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Original Article

Buster Effect of Apricot Kernel Oil on Hypocholesteremia

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ABSTRACT

Cholesterol is a natural substance produced by liver in human body According to research based on Framingham Heart Study, ideal cholesterol level is below than 150 mg/dL. Apricot (*Prunus armeniaca)* is an important medicinal plant belongs to family *Rosaceae* which is also grown in Pakistan. In local language it is called "Kubani" having nutritious flesh, pits containing kernels. **Objective:** To explore therapeutic potential of apricot kernel oil on hypercholesterolemic rabbits. **Method**: Apricot kernel oil was extracted by cold extraction method. Rabbits were adapted for two weeks before starting treatments. Total feed doses i.e. 250 g was divided in two portions and were given to rabbits in early morning and early evening. Food consumption for every rabbit was consistent to 250 g/day for four week's experimentation. **Results:** After usage of 1 % apricot Kernel oil (supplemented) the maximum blood cholesterol level decreased from 159.38 mg/dL to 122.8 mg/dL and also decreased in blood triglyceride level was from 237.82 mg/ dL to 192.20 mg/ dL. The HDL contents of rabbits were increased from 26.750 mg/ dL to 33.450 mg/ dL. LDL contents of rabbits were decreases from 46.90 mg/ dL to 36.05 mg/ dL. VLDL contents of rabbits were decreases from 23.7 mg/ dL to 18.3 mg/ dL detected after Six weeks. **Conclusion:** Current study was carried out. Apricot kernel oil has ability to remove the lipid profile especially cholesterol

INTRODUCTION

Hypercholesterolemia is a lipoprotein metabolic ailment categorized by raised serum low density lipoprotein and blood cholesterol. It is one of the most significant threat leading to cardiovascular diseases (CVDs) [1]. Energy store in the form of lipids and a substantial role as enzyme co-factors, intracellular messengers, and hormones play by them [2]. Cholesterol has vital functions in human body. It is a significant component of cell membrane which can regulate the membrane over a variety of physiological temperature. Human body utilizes the cholesterol as a precursor for the synthesis of bile acids, for the digestion of dietary fats and fat-soluble vitamins [3, 4]. Hypercholesterolemia contributed to 45% of heart attacks in Western Europe and 35% of heart attacks in Central and Eastern Europe [5]. Apricot (*Prunus armeniaca* L.) is classified under the *Prunus* species of Rosacea family of the Rosales group and has an important worth in human nutrition. Apricot has rich nutritional profile in context of

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sugar (60%), crude fiber (11.50%), protein (8%), crude fat (2%), total minerals (4%), vitamins (highly rich in vitamin A, C, K and B complex), and sensible amounts of organic acids (citric acid and malic acid) [6]. As a need of new times, further dietary approaches have been made that plays a substantial role in lowering hypercholesterolemia. These approaches comprise the use of probiotics, prebiotics, soy proteins, useful microbiota, soluble dietary fibers, plant sterols and stanols. The oil obtained from kernels is of pharmacological, nutritional and industrial importance. Rich nutritional profile of oil makes it an acceptable source of omega fatty acids, antioxidants and tocopherol which tends to lowers down the oxidative damage caused by free radicals, lowers the raised level of cholesterol in blood due to presence of tocopherols and improves liver functioning. The best intake ratio of omega-6 to omega-3 is 1: 1 and 4: 1 and the minimum dietary intake amount for omega 3 and omega 6 of a healthy adult person is 1.4-1.5g/day [7]. Imbalance in the intake quantity of omega's and deficiency of fatty acids leads to harmful disorders counting schizophrenia, heart attack, asthma, diabetes mellitus, depression, increased aging, obesity, stroke, Alzheimer's disease and osteoarthritis [8]. Kernels inside seed shell can be used to yield oils which are rich sources of nutritional compounds like oleic, linoleic and linolenic acids, carotenes, antioxidants, tocopherols and several other active components can be used to treat certain medical disorders. The oil obtained from kernel of apricot is rich in polyunsaturated fatty acids and heart friendly compounds and its consumption avoids the plaque formation in arteries leading to blockage and several other diseases [9]. Due to presence of antioxidant present in oil make the heart protective [10]. Due to phenolic compound present in oil reduce the risk of free redical that make the oxidative damage in living cells and some common disorder like cardiovascular disease and cancer [11]. Oil has also some properties of antioxidant, antitumor, anti-carcinogenic, anti -platelet, anti-microbial, anti -mutagenic and anti-allergic [12]. Apricots provide a significant amount of fiber (soluble and insoluble) [13]. Soluble dietary fiber is effective in lowering LDL cholesterol by binding bile acids or cholesterol during intraluminal micelle formation; thereby reducing the cholesterol content in liver cells and increasing the clearance of LDL cholesterol [14]. Our objective of this study was to check the effect of apricot kernel oil efficacy in the sense of lipid profile (cholesterol, triglyceride level, HDL, LDL and VLDL) in rat.

METHODS

The details of material used and analytical methods employed during the study are given below. The apricot kernel was purchased from local market of Sargodha and oil was extracted by cold extraction method. After removed any coating or husks left on the kernel of apricot cleaned the kernels. Before ready to press then heated kernel. Heating helps the extraction of the oil. Oven is adjusted no higher than 120 degrees Fahrenheit. Placed the seeds on a cookie sheet and heated them for about 10 minutes. Feed the kernel into the press. Removed press's end cap after finish with kernel stock. Allowed all the oil to drip through the holes of the end cap, before removing it to take out the press cake. Clarified the cold pressed oil. Covered the container of oil with a piece of cheesecloth, and allowed it to rest for three to four days in a dark or semi-dark location. Any debris in the oil will float to the top. Removed the top layer of the oil. [15]. Biological study was performed by using rabbits as experimental model kept in animal house, department of pharmacy, University of Sargodha. 24 white New Zealand rabbits of age 8 – 10 weeks of mixed gender were purchased from local market. They were kept distinct from each other under experimental conditions. Feedings of rabbits were prepared at Food Microbiology Laboratory at Institute of Food Science and Nutrition, University of Sargodha, Sargodha - Pakistan. Feed was prepared for treatment of hypercholesterolemic rabbits. All feeding ingredients were purchased from local market of Sargodha. Feeding used for experiment includes corn starch, barley water, common salt (NaCl), vitamins (Mix), sucrose and corn oil. Hyperlipidemic feeding preparation: Corn starch, vitamins, barley powder, common salt, sucrose was mixed with 7 g of corn oil according to feeding pattern given in Table 1 [16]. Feed for 6 week. Total feed dose i.e. 250 g was divided in two portions and were given to rabbits in early morning and early evening [17].

Quantity (g/100g)		
Ingredients	**Standard Feed**	**Hyperlipidemic Feed**
Barley	35.0	35.0
Corn Starch	38.0	35.0
Sucrose	12.0	12.0
Salt (NaCl)	0.50	0.50
Vitamin	3.00	3.00
NaHPO4	2.00	2.00
CaCO3	2.50	2.50
Cholesterol(powder)	0.00	2.00
Corn oil	7.00	8.00
Total	100.00	100.00

Table 1: Preparation of hyperlipidemic feed (g/kg) for making rabbits hyperlipidemic [16]

Feed used for treatment was prepared by mixing basic components like corn starch, barley, vitamins, sucrose and common salt with 7 g of corn oil. The feed was mixed finely by adding distilled water and pebbles were prepared in order to feed rabbits. According to Table 2, four different feed were prepared using different concentrations of

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apricot kernel oil [16]. Four experimental treatments were formed by dividing e24 hyperlipidemic rabbits into 2 groups. One group containing 12 male rabbits and second group contains 12 female rabbits. All rabbits were fed separately according to treatment feed. Food consumption for every rabbit was consistent to 250 g/day for four week's experimentation [17].

Ingredients (g/100g)	On Normal feed	Hyperlipidemic induced		
	Control	T0	T1	T2
Barley	40	35	35	35
Corn Starch	40	38	38	38
Sucrose	12	12	12	12
Salt (NaCl)	0.5	0.5	0.5	0.5
Vitamin	3	3	3	3
NaHPO4	2	2	2	2
CaCO3	2.5	2.5	2.5	2.5
Apricot kernel Oil	0	0	0.5	1
Corn oil	0	7	6.5	6
Total	100	100	100	100

Table 2: Formulation of treatment feedings (g/100g) [16]

The blood was withdrawn from cervix vein of all rabbits by trapping them in stand. The blood was withdrawn by using 3 cc BD syringe and was put in different blood collecting tubes of 5ml containing Ethylenediaminetetraacetic acid (EDTA) in for separation of serum. After centrifuge at 3000 rpm for 5 minutes' serum was separated and was sent to diagnostic laboratory for analysis [17]. The analysis involves triglycerides, cholesterol, low density lipoproteins (LDL), very low-density lipoproteins (VLDL), and high-density lipoproteins (HDL) values every week after weighing stage. Statistical Analysis: The final data which obtained under multi factor factorial completely randomized designs (CRD) was exposed for statistical analysis of variance technique (ANOVA). The values $p \leq 0.05$-0.01 will be considered as statistically significant. LSD test is used for comparing the mean of all treatments [18]. The data were analyzed by using SPSS version 17.0 (Statistical Package for Social Sciences).

RESULTS

The cholesterol level significantly decreased with increase in concentration of the apricot kernel oil. The lowest blood cholesterol level was perceived in rabbits having feedings supplemented with 1% apricot kernel oil and vice versa. The range for cholesterol contents was from 88.49 mg/ dL to 145.71 mg/ dL.The blood cholesterol level decrease from 159.35 mg/ dL to 122.80 mg/ dL during the treatment period of 6 weeks, while no significant at 0 % feeding. The maximum decrease in blood cholesterol level was detected after 6 weeks in the rabbits fed on food supplemented with 1% apricot kernel oil with mean values of 159.38 mg/ dL to 122.8 mg/ dL as shown in table 3. The triglycerides in the blood of rabbits fed on feeding supplemented with various concentrations of apricot kernel oil were significantly declined with increment in concentration of the apricot kernel oil. The lowest triglyceride contents were detected in rabbits consuming feed supplemented with 1% apricot kernel oil whereas the highest TG count in blood of rabbits fed on feed supplemented with 0% apricot kernel oil. The ranges for triglyceride contents were from 256.59 mg/ dL to 154.86 mg/ dL, respectively. With the passage of treatment time, decline in triglyceride contents of rabbits was significantly observed. The decrease in blood triglyceride level was from 237.82 mg/ dL to 192.20 mg/ dL during a period of 6 weeks as shown in table 3. When the concentration of apricot kernel oil increase in the feed, there was slow raise in HDL level. The extreme HDL level was perceived in rabbits fed on feed supplemented with 1% apricot kernel oil whereas the least level of HDL was observed in rabbits fed on feed supplemented with 0% apricot kernel oil. The range for HDL was from 18.829 mg/ dL to 31.086 mg/ dL. With passage of treatment time a significant increasing trend for HDL contents in rabbits was detected during a period of 6 weeks from 26.750 mg/ dL to 33.450 mg/ dL as shown in table 3. Significantly lowest level of LDL was found in rabbits fed on feed supplemented with 1% apricot kernel oil whereas the significantly lowest level was observed in rabbits fed on feed supplemented with 0% apricot kernel oil from 26.14 mg/ dL to 42.77 mg/ dL. With passage of treatment time a significant decreasing trend for LDL was perceived during a period of six weeks from 46.90 mg/ dL to 36.05 mg/ dL. Significant decreasing trend was displayed by effects of 1% apricot kernel oil showed maximum decline in blood VLDL count from 13.34 mg/ dL to 29.94 mg/ dL as shown in table 3. With passage of treatment time a significant decreasing trend for VLDL was perceived during a period of six weeks from 23.7 mg/ dL to 18.3 mg/ dL (table 3).

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	Mean					
	Weeks	**T1**	**T2**	**T3**	**T4**	**Mean**
Cholesterol	0	96.2±6.37^{KLM}	181±16.4C^{DEF}	182.4±13.2^{CDE}	182.4±13.2^{CDE}	159.35±11.45^{AB}
	1	91.8±5.34^{KLM}	194±16.4^{ABCDE}	195.4±13.2^{ABCD}	195.4±13.2^{ABCD}	168±11.19^{A}
	2	84.6±5.08^{M}	199.8±9.99^{ABC}	173.1±10.75^{EF}	173.1±10.75^{EF}	154.65±8.26^{BC}
	3	89.6±5.73^{KLM}	205.6±4.97^{AB}	150.8±14.67^{GH}	150.8±14.67^{GH}	144.35±7.75^{CD}
	4	86±2.98^{LM}	214.6±4.97^{A}	127.8±14.67^{I}	127.8±14.67^{I}	138.45±7.06^{DF}
	5	85.8±8.75^{LM}	212.8±4.92^{A}	106.1±9.92^{JKL}	106.1±9.92^{JKL}	130.65±7.13^{EF}
	6	85.4±7.12^{LM}	211±7.32^{AB}	84.4±8.16^{M}	84.4±8.16^{M}	122.8±7.77^{F}
	Mean	**88.4857±5.91^{C}**	**202.686±9.28^{A}.**	**145.714±12.0^{B}**	**145.714±12.0^{B}**	
TG	0	155.8±9.72^{F}	260.64±21.53^{AB}	182.4±13.2^{CDE}	270.84±19.58^{A}	237.82±16.3^{A}
	1	149.6±5.51^{F}	247.72±5.18^{ABC}	195.4±13.2^{ABCD}	255.84±5.24^{ABC}	229.81±6.57^{A}
	2	153.2±11.06^{F}	255.12±7.8^{ABC}	173.1±10.75^{EF}	257±18.63^{AB}	226.18±12.7^{A}
	3	148.8±9.23^{F}	265.04±11.07^{AB}	150.8±14.67^{GH}	226.6±19.37^{CD}	208.76±13.33^{B}
	4	161.2±11.45^{F}	256±3.86A^{BC}	127.8±14.67^{I}	196.4±17.2^{E}	201.75±11.01^{BC}
	5	162.6±6.92^{F}	258±3.19^{AB}	106.1±9.92^{JKL}	177.2±20.03^{EF}	198.95±10.72^{BC}
	6	152.8±11.82^{F}	253.6±3.1A^{BC}	84.4±8.16^{M}	168.8±20.86^{EF}	192.2±12.1^{C}
	Mean	**154.86±9.38723^{C}**	**256.59±7.96085^{A}**	**145.714±12.0^{B}**	**221.81±17.2725^{B}**	
HDL	0	20.6±1.44^{LMN}	45±1.58^{AB}	23.4±1.81^{JKL}	18±1.83^{N}	26.75±1.66^{EW}
	1	19.4±1.12^{LMN}	45.4±0.88^{A}	25.2±0.86^{IJK}	22.8±2.1^{KLM}	28.2±1.24^{DE}
	2	18±1.1^{N}	45.8±1.18^{A}	26.8±1.11^{IJK}	27.4±3.18^{IJ}	29.5±1.64^{CD}
	3	19±1.3L^{MN}	43.8±1.18^{AB}	28.2±1.25^{HI}	32.2±3.25^{GH}	30.8±1.75^{C}
	4	18.2±0.58^{N}	43±2.12^{ABC}	34.6±1.45^{FG}	36.8±2.25^{EF}	33.15±1.6^{B}
	5	18.4±1.96^{MN}	41.4±3.41^{ABCD}	40.8±2.06B^{CDE}	41.6±2.76^{ABCD}	35.55±2.55^{A}
	6	18.2±1.46^{N}	38.8±3.6^{CDEF}	38±2.16^{DEF}	38.8±2.87C^{DEF}	33.45±2.52^{AB}
	Mean	**18.83±1.28^{C}**	**43.31±1.99^{A}**	**31±1.53^{B}**	**31.09±2.61^{B}**	
LDL	0	28.6±1.94^{LMN}	53.2±4.86^{DEFG}	52.4±2.91^{EFG}	53.4±4^{DEF}	46.9±3.43^{AB}
	1	27±1.48^{LMN}	56.8±4.67^{BCDE}	56±2.68C^{DEF}	57.2±3.89^{ABCDE}	49.25±3.18^{A}
	2	25.2±1.46^{N}	58.6±2.99^{ABCD}	47.2±2.1^{GH}	50.4±3.1^{FGH}	45.35±2.41^{BC}
	3	26.2±1.66^{MN}	60.2±1.5^{ABC}	38.4±1.71^{IJ}	44.4±4.24^{HI}	42.3±2.28^{CD}
	4	25.4±0.93^{MN}	63±1.58^{A}	36.8±1.5^{JK}	37.6±4.12^{J}	40.7±2.03^{DE}
	5	25.6±2.54^{MN}	62.4±1.27^{AB}	34.8±1.5^{JK}	31.4±2.96^{KLM}	38.55±2.07^{EF}
	6	25±2.02^{N}	61.8±2.06^{ABC}	32.4±2.51^{JKL}	25±2.52^{N}	36.05±2.28^{F}
	Mean	**26.14±1.72^{C}**	**59.43±2.7^{A}**	**42.57±2.13^{B}**	**42.77±3.55^{B}**	
VLDL	0	14.8±0.97^{IJKL}	26.8±2.53^{CDE}	26.4±1.56^{DE}	26.8±2.06^{CDE}	23.7±1.78^{AB}
	1	13.6±0.75J^{KL}	28.4±2.33^{BCD}	28.2±1.44^{BCD}	28.6±1.94^{BCD}	24.7±1.62^{A}
	2	12.8±0.73^{L}	29.8±1.5^{ABC}	24±1.16^{EF}	25.6±1.56^{DEF}	23.05±1.24^{B}
	3	13.4±0.93^{KL}	30.4±0.88^{AB}	19.2±0.86^{G}	22.6±2.19^{F}	21.4±1.21^{C}
	4	13±0.45^{KL}	31.8±0.63^{A}	18.6±0.66^{GH}	18.8±2.06^{GH}	20.55±0.95^{CD}
	5	13±1.3^{KL}	31.2±0.63^{AB}	17.6±0.66G^{HI}	16±1.36H^{IJK}	19.45±0.99^{DE}
	6	12.8±0.97^{L}	31.2±1.11^{AB}	16.6±1.33G^{HIJ}	12.6±1.33^{L}	18.3±1.19^{E}
	Mean	**13.34±0.87^{C}**	**29.94±1.37^{A}**	**21.51±1.09^{B}**	**21.57±1.79^{B}**	

Table 3. Effect of treatments and time period on Cholesterol, TG, HDL, LDL and VLDL of rabbits

DISCUSSION

The maximum decrease in blood cholesterol level was detected after 6 weeks in the rabbits fed on food supplemented with 1% apricot kernel oil with mean values of 159.38 mg/ dL to 122.8 mg/ dL as shown in table 3 are supported with this result Performed an experimental study to investigate the effect of apricot kernel oil (AO) and pumpkin oil (PO) on plasma cholesterol and triacylglycerol levels [19]. After the treatment period, it was concluded that both AO and PO possess protective effect on hypercholesterolemia. The administration of plant sterols with margarines at doses of 1.5 and 3 g/day for 6 months induced the same reduction in both total (–8.9% vs. –8.3%) and LDL cholesterol (–11.3% vs. 10.6%) [20]. The decrease in blood triglyceride level was from 237.82 mg/ dL to 192.20 mg/ dL during a period of 6 weeks. Was match with the reported that feeding of oleic acid and linoleic acid (5%) decreases the level of triglycerides, LDL-C and total cholesterol [21]. Apricot kernel oil contains maximum amount of oleic and linoleic acids possessing excellent anti-inflammatory and anti-atherogenic potential [22]. Demonstrated that the effect of treatment, fermentation time, and interactive effect of treatment and fermentation time on substrate utilization was found to be significant after 6 hours of fermentation highest substrate was utilized in treatment T18 (where 2 % probiotic, 1.5 % GOS, and 1.5 % Maltodextrin were used) with mean value of 23.81 %. The range for HDL was from 18.829 mg/ dL to 31.086 mg/ dL support the study in which cholesterol lowering potential of linoleic acid was justified by human trials [23].

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Apricot kernel oil contains a favorable amount of linoleic acid having protective effect on HDL. With increase in concentration of apricot kernel oil in the feed, there was a progressive decrease in LDL levels. from 26.14 mg/ dL to 42.77 mg/ dL. Similer result found with performing experimental trials to evaluate the effect of dietary oils on liver and lipid peroxidation LDL level [24]. Results showed that dietary oils like apricot kernel oil like reduce the LDL level as it contains an excellent number of tocopherols which are main antioxidants present in apricot kernel oil. They tend to lower the LDL levels by reducing the production of LDL in body. VLDL contents of rabbits were decreases from 23.7 mg/ dL to 18.3 mg/ dL this trend also found in efficacy of plant sterols and stanols in reducing total cholesterol [25]. This was similar to current findings due to excellent amount of sterols especially phytosterols and stanols having ability to lowers down the cholesterol as well as LDL and VLDL.

CONCLUSIONS

Current study was carried out to explore therapeutic potential of diet supplemented with apricot kernel oil on hypercholesterolemic rabbits. Apricot kernel oil has ability to remove the lipid profile especially cholesterol. The maximum cholesterol level was decreased 159.38 mg/ dL to 122.8 mg/ dL, triglyceride 237.82 mg/ dL to 192.20 mg/ dL, High density lipoprotein increased from 26.750 mg/ dL to 33.450 mg/ dL, Low density lipoprotein decreased from 46.90 mg/ dL to 36.05 mg/ dL, very Low density lipoprotein decreased from 23.7 mg/ dL to 18.3 mg/ dL during the 6 week feeding of animal in-Vivo study having 1 % kernel oil. Low cast and easily available oil by extraction method.

Conflicts of Interest

The authors declare no conflict of interest

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