.3±1.1	93.2±1.3	126.7±1.5	2.9••	2.1	28.0	1.8NS	17.7•	200*
Roots/tubers	69.2±1.0	67.9±1.3	48.2±1.5	2.9••	1.8	30.3	1.4 NS	13.0•	100*
Fruits	66.6±0.8	68.2±1.0	82.3±1.0	2.1••	2.4	19.1	1.7NS	11.3•	100*
Milk and milk products	351.6±1.4	345.6±2.5	333.9±1.3	4.1••	1.7	5.0	2.3 NS	9.2•	300*
Meat/poultry	50.8±1.9	49.6±1.7	46.1±1.3	3.7••	2.3	9.3	1.9NS	2.7•	30#
Fats/oils	38.2±0.3	37.1±0.5	32.7±0.3	0.9••	2.9	14.4	2.0NS	10.3•	15*
Sugar/jaggery	34.1±0.3	33.5±0.3	28.9±0.3	0.7••	1.7	15.2	1.7NS	12.2•	NA

Values represent mean±SE • and •• indicate significance of values at P=0.01 and P=0.05, respectively *Raghuram *et al.* (2007)
SA- Supplementation of *Aloe vera* L. NI- Supplementation of *Aloe vera* L. + Nutrition counseling NS = Non-significant

among the subjects was due to faulty eating habits, sedentary life style and lack of physical exercise. The physical activity pattern of the subjects showed that majority of the subjects were not doing any kind of physical exercise. After nutrition intervention 26.7 and 46.7 per cent of the subjects in group II and III started some kind of physical exercise while there was no change in group I (Table 3). Walker *et al.* (1999) reported that a regular walking programme that represents the simplest form of exercise improved the fitness and lipid profile in subjects at a risk for type 2 diabetes. Dietary and physical activity changes can result in 5-7 per cent weight loss which can further reduce the incidence of type 2 diabetes (Knowler *et al.,* 2001). The mean daily food intake of cereals, pulses, milk/milk products, roots/tubers, meat/poultry, fats/oil, sugar/jaggery decreased significantly ($p \leq 0.01$) in the subjects of group II and III (except pulses, milk/milk products, roots/tubers, meat/ poultry, fats/oil, sugar/jaggery in the subjects of group I) after the study (Table 4). The present study was in line with Gulati (2000) who reported a significant decrease in cereal intake after three months of nutrition education.

In the mean daily intake of nutrients it was found that there was a significant decrease ($p \leq 0.01$) in intake of energy by the subjects of group II and III after nutrition intervention and a non significant ($p \leq 0.01$) decrease in the subjects of group I. There was a significant reduction ($p \leq 0.01$) seen in the carbohydrates intake by the subjects in group II and III at the end of the study with maximum change of 8.1 per cent in the subjects of group II followed by the subjects of group III (7.8%). It was found that there was 11.2 per cent reduction in the protein intake by subjects of group II and 8.8 per cent reduction by subjects of group III. The fat intake reduced by 10.1 per cent in the subjects of group II and 9.6 per cent in the subjects of group III. Also, there was a significant decrease (p=0.01) in the fiber intake by the subjects of group II and III and a non significant decrease (p=0.01) in the subjects of group I. However, the intake values were still high than the suggested intake of 40 g/day by Raghuram *et al.* (2007) (Table 5). In this study, it was seen that there was a significant decrease (p=0.01)

Table 5. Mean daily intake of nutrients of the subjects before and after supplementation of *Aloe vera* and nutrition intervention

Nutrient	Before 1	After 2 3 months	After 3 6 months	CD	% change Between 1 and 2	% change Between 1 and 3	Paired t-value Between 1 and 2	Paired t-value Between 1 and 3	Suggested intake
Control									
Group I									
Energy(Kcal)	2030±8.0	2026±9.4	2005±5.3	17.4••	0.2	1.2	0.8 NS	3.6•	1500*
Carbohydrates(g)	314.6±1.2	314.1±1.2	311.1±0.8	2.5••	0.2	1.1	1.1 NS	3.2•	233*
Protein (g)	63.9±0.7	63.8±0.2	63.4±0.3	NS	0.3	0.8	1.8 NS	1.2NS	66*
Total fat (g)	57.3±0.5	57.2±0.5	56.3±0.5	NS	0.2	1.7	1.7NS	2.0 NS	33*
Saturated fat (g)	28.8±0.6	28.8±0.6	28.4±0.5	NS	0.2	1.5	1.7 NS	1.6 NS	15*
Unsaturated fat (g)	28.5±0.5	28.4±0.6	27.9±0.5	NS	0.2	1.9	1.6 NS	1.8 NS	18*
Dietary fiber (g)	51.2±0.8	51.1±0.9	50.0±0.8	NS	0.3	2.3	1.1 NS	3.4•	40*
Experimental		SA	NI						
Group II									
Energy(Kcal)	2471±8.5	2439±8.9	2248±7.8	17.8••	1.3	9.0	3.2•	13.7•	1500*
Carbohydrates(g)	380.2±1.3	374.8±2.2	349.4±1.7	4.1••	1.4	8.1	3.0•	24.1•	233*
Protein (g)	79.4±0.2	77.6±0.8	70.6±0.5	1.3••	2.3	11.2	4.5•	19.1•	66*
Total fat (g)	70.3±0.2	69.9±1.0	63.2±0.3	1.4••	0.4	10.1	0.3 NS	18.9•	33*
Saturated fat (g)	38.6±0.9	37.8±1.2	28.2±0.6	2.3••	2.3	26.9	2.9•	8.9•	15*
Unsaturated fat (g)	31.6±1.0	32.2±1.2	34.9±0.6	2.2••	1.8	9.4	1.0 NS	2.8•	18*
Dietary fiber (g)	55.5±0.7	54.7±0.7	51.0±0.7	17.5••	1.4	8.1	2.3 NS	20.4•	40*
Group III									
Energy(Kcal)	2269±7.4	2236±8.7	2079±8.6	18.4••	1.4	8.4	3.3•	26.1•	1500*
Carbohydrates(g)	356.3±1.1	350.2±1.4	328.4±1.3	2.9••	1.7	7.8	3.9•	24.3•	233*
Protein (g)	72.3±0.2	70.9±0.4	65.9±0.2	0.7••	1.9	8.8	2.8•	27.6•	66*
Total fat (g)	61.6±0.2	61.3±0.4	55.7±0.3	0.7••	0.5	9.6	0.6 NS	16.3•	33*
Saturated fat (g)	33.9±0.9	33.2±0.9	25.1±0.9	2.1••	1.9	25.8	1.5 NS	4.8•	15*
Unsaturated fat (g)	27.7±0.9	28.1±0.9	30.6±0.7	1.9••	1.2	9.3	2.4 NS	3.6•	18*
Dietary fiber (g)	57.1±0.9	56.5±1.0	52.3±0.9	2.2••	1.1	8.4	2.5 NS	12.0•	40*

Values represent mean±SE • and •• indicate significance of values at P=0.01 and P=0.05, respectively *Raghuram *et al.* (2007)
SA- Supplementation of *Aloe vera* NI- Supplementation of *Aloe vera* + Nutrition counseling NS = Non-significant

in thiamine, riboflavin, niacin and folic acid vitamins after the study in the subjects of group II and III and a non significant ($p \leq 0.01$) decrease in the subjects of group I. Whereas, a significant increase ($p \leq 0.01$) was observed in vitamin C in the subjects of group II and III (Table 6). Mean daily intake of minerals like calcium, phosphorus, magnesium and zinc decreased significantly ($p \leq 0.01$) in the subjects of group II and III after the study and non significantly ($p \leq 0.01$) in the subjects of group I. Whereas, a significant increase ($p \leq 0.01$) was observed in iron intake by the subjects of group II and III (Table 7).

The initial mean values of BMI were 28.0, 26.1 and 26.4 kg/m^2 in the subjects of group I, II and III, respectively. After *Aloe vera* L. supplementation, the corresponding values recorded were to be 27.9, 25.7 and 25.9 kg/m^2 in the subjects of group I, II and III, respectively. There was a significant reduction ($p \leq 0.01$) in the mean values in the subjects of group II and III after three months and a non significant reduction ($p \leq 0.01$) in the subjects of group I. After nutrition intervention these figures further reduced to 25.4 and 25.3 kg in the subjects of group II and III respectively. A significant reduction in BMI after *Aloe vera* supplementation was also reported by Arora *et al.* (2009). Heydari *et al.* (2006) and Anuradha and Vidhya (2001) also found that dietary counseling was effective in reducing body mass index in diabetic patients. The initial mean values of mid upper arm circumference of the subjects in group I, II and III were 28.8, 29.6 and 28.8 cm, respectively. After *Aloe vera* supplementation, the corresponding values recorded were as 28.6, 28.6 and 27.4 cm in the subjects of group I, II and III, respectively. There was a significant reduction (p=0.01) in the mean values of mid upper arm circumference of the subjects in group II and III after supplementation of *Aloe vera*. After nutrition intervention these figures further reduced to 27.9 and 26.8 cm in the subjects of group II and III, respectively. The per cent reduction in the mid upper arm circumference of the subjects in group II and III was 5.4 and 7.2, respectively. The initial mean triceps skin fold thickness values recorded was 11.3, 12.1 and 11.9 mm in the subjects of group I, II and III respectively. The corresponding values were observed to be 11.2, 11.7 and 11.4 mm after supplementation of *Aloe vera* in the subjects of group I, II and III, respectively.. After nutrition intervention these values further reduced to 11.4 and 11.1 mm in the subjects of group II and III, respectively. There was a significant reduction (p=0.01) in the mean values of tricep skin fold thickness of the subjects in group II and III and a non significant reduction (p=0.01) in the subjects of group I (Table 8). A significant reduction in triceps skin fold thickness after *Aloe vera* supplementation was also reported by Arora *et al.* (2009). The knowledge gain of the subjects is shown in the Table 9. The total KAP score of the subjects was significantly increased by 73.6 and 74.1 per cent in the subjects of group II and III after nutrition intervention respectively and there was a non significant increase ($p \leq 0.01$) in the subjects of group I.

Table 6. Mean daily intake of vitamins of the subjects before and after supplementation of *Aloe vera* L. and nutrition intervention

Vitamins	Before 1	After 2 3 months	After 3 6 months	CD	% change Between 1 and 2	% change Between 1 and 3	Paired t-value Between 1 and 2	Paired t-value Between 1 and 3	Suggested intake
Control									
Group I									
Thiamine (mg/day)	2.2±0.1	2.2±0.1	2.1±0.1	NS	0.4	1.1	1.7 ^{NS}	4.0$^{\bullet}$	1.2*
Riboflavin (mg/day)	1.8±0.2	1.8±0.3	1.8±0.2	NS	1.2	1.6	2.3 ^{NS}	5.5$^{\bullet}$	1.4*
Niacin (mg/day)	18.2±0.1	18.1±0.1	18.1±0.1	NS	0.1	0.1	4.5$^{?}$	5.0$^{\bullet}$	16*
Folic acid (µg/day)	323.2±0.2	322.9±0.3	322.5±0.3	NS	0.1	0.2	1.4 ^{NS}	2.8$^{\bullet}$	100*
Vitamin C (mg/day)	38.6±0.1	38.9±0.2	38.9±0.1	NS	0.7	1.0	1.8 ^{NS}	3.0$^{\bullet}$	40*
Experimental		SA	NI						
Group II									
Thiamine (mg/day)	2.1±0.1	2.0±0.1	1.8±0.3	0.1$^{\bullet\bullet}$	5.5	17.4	3.3$^{\bullet}$	7.0$^{\bullet}$	1.2*
Riboflavin (mg/day)	1.8±0.1	1.8±0.1	1.7±0.1	0.1$^{\bullet\bullet}$	2.2	6.1	2.9$^{\bullet}$	7.3$^{\bullet}$	1.4*
Niacin (mg/day)	17.9±0.2	17.5±0.2	16.5±0.2	0.5$^{\bullet\bullet}$	2.4	7.6	2.8$^{\bullet}$	14.7$^{\bullet}$	16*
Folic acid (µg/day)	320.8±0.6	317.1±1.3	308.6±1.1	2.4$^{\bullet\bullet}$	1.2	3.8	2.6 ^{NS}	10.3$^{\bullet}$	100*
Vitamin C (mg/day)	36.9±0.5	39.6±0.8	46.2±0.8	1.6$^{\bullet\bullet}$	6.8	20.1	2.7$^{\bullet}$	14.1$^{\bullet}$	40*
Group III									
Thiamine (mg/day)	2.2±0.1	2.1±0.1	1.8±0.1	0.1$^{\bullet\bullet}$	4.2	18.3	4.6$^{\bullet}$	8.6$^{\bullet}$	1.2*
Riboflavin (mg/day)	1.7±0.2	1.7±0.1	1.6±0.1	0.1$^{\bullet\bullet}$	1.7	6.3	2.28	12.0$^{\bullet}$	1.4*
Niacin (mg/day)	19.5±0.5	19.0±0.6	17.6±0.6	1.3$^{\bullet\bullet}$	2.5	9.8	2.8$^{\bullet}$	13.7$^{\bullet}$	16*
Folic acid (µg/day)	335.2±2.5	329.1±2.4	320.2±2.1	5.2$^{\bullet\bullet}$	1.8	4.5	1.9 ^{NS}	8.4$^{\bullet}$	100*
Vitamin C (mg/day)	42.6±0.8	44.5±1.1	51.9±1.1	2.2$^{\bullet\bullet}$	4.2	17.9	3.0$^{\bullet}$	19.9$^{\bullet}$	40*

Values represent mean±SE | $^{\bullet}$ and $^{\bullet\bullet}$ indicate significance of values at P=0.01 and P=0.05, respectively | NS = Non-significant

SA- Supplementation of *Aloe vera* | NI- Supplementation of *Aloe vera* + Nutrition counseling | *ICMR (2003)

Table 7. Mean daily intake of minerals of the subjects before and after supplementation of *Aloe vera* L. and nutrition intervention

Minerals (mg/day)	Before 1	After 2 3 months	After 3 6 months	CD	% change Between 1 and 2	% change Between 1 and 3	Paired t-value Between 1 and 2	Paired t-value Between 1 and 3	Suggested intake (mg/day)
Control									
Group I									
Calcium	644.2±1.5	641.9±1.8	641.2±1.6	NS	0.4	0.5	3.8•	4.2•	400#
Phosphorus	1751.9±3.6	1742.8±3.8	1734.1±4.0	8.6••	0.5	1.0	3.0•	8.6•	400#
Magnesium	570.8±0.8	566.5±1.3	564.2±1.3	2.72••	0.8	1.2	4.7•	7.6•	350#
Zinc	9.5±0.1	9.4±0.1	9.4±0.1	NS	0.7	1.2	1.7 NS	5.7•	15.5#
Iron	19.7±0.5	19.8±0.5	19.8±0.5	NS	0.4	0.5	2.4 NS	5.7•	28#
Experimental		SA	NI						
Group II									
Calcium	720.9±2.4	700.7±6.1	654.2±3.2	9.5••	2.8	9.3	3.0•	14.9•	400#
Phosphorus	1775.2 ±3.0	1751.8±6.4	1699.4±4.9	11.1••	1.3	4.3	3.1•	13.0•	400#
Magnesium	589.7±1.3	581.3±2.7	549.7±1.6	4.4••	1.4	6.8	2.9•	17.4•	350#
Zinc	10.4±0.2	10.2±0.2	9.2±0.2	0.5••	1.3	11.7	1.4 NS	20.2•	15.5#
Iron	21.7±0.5	22.2±0.8	23.5±0.5	1.4••	2.1	7.7	0.8 NS	13.8•	28#
Group III									
Calcium	735.9±2.4	723.3±5.8	673.0±3.7	9.4••	1.7	8.5	2.8•	17.0•	400#
Phosphorus	1875.2±3.0	1837.1±6.7	1760.9±6.1	16.4••	2.0	6.1	3.3•	14.5•	400#
Magnesium	619.6±1.3	603.9±5.2	561.6±4.2	8.8••	2.5	9.3	3.0•	13.5•	350#
Zinc	10.9±0.2	10.8±0.1	9.6±0.2	0.4••	1.1	12.3	1.4 NS	14.3•	15.5#
Iron	23.7±0.5	24.3±0.7	26.0±0.5	1.4••	2.4	8.9	0.3 NS	19.7•	28#

Values represent mean±SE • and •• indicate significance of values at P=0.01 and P=0.05, respectively
SA- Supplementation of *Aloe vera* L. NI- Supplementation of *Aloe vera* L.+ Nutrition counseling NS = Non-significant *ICMR (2003)

Table 8. Anthropometric measurements of the subjects before and after supplementation of *Aloe vera* L. and nutrition intervention

Variables	Before 1	After 2 3 months	After 3 6 months	CD	% change Between 1 and 2	% change Between 1 and 3	Paired t-value Between 1 and 2	Paired t-value Between 1 and 3	Suggested intake (mg/day)
Control									
Group I									
Height (cm)	166.5 ±1.2	166.5 ±1.2	166.5 ±1.2		-	-	-	-	
Weight (kg)	77.2±0.8	77.0±0.7	76.9±0.8	NS	0.2	0.4	1.8 NS	1.9 NS	66#
BMI (kg/m^2)	28.0±0.5	27.9±0.5	27.9±0.4	NS	0.2	0.4	1.7 NS	1.9 NS	18.5-24.99*
MUAC (cm)	28.8±0.4	28.6±0.5	28.5±0.5	NS	0.8	0.9	2.5 NS	2.0 NS	29.3[1]
TSFT (mm)	11.9±0.1	11.2±0.1	11.2±0.1	NS	0.7	0.9	1.4 NS	1.4 NS	12.5[1]
Experimental	SA	NI							
Group II									
Height (cm)	169.4±1.5	169.4±1.5	169.4±1.5		-	-	-	-	
Weight (kg)	75.2±1.2	74.1±1.2	73.1±1.2	1.03••	1.5	2.8	10.1•	10.4•	69#
BMI (kg/m^2)	26.1±0.7	25.7±0.6	25.4±0.6	0.65••	1.5	2.8	8.5•	10.3•	18.5-24.99*
MUAC (cm)	29.6±0.9	28.6±0.9	27.9±0.5	1.23••	3.3	5.4	6.0•	10.7•	29.3[1]
TSFT (mm)	12.1±0.1	11.7±0.1	11.4±0.2	0.55••	3.1	5.9	4.3•	5.4•	12.5[1]
Group III									
Height (cm)	168.2±1.5	168.2±1.5	168.2±1.5		-	-	-	-	
Weight (kg)	74.9±1.2	73.5±1.3	71.9±1.4	2.75••	1.8	3.9	6.1•	5.0•	68#
BMI (kg/m^2)	26.4±0.7	25.9±0.7	25.3±0.7	0.73••	1.8	3.9	6.0•	5.2•	18.5-24.99*
MUAC (cm)	28.8±0.4	27.4±0.5	26.8±0.5	1.33••	4.8	7.2	6.7•	7.7•	29.3[1]
TSFT (mm)	11.9±0.1	11.4±0.2	11.1±0.1	0.41••	4.5	6.8	5.7•	9.0•	12.5[1]

Values represent mean±SE • and •• indicate significance of values at P=0.01 and P=0.05, respectively *Anonymous 2005 # ICMR (2003)
1 Jelliffe (1966) SA- Supplementation of *Aloe vera* L. NS= Non-significant NI- Supplementation of *Aloe vera* L. + Nutrition counseling

Table 9. KAP scores obtained by the subjects before and after supplementation of *Aloe vera* L. and nutrition intervention

Variables	Before	After		CD	% change		t - value	
	1	2 3 months	3 6 months		Between 1 and 2	Between 1 and 3	Between 1 and 2	Between 1 and 3
Control								
Group I								
Knowledge	12.6±0.5	12.6±0.5	12.7±0.5	NS	0.5	0.8	1.0 ^{NS}	1.3 ^{NS}
Attitude	8.1±0.4	8.2±0.5	8.2±0.5	NS	0.4	0.4	0.3 ^{NS}	1.0 ^{NS}
Practices	7.9±1.6	8.0±1.7	8.0±1.7	NS	0.8	0.8	0.4 ^{NS}	0.4 ^{NS}
Total KAP score	28.7±1.0	28.8±1.1	28.9±1.1	NS	0.6	0.7	0.6 ^{NS}	1.1 ^{NS}
Experimental		SA	NI					
Group II								
Knowledge	8.9±0.8	28.3±0.5	43.3±0.4	1.4$^{••}$	68.4	79.4	13.4$^{•}$	25.6$^{•}$
Attitude	7.5±0.4	14.5±0.6	22.2±0.3	1.0$^{••}$	47.9	66.1	18.4$^{•}$	24.9$^{•}$
Practices	6.2±0.4	13.9±0.6	20.2±0.5	1.2$^{••}$	55.6	69.4	12.4$^{•}$	29.0$^{•}$
Total KAP score	22.6±1.0	56.6±0.9	85.7±0.9	2.1$^{••}$	60.0	73.6	25.8$^{•}$	23.4$^{•}$
Group III								
Knowledge	9.6±0.3	24.1±0.4	43.5±0.3	0.7$^{••}$	60.2	77.9	28.9$^{•}$	29.8$^{•}$
Attitude	6.4±0.5	14.1±0.6	20.9±0.6	1.3$^{••}$	54.8	69.6	29.0$^{•}$	33.6$^{•}$
Practices	6.1±0.5	14.7±0.5	20.6±0.6	1.2$^{••}$	58.8	70.6	25.0$^{•}$	33.1$^{•}$
Total KAP score	22.0±0.8	52.9±1.6	85.0±0.9	2.7$^{••}$	58.4	74.1	28.0$^{•}$	30.9$^{•}$

Values represent mean±SE $^{•}$ and $^{••}$ indicate significance of values at P=0.01 and P=0.05, respectively

SA- Supplementation of *Aloe vera* L. NI- Supplementation of *Aloe vera* L. + Nutrition counseling NS = Non-significant

Conclusion:

The investigation of the present study revealed that supplementation of 100mg and 200mg of *Aloe vera L.* gel powder along with nutrition counseling improved the food intake and anthropometric measurements of selected subjects. It was also observed that total knowledge scores of the selected subjects improved significantly after nutrition counseling.

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Received : *07.05.2012;* **Accepted :** *02.07.2012*