

## Use of Apple to Prevent Risk of Atherosclerosis

AJAZ FATIMA<sup>1</sup>, KHALID NIAZ<sup>2</sup>, ABDUL QUDOOS<sup>3</sup>, SHAH MURAD<sup>4</sup>

### ABSTRACT

**Background:** Oxidative stress and atherosclerosis are considered key phenomenon for ischemic heart disease, cardiac arrest and myocardial infarction. By keeping lipid levels normal in body, predisposing phenomenon of atherosclerosis may be inhibited and stopped at early stages. Apple is one of the daily used fruit, which lowers harmful fats in human body.

**Methods:** We tried to observe and compare lipid lowering potential of apple in our low socioeconomic population. Duration of study was 6 months. It was conducted in Jinnah Hospital Lahore. Forty participants were selected and classified in two groups, twenty in each. Group A was control group who were advised to eat their normal food. They were advised to come research center fortnightly for counseling or donating blood sample. Group B was tested group, whose blood sample was taken to determine their LDL-Cholesterol, before and after eating 250 grams apple daily for six months.

**Results:** At the end of research study we observed that there was no decrease in LDL-cholesterol in group A, in opposite their LDL-C level somewhat increased. In group B, LDL-C decreased from 250.71±1.22 mg/dl to 239.70±2.22mg/dl. It was 11.01mg/dl decrease. Statistically this change in LDL-C was significant (p-value<0.01).

**Conclusion:** We concluded from this study that apple can lower LDL-cholesterol, chances of development of atherosclerosis and eventually ischemic heart disease and myocardial infarction.

**Keywords:** Apple, atherosclerosis, lipid level

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### INTRODUCTION

High lipid levels, especially Low Density Cholesterol (LDL-C) in human body are responsible for increased chance/risk for development of atherosclerosis, leading to morbidity and mortality due to heart attack<sup>1</sup>. To remain escaped victim of coronary artery disease, it is more important to remain with familiar intake of healthy foods and vegetables. Apple is one of those healthier food fruits<sup>2</sup>. The strongest dietary agent for reducing cholesterol is apples. Eating one apple daily for four weeks reduces LDL cholesterol up to 40%<sup>3</sup>. Apples have lowering blood-cholesterol level feature because it contains 'pectin', that enhances digestive health and reduces absorption of lipids in gastrointestinal tract<sup>4</sup>. Apple can reduce risk of developing Alzheimer's disease, protect against Parkinson's disease, pancreatic cancer. It decreases risk of diabetes, prevent gallstones, beat diarrhea and constipation. Apple neutralize irritable bowel syndrome, avert hemorrhoids, control weight, detoxify liver, boost immune system of body, and prevent cataracts<sup>5</sup>. In 2004, USDA scientists investigated over 100 foods to measure their antioxidant concentration per serving size. Two apples—Red Delicious and Granny Smith—ranked 12<sup>th</sup> and 13<sup>th</sup> respectively. Antioxidants are disease-fighting

compounds. Scientists believe these compounds help prevent and repair oxidation damage that happens during normal cell activity. Apples are also full of a fibre called pectin—a medium-sized apple contains about 4 grams of fibre. Pectin is classed as a soluble, fermentable and viscous fibre, a combination that gives it a huge list of health benefits<sup>6</sup>. Reduced oxidative stress in human body, and especially in those who are on high risk of ischemic heart disease, is achievable by frequent use of healthy diet<sup>7</sup>.

### SUBJECTS AND METHODS

The study was conducted in Jinnah Hospital, Lahore from 1st January 2014 to September 2014. Forty hyperlipidemic male, female patients, who were already diagnosed cases of primary and secondary hyperlipidemia, were selected. Age limit was from 18 to 75 years old. The inclusion criteria was mild to moderate hyperlipidemia, not past history of any heart disease, poor socioeconomic background, not already taking medications for any other disease. Written consent was taken and was approved by Research Ethics Committee of the hospital. Detailed medical history and physical examination of all patients were carried out. Patients, rather called 'volunteers' were divided in two groups, 20 volunteers were labelled as CONTROL GROUP (group-1), and 20 were selected for group-2, and were advised to take 250 grams of fresh apple with skin, at morning.

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<sup>1</sup>Assistant Professor of Pharmacology, LM&DC, Lahore

<sup>2</sup>Pharmacology department, UHS, Lahore

<sup>3</sup>Pharmacology Department, UHS, Lahore

<sup>4</sup>Shah Murad, Professor of Pharmacology, LM&DC, Lahore

Correspondence to Dr. Ejaz Fatima email: [aijazfatima@gmail.com](mailto:aijazfatima@gmail.com)

Apples were provided by Remington Pharmaceuticals, Lahore, Pakistan. Duration of study was 6 months. Participants were advised to visit Lipid Research Center of the hospital fortnightly. At the start of research work, blood sample was taken from all participants, registered. Their LDL-Cholesterol was measured at the start of research work (pre-treatment value) and on end of the research work, i.e., 6 months (post treatment value). Serum LDL-cholesterol was calculated by Friedwald formula<sup>8</sup> (LDL-Cholesterol=Total Cholesterol-(Triglycerides/5 +HDL-Cholesterol). Data were expressed as the mean±SD and “t” test was applied to determine statistical significance as the difference. A probability value of <0.05 was considered as non-significant, P<0.01 was labelled as significant and P<0.001 was considered as highly significant change in the results when pre and post-treatment values were compared.

**RESULTS**

After 6 months trial on taking apple 250 grams per day, in 20 participants, LDL-cholesterol decreased from 250.71±1.22mg/dl to 239.70±2.22mg/dl. It is significant change, statistically (p-value<0.01). LDL-cholesterol in control group at start of study was 241.22±2.10 mg/dl, which increased to 242.69±3.12 mg/dl in six months. Change in this group was opposed by increased values of LDL-cholesterol. But this difference in pre and post treatment values is non-significant, statistically (p-value>0.05). Difference in LDL-cholesterol in 20 participants, in pre and post trial value was 11.01mg/dl. It seems like small amount of LDL-cholesterol was reduced in linear fashion, but it has considerable significance, when statistically analyzed, by paired’t’ test. Changes in LDL-cholesterol, in control group and tested group are shown in Table-1 and Table-2.

Table 1: Before and after values of LDL-C, in control group with its statistical significance (n=20)

Parameter	Pretreatment value	Post-treatment value
LDL-Cholesterol	241.22±2.10	242.69±3.12

P value: >0.05

Key: 'n' indicates sample size, ± indicates standard error in mean values, values are measured in mg/dl, p-value >0.05 is non significance in change (before and after the trail values)

Table 2: Before and after values of LDL-C, in tested group with its statistical significance (n=20)

Parameter	Pretreatment value	Post-treatment value
LDL-Cholesterol	250.71±1.22	239.70±2.22

P value: <0.01

Key: 'n' indicates sample size, ± indicates standard error in mean values, values are measured in mg/dl, p-value <0.01 shows significance in change (before and after the trail values)

**DISCUSSION**

Right from childhood everyone has learnt the saying “An apple a day keeps doctor away”. It contains vitamin A, B-1,2,3, B-5,6, B-9, vitamin C, E and K. It contains minerals like sodium, potassium, zinc, iron, potassium, magnesium, manganese, phosphorus, calcium and copper. Many of these ingredients acts as antioxidant in human body. Reduced oxidative stress in human body may prevent risk of ischemic heart disease (IHD) and mortality due to IHD. LDL-cholesterol in human body is also potent factor regarding atherosclerosis, leading to IHD. Our study results proved 11.01 mg/dl reduction in LDL-cholesterol, which matches with results of study conducted by Markowski J et al<sup>9</sup> who observed same significant reduction in LDL-cholesterol in 50 hyperlipidemic participants. Their sample size in research plan was 50, which also support matching with our results. Our results also matches with results of study conducted by Alvarez-Parrilla E et al<sup>10</sup>. They used apple juice to observe its hypolipidemic effects in smokers and non smoker individuals, in their study. Boyer J and Liu RH<sup>11</sup> stated that significant changes in LDL-cholesterol may be achieved when considerable amount of apple with skin is used as daily dietary and foody fruit. Our study results are in contrast with results of study conducted by MJ Stampfer and WC Willett<sup>12</sup> who observed non significant changes in LDL-cholesterol with p-value >0.05. This contrast may be due to closed and more vigilant research study, conducted parallel with limited intake of dietary lipids and physical exercise. Their gender of participants was also restricted for male participants only. Our results did not matched with results of research conducted by Conceicao OM et al<sup>13</sup> whose inclusion criteria for research was only female participants. This contrast in our and their study results may be due to genetic variant make up in different genders. Pajk T et al<sup>14</sup> states that only dietary changes are not sufficient to reduce LDL-cholesterol upto level that could prevent development of atherosclerosis leading to IHD. Our results are in contrast with results of research study conducted by Aprikian O et al<sup>15</sup> who observed small change in LDL-cholesterol when different preparations of apple were feed to already cholesterol-feed rats. They observed only 4.56±2.11 mg/dl reduction in LDL-cholesterol of 15 hyperlipidemic rats. Genes, endocrine system, neurotransmitter and genetic proteins play major role in metabolism of human or animal body. This contrast in two study results indirectly emphasize on need of further research studies on specific research model, environment, geography and wide spectrum of subjects and animals.

## CONCLUSION

We concluded from this research study that apple, which is rich source of multivitamins, fibers and minerals, can prevent early steps of initiation of atherosclerosis which is key metabolic phenomenon for IHD and myocardial infarction.

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