

## Effect of Cloves and Turmeric on Hyperlipidemics

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**KEYWORDS** Spices. Hyperlipidemics. Triglycerides. Total Cholesterol. HDL. LDL. VLDL

**ABSTRACT** Spices have been used to preserve food, enhance flavour and as remedies for a long list of ailments and are effective in controlling serum lipids. The objectives of the study were to analyse the nutritive values and active principles of cloves and turmeric, prepare the respective spice capsules and to supplement the diets of hyperlipidemic adults with the spice capsules for a period of three months. A group of 45 mild to moderate hyperlipidemics were selected for the supplementation study and were divided into three groups (15 each), two supplementation groups and one control group. To one group, cloves and to the other turmeric, both in the form of capsules were supplemented. Cloves and turmeric after a series of processing were made into capsules of 500 mg each. Clinical examination and biochemical parameters were evaluated before and after supplementation. The results revealed that most of the clinical symptoms experienced by the cloves supplemented group disappeared whereas only few symptoms disappeared in turmeric supplemented group. Cloves supplemented group of hyperlipidemics showed a maximum reduction in total cholesterol, triglycerides, LDL and VLDL cholesterol and an increase in the HDL cholesterol which were significant at one per cent level. No change was observed in the turmeric supplemented and control group.

### INTRODUCTION

Spices have been used to preserve food, enhance their flavour and as remedies for a long list of ailments. Today the pendulum is swinging back and researchers are confirming what herbalists have known all along that, the spice rack can be as potent as a medicinal chest. Spices contain phytonutrients, which may prevent the mutation of healthy cells into cancerous cells. Spices are the powerhouse of pleasure and health (Zak 2006). A great advantage that the use of herbal remedies has over commercial drugs is the reduced side effects, since the concentration of active ingredients in herbs is much lower.

Cloves are stimulating and have antibacterial, antiviral, antifungal and antiseptic properties. They act as natural anesthetic due to the eugenol oil and hence used for dental treatment. Clove oil is used for medicines both topically and internally. This oil contains a compound that helps for blood circulation and can stimulate the skin when applied directly on it. Cloves heal ailments of the digestive system and are well known for relieving flatulence and can actually help to promote good digestion as well as metabolism (Platel and Srinivasan 2004).

Turmeric, known as 'Indian saffron' due to of its brilliant yellow color, is considered the best spice in the world. Turmeric, a multifaceted wonder spice helps to detoxify the liver, balance

cholesterol levels, fight allergies, stimulate digestion, boost immunity and enhance complexion. It is also an antioxidant, recognizing turmeric as a healing spice, contributing bitter, pungent and astringent tastes. Activities of turmeric include alterative, analgesic, antibacterial, anti-inflammatory, anti-tumor, anti-allergic, antioxidant, antiseptic, antispasmodic, appetizer, astringent, carminative, cholagogue, digestive, diuretic and stimulant (Shankar and Srivastava 2007).

Cardio-vascular diseases are the number one cause of death globally; more people die annually from cardio-vascular diseases than from any other cause. By 2015, almost 20 million people will die from cardio-vascular diseases mainly from heart disease and stroke (WHO 2004). The causes of cardio-vascular diseases are well-established and well-known which include unhealthy diet, inadequate physical activity, tobacco use which are called modifiable risk factors and may show up in individuals as raised blood pressure, blood glucose, blood lipids and overweight and obesity.

The compounds present in certain spices are more effective in controlling serum lipids. The botanicals available in our country have been proved to be safe and effective, through several hundred to thousand years of use. Many actions associated with herbal supplements may help prevent or potentially alleviate hyperlipidemia.

### Objectives

- ★ To analyse the nutrient content and active principles of the selected spices - cloves and turmeric.
- ★ To prepare the respective spice capsules and supplement the diets of selected hyperlipidemics with the spice capsules for a period of three months.

### MATERIALS AND METHODS

The study was carried out in an industrial concern in Coimbatore city in Tamil Nadu state where nearly 2000 adults are employed. From this, 500 adults in the age group of 40 to 60 years with hyperlipidemia were identified. The controlled nature of the disease condition and their willingness to participate and co-operate in the three months feeding trial formed the basis for selection of adults. One group of 45 mild to moderate hyperlipidemics was selected for the supplementation study. Details regarding the socio-economic characteristics were gathered through interview method using a pre-tested questionnaire. Questions also included getting information on their lifestyle pattern, health status, physiological symptoms experienced and other diseases if any. Five hundred adults including the selected adults for supplementation study and control groups were interviewed. Nutritional assessment was carried out using anthropometric measurements (height, weight, BMI, WHR), clinical examination (blood pressure, clinical examination), biochemical assessment (blood haemoglobin, lipid profile, total cholesterol, triglycerides, HDL, LDL and VLDL cholesterol) and food and nutrient intake.

After an extensive appraisal of literature pertaining to spices, cloves and turmeric were selected. These spices were chosen as they hold great scope for controlling blood cholesterol and are widely practised in Ayurveda system of medicine but lacks strong scientific evidence. The spices, cloves and turmeric with Agmark certification were procured and cleaned. The cleaned spices were then spread in trays and dried in a cabinet drier at 40°C for one hour and allowed to cool. The dried spices were then pulverized, sieved and then stored in air tight containers. They were formed into capsules using special capsuling machines. The prepared spices in the form of capsules had approximately

490 to 500 mg of spice powders each to facilitate easy distribution of appropriate dosage.

The nutrients present in the selected spices namely cloves and turmeric were analysed using standard procedures (Ashwood et al. 1994). The selected 45 hyperlipidemics were divided into three groups consisting of 15 adults in each group. Thirty adults (two groups of 15 adults in each group) constituted the experimental group who were given each two grams of cloves (HA) and turmeric (HB) in the form of four capsules daily for a period of three months. The remaining 15 adults constituted the control group (HC). To the hyperlipidemic control group, two grams of powdered sugar in the form of capsules were given daily till the end of the supplementation period.

The data collected was consolidated and statistically analysed for arriving at the results of the effect of supplementation of cloves and turmeric on hyperlipidemics for various parameters.

### RESULTS AND DISCUSSION

The results pertaining to the present study entitled are discussed as follow:

#### I. Demographic and Lifestyle Pattern

Among the 500 adults surveyed, a majority of 30.4 per cent belonged to the age group of 40 to 45 years. The findings of the study revealed a higher prevalence of hyperlipidemia among adults of 40 to 45 years. All the adults were literates. It is a welcome observation that about 5 per cent of males and 61 per cent of females were graduates and 25 per cent of males have completed professional courses. Twenty-three per cent of the males were engineers. 41 per cent of males and 29 per cent of females were employed either in government or private concerns. All the adults were sedentary workers. It is clearly seen that 47 per cent of the families were joint and 53 per cent of them were of nuclear type. Seventy two per cent of the males and 58 per cent of the females were from high income group (> Rs. 7500).

Yoga was practised by 45 per cent of the adults either daily, weekly once or twice and 55 per cent of the adults were not practising yoga. Thirty-five per cent of the adults reported that they did exercise regularly from half an hour to

one hour in order to keep their body fit and to control the disease condition. All the females were engaged in household work.

Seventy-four per cent of the males had the habit of cigarette smoking. Among them, 55 per cent of the adults were regular smokers and 43 per cent of the adults developed the habit of smoking in the past ten years. Only 26 per cent of the adults did not have the habit of smoking. One hundred and ten adults were not taking alcohol and 60 per cent consumed for the past 10 years and 31 per cent consumed regularly and 34 per cent occasionally. After the onset of the disease, about 34 per cent of adults stopped consuming alcohol. Among the males, 67 per cent did not have the habit of chewing neither tobacco, *pan masala* nor betel leaves. Among females, 60 per cent had the habit of chewing and only 40 per cent did not have this habit. None of the women had the habit of chewing *pan masala*, but a majority (77 %) of women consumed betel leaves.

## II. Dietary Pattern and Medical History

A majority of the male and female adults (61 % and 62 % respectively) were non-vegetarians. Pure vegetarians among the males accounted for 29 per cent and among the females 27 per cent. All the male and female adults consumed three meals a day. When the meal pattern of the adults was considered, 80 % of the adults consumed rice based food items for their breakfast and very less percentage (20 %) of the adults consumed either wheat or *ragi* based food items. Fruits were consumed by 53 per cent of the adults. About 55 per cent of the adults had wheat based and the remaining 45 per cent had rice based preparations for dinner. A great percentage of the adults avoided roots and tubers as they were very much concerned about their disease condition.

Data collected regarding the consumption of beverages revealed that majority of the adults consumed both tea and coffee either with (17 %) or without sugar (19 %) depending on their disease condition. About 17 per cent of the adults consumed tea without sugar. Twelve per cent of the adults did not consume any beverage.

Out of the 245 hyperlipidemic adults, a majority of 42 and 32 per cent consumed green leafy vegetables, vegetables and fruits as special food items. This was followed by pulses and

grams and oats kanji (32 % and 23 %). Eighty-five and 74 per cent of hyperlipidemic adults avoided coconut and salt in their diet. Sixty-six per cent of adults avoided nuts and oil seeds and 54 per cent avoided deep fat fried foods as they contained more oil. It was also observed that many adults avoided junk foods (40 %), milk and milk products (42 %) and non-vegetarian items (35%). About 17 per cent of the hyperlipidemic adults did not follow any dietary modifications.

It was observed that among the 500 adults, 245 adults had hyperlipidemia. It was found that 44 males and 19 females had hyperlipidemia for the past five years. Regarding the familial trait, majority of the males (37) and females (29) both parents had either hyperlipidemia or diabetes mellitus. About 27 males and 23 females did not show any familial history of hyperlipidemia. A total of 8 per cent of the hyperlipidemic adults were taking treatment for a period of 1 to 5 years. It is evident that among the hyperlipidemic adults, about 80 per cent of males and 92 per cent of females did not take any treatment to control the disease. They were maintaining their lipid levels through diet modification. A majority (12 %) of hyperlipidemic adults went for allopathic treatment with three per cent taking Ayurvedic treatment.

## III. Nutritional Awareness on the Consumption of Spices

The spice cabinet proves to be a source of help for many disease conditions. Only 43.7 per cent males and 46.3 per cent females were aware that spices could help to control or fight against disease conditions. About 56 per cent of males and 54 per cent females with an overall percentage of 55 did not have any idea regarding the medicinal properties of spices. The medicinal value of garlic was reported by 13 males and 19 females (overall 14 %).

## IV. Nutrient Analysis of the Selected Spices

The nutrient analysis of the selected spices, namely, cloves and turmeric revealed that maximum moisture content was seen in cloves (14.11 g/100g). The energy content was high in turmeric with 310 Kcal and cloves with 270 Kcal per 100 g. Cloves had a protein content of 7.7 g with a maximum fat content of 1.72 g followed by

turmeric with 1.54 g in 100g. Carbohydrate content was found to be highest in turmeric with 44.25 g per cent. Ash content ranged from 7.61 to 7.66 per cent in turmeric and cloves. Minerals like phosphorus, sodium, potassium and iron were high in turmeric with 71 mg, 0.035 mg, 0.031 mg and 0.009 mg respectively. Riboflavin content was 0.09 mg in cloves. Vitamin A was found to be high with 36 mg in cloves and 91 mg in turmeric. The crude fibre was also maximum in cloves with 14.68 g. Trace elements like lead, zinc, arsenic and chromium were found to be below the detectable limits, whereas only copper was found among the spices in traces ranging from 0.001 to 0.003 mg. Active principles present in cloves included 19.6 mg of cinnamaldehyde, 0.04 mg of eugenol, 1.39 mg of allicin and 0.09 mg of curcumin. Maximum quantities of curcumin was present in turmeric (0.21 mg %), cinnamaldehyde (36 mg %) and allicin (9.32 mg %) compared to cloves.

#### V. Mean Food and Nutrient Intake

The consumption of cereals was more than the recommended allowance by 53.6 per cent among the hyperlipidemic adults. Consumption of pulses followed the same trend with 16.7 per cent more than the allowance. The intake of green leafy vegetables and other vegetables was deficit by 55 and 26.7 per cent respectively. The consumption of roots and tubers was in excess among the hyperlipidemic adults by 55 per cent. The intake of fruits (40 %), milk and milk (5 %) products was also generally inadequate among the males. The consumption of fleshy foods, fats and oils were in excess of 20 and 33 per cent respectively. The findings revealed that a high intake of fleshy foods and fats and oils might have predisposed the selected adults for hyperlipidemic conditions.

There was an excess intake of energy to the tune of 11 per cent by the hyperlipidemic adults. Compared to the RDA there was an excess in the consumption of proteins and fat by 47 and 13 per cent respectively. When B vitamins thiamine and riboflavin were considered there was an excess of 33.3 per cent among both. There was a deficit of 60 per cent in the consumption of vitamin C. Minerals like calcium was deficit in the range of 49 per cent. There was a severe deficit in the consumption of fiber to the tune of 56 per cent.

The general observation from the nutrient intake data revealed that there was an excess intake of energy, protein and fat than the RDA whereas a deficit intake of beta carotene, vitamin C and fiber was observed which requires proper diet counselling among the hyperlipidemics.

#### VI. Clinical Symptoms Experienced by the Hyperlipidemics

The clinical symptoms observed among hyperlipidemics like polyphagia, polydipsia, headache, nocturia, weight gain, fatigue, giddiness, shivering, breathlessness, palpitation, hypertension, inability to work were found to disappear after a three months period of supplementation with cloves. Among the adults supplemented with turmeric the symptoms showed little change after supplementation. No change or improvement was observed in control group.

#### VII. Effect of Supplementation of Spices on the Nutritional Status

##### VIIa. Body Weight

The mean body weights of the hyperlipidemic adults before supplementation with cloves, turmeric and control groups were 70.87 kg, 69.8 kg and 76.07 kg respectively. After a period of three months of spice capsule supplementation it was observed that there was a weight reduction of 1 kg in cloves supplemented group. Whereas there was an increase in weight among the adults supplemented with turmeric with a mean difference of 0.75 kg. The increase in weight among turmeric group was statistically significant at one per cent level. When compared between the groups and control it was observed that the weight reduction or increase was not significant.

##### VIIb. Body Mass Index

It is evident that none of the adults included for the study were of underweight category as per BMI less than 18.5. In the present study, majority were obese and only a few were of normal weight range indicating the need to control and maintain the disease condition so as to reduce the risk of cardiovascular complications. After supplementation, there was

a shift in the BMI, that is, among the 26 adults at risk of obesity, six moved to the normal group and those in the obese I and II category remained in the same group. This shows that the hyperlipidemic adults apart from the consumption of spices daily in the form of capsules, they were maintaining their calorie intake and exercised regularly as per the advice of the doctor and counselling by the investigator.

### VIIc. Waist Hip Ratio

Before supplementation among the hyperlipidemic adults, 45 were in the normal WHR category of  $d''$  0.95 and 30 were in the obese WHR category of  $e''$  0.95. But after a period of three months of supplementation with spice capsules it was observed that only 19 were of obese WHR category. The number of normal category WHR adults increased from 45 to 56.

### VIIId. Blood Pressure

Among 54 hyperlipidemic adults whose blood pressure was either above or below normal, 16 moved to the normal blood pressure category after supplementation of spices for a period of three months.

## VIII. Effect of Supplementation of the Spices on the Biochemical Profile of Hyperlipidemics

### VIIIa. Blood Haemoglobin Levels

The initial blood haemoglobin values of the hyperlipidemic adults of the group supplemented with turmeric and control group except cloves group were found to be in the normal range of 13.5 to 16.5 g/dl suggested by Ashwood et al. (1994). None of the selected adults were found to suffer from anaemia. A gradual increase in the blood haemoglobin levels was observed among the cloves (from 13.27 to 13.93 mg/dl) supplemented group over the three months period which was found to be significant at one per cent level. There was a slight increase in haemoglobin levels among the other groups but not at a significant level. A comparison revealed a highly significant change at 1 per cent level in haemoglobin levels among cloves supplemented group with no significant change among turmeric group. This clearly indicated that over a period of three months, cloves supplementation was

effective in raising the blood haemoglobin levels with a minimum increase among turmeric supplementation.

### VIIIb. Total Cholesterol

Figure 1 presents the total cholesterol levels of the hyperlipidemics. The mean total cholesterol levels of the hyperlipidemic adults before spice supplementation was 251.93 mg/dl in cloves group, 244.53 mg/dl in turmeric group and 249.47 mg/dl in control group which were much higher than the normal desirable range of  $< 200$  mg/dl (NCEP 2001). It is observed that the total cholesterol level in the cloves group had a mean difference of 51.47 mg/dl followed by turmeric group 10.53 mg/dl. In cloves supplemented group the total cholesterol level came down to the normal range which was found to be significant at one per cent level ( $P < 0.01$ ). The differences in the levels of turmeric group and control group were negligible. Findings revealed that the spices were more effective in reducing the total cholesterol level over the supplementation period of three months. A one per cent drop in serum cholesterol reduces the risk for Coronary Heart Disease (CHB) by two per cent (Nathan et al. 2005).

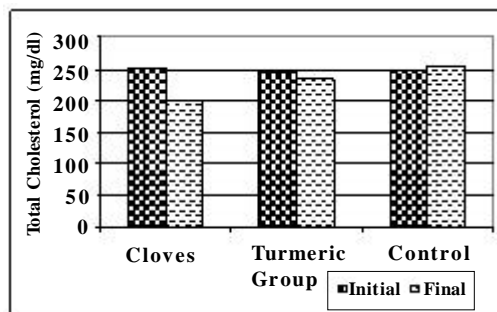


Fig. 1. Total cholesterol levels of hyperlipidemic adults, before and after supplementation of spices

### VIIIc. Triglyceride

Table 1 depicts the mean triglyceride levels of the hyperlipidemics before and after spice supplementation. Initially the serum triglyceride levels of the hyperlipidemic adults, among cloves, turmeric and control groups were found to be in the borderline high category of 150 to 199 mg/dl as per NCEP (2001). After three

**Table 1: Changes in mean triglyceride levels before and after supplementation of spices**

Group	Triglyceride (mg/dl)			t' value	
	Initial (I)	Final (F)	Difference	IVsF	Between groups
Cloves	185.6	140.93	-44.67		HAVsHC
HA	±21.61	±14.71	±13.29	10.69**	10.75**
Turmeric	178.27	188.6	+10.33		HB Vs HC
HB	±22.29	±27.88	±13.92	2.8*	2.31*
Control	195.4	195.73	+0.33		
HC	±31.57	±28.22	±8.3	0.13 <sup>ns</sup>	

Normal: < 150 mg / dl Borderline high : 150 to 199 mg / dl

High: 200 to 499 mg / dl Very high : > 499 mg / dl (NCEP 2001)

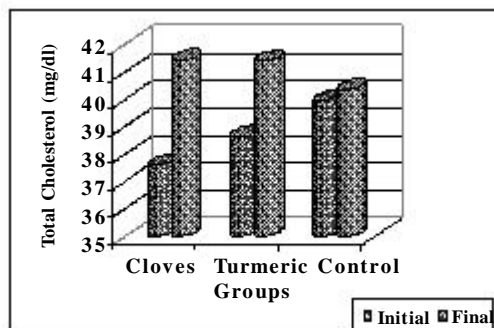
\* P < 0.05; Significant at 5 per cent level

\*\* P < 0.01; Significant at 1 per cent level

months of supplementation with spices the triglycerides reached a level of 140.93 mg/dl in cloves group which was well within the desirable level of <150 mg/dl. There was a slight increase in the turmeric supplemented group (188.6 mg/dl) and with a minimum change in the control group. A comparison of cloves supplemented group with control group revealed a significant difference at one per cent level. There was a five per cent increase in the triglyceride level among turmeric group in comparison with the control. A comparison of the final triglyceride levels with initial values indicated a reduction ranging from 43.33 mg/dl to 47.73 mg/dl among cloves group which was found to be statistically significant at one per cent level. Lowering triglycerides and increasing HDL cholesterol is associated with a reduction in cardiovascular events in patients with type 2 diabetes mellitus (Klausen et al. 2004).

#### VIII.d. HDL Cholesterol

The mean HDL cholesterol levels of the hyperlipidemics before and after supplementation are presented in Figure 2. The desirable level of HDL cholesterol ranges between 40 to 60 mg/dl (NCEP 2001). In the present study, the initial HDL cholesterol level was found to be in the desirable range among all the groups of hyperlipidemic adults. However, HDL cholesterol level in the cloves and turmeric supplemented groups showed a gradual increase

**Fig. 2. HDL cholesterol levels of hyperlipidemic adults before and after supplementation of spices**

from the initial values after three months of supplementation, the increase was found to range between 0.83 to 3.83 with a highest increase (3.83 mg/dl) for cloves supplemented group. The differences between initial and final were found to be significant for cloves and turmeric group at one per cent level (P<0.01). No significant change was observed in the initial and final values of control group. This difference in the spice supplemented group probably indicates the effect of cloves and turmeric in increasing the HDL cholesterol levels and maintaining a lower risk for lipid profile among hyperlipidemics. When compared with the control group, the increase in HDL was more significant among cloves and turmeric group which was statistically significant at one per cent level. Elevated levels of HDL cholesterol actually lower the risk of HDL (greater than or equal to 60 mg/dl) and is considered as a negative risk factor for HDL (Gardner et al. 2007).

#### VIII.e. LDL Cholesterol

The changes in the LDL cholesterol levels of the hyperlipidemics before and after spice supplementation are presented in Table 2. The LDL cholesterol levels of hyperlipidemic adults before supplementation of cloves and turmeric were 177.2 mg/dl and 170.2 mg/dl respectively and found to be in the higher range of 160 to 189 mg/dl (NCEP 2001). It showed a reduction of 46.36 mg/dl, and 15.34 mg/dl among the cloves and turmeric supplemented groups respectively after three months of supplementation. These values were found to be in the near optimal range

**Table 2: Changes in mean LDL cholesterol levels before and after supplementation of spices**

Group	LDL Cholesterol(mg/dl)			t' value	
	Initial (I)	Final (F)	Difference	IVsF	Between Groups
Cloves HA	172.2 ±23.41	130.84 ±15.55	-46.36 ±17.51	8.42**	HAVsHC 10.23**
Turmeric HB	170.2 ±16.2	154.86 ±16.1	+15.34 ±18.41	3.22**	HB Vs HC 4.06*
Control HC	170.42 ±16.11	176.95 ±17.01	+6.53 ±8.24	2.52*	

Optimal: < 100 mg / dl; Near optimal: 100 to 129 mg / dl

Borderline high: 130 to 159 mg / dl High: 160 to 189 mg / dl

Very high: > 189 mg / dl (NCEP 2001)

\* P < 0.05; Significant at 5 per cent level

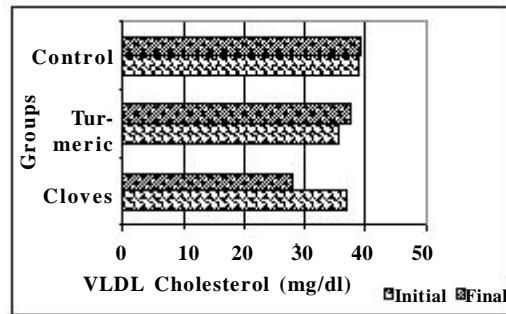
\*\* P < 0.01; Significant at 1 per cent level

of 100 to 129 mg/dl (NCEP 2001) in cloves supplemented group. Though the LDL cholesterol levels decreased in turmeric supplemented group they were still in the borderline high risk category of 130 to 159 mg/dl. The differences in the LDL cholesterol levels in all the supplemented groups were statistically significant at one per cent level. There was a significant increase in the LDL cholesterol level in the control group at five per cent level. The changes in the LDL cholesterol levels of the groups with the control group was also found to be significant at one per cent level (P<0.01) with a higher reduction in the cloves supplemented group. Half teaspoon of cinnamon per day can lower LDL cholesterol (Khan et al. 2003).

#### VIII.f. VLDL Cholesterol

Figure 3 gives the VLDL cholesterol levels of the hyperlipidemics before and after supplementation of spices. The initial serum VLDL cholesterol levels in the experimental groups of cloves, turmeric and control groups of adults were 37.12 mg/dl, 35.65 mg/dl and 39.08 mg/dl respectively and the values were in the higher range of normal values of 5 to 40 mg/dl as per NCEP (2001). There was a slight increase of 2.07 mg/dl in the turmeric supplemented group and no change was observed in the control

group. The reduction in the VLDL cholesterol levels in the cloves supplemented group was found to be significant at one per cent level (P<0.01). A comparison of cloves supplemented group with the control group revealed a statistically significant difference at one per cent level and turmeric group which showed a five per cent level of significance.



**Fig. 3. VLDL cholesterol levels of hyperlipidemic adults before and after supplementation of spices**

From the foregoing parameters on lipid profile on the hyperlipidemics on supplementation with spices namely cloves and turmeric it could be clearly seen that cloves supplementation was more effective than turmeric supplementation. Further, long term supplementation studies are required to give conclusive evidences. Comprehensive spicy therapeutic regimen thus offers time tested safe and effective support to conventional therapy in the management of hyperlipidemia.

#### CONCLUSION

Variety is the spice of life and enjoying a variety of herbs and spices may help us live a healthier life as well. The results of supplementation with cloves and turmeric to hyperlipidemics indicated the probable role of spices in the management of hyperlipidemia and the associated symptoms. Among the hyperlipidemics a positive trend in the control of lipid profile was evident in cloves supplemented group and longer periods of dietary supplementation of spices could help to maintain the lipid levels. The results clearly indicated the positive role of spices in maintaining the lipid profile and relieved them of painful symptoms in perfect condition thus corroborating the results

of some studies on cardiovascular condition from other countries. This positive impact on adults with hyperlipidemia is encouraging and being a dietary intervention it is devoid of other possible side effects, proving that spices supplementation is a cost effective and sustainable strategy in the management of hyperlipidemia. Let us popularize the use of spices as a source of food nutrients in our dietaries.

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