

Effect of Consumption Dried Apple Peel and Ginger on Blood Level of Cholesterol

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Abstract

This experiment conducted and applied in the Budget Clinic in a Rashed district, Baghdad supervised by Dr. Haatum Al-Aithawy in June-August, 2014. This experiment conducted on samples of women who suffering from high blood pressure, cholesterol, triglyceride, and blood sugar. Fifty married and dyewood women were selected randomly with age ranging between 30-60 years. Twenty five women were given dried red apple peel powder, other 25 women were given dried ginger powder, in a laboratory tablet in dose of 3 tablet /day/for 5-6 weeks. The blood pressure and lipid profile been measured for the studied samples before and after treatment.

Medical tests been done statistically analyzed before consuming the suggesting powder of apple peel or rhizomes ginger for 25 ladies, it was found that 56% upon them suffering from high blood pressure (hypertension stage 2 ≥ 160 mmHg), 36% upon them suffering from high blood pressure (hypertension stage 1 range from 139-150 mmHg) and 8% upon them suffering from high blood pressure (prehypertension 120-139 mmHg). After starting our experiment with the same samples and after giving dried apple peel powder, it was found that a high significant differences as the percentage of the women who was suffering from high blood pressure decreased from 56% to 8%, and increase in women percentage to 60% and 24% who suffering from hypertension stage 1(139-150 mmHg) and prehypertension respectively. Lipid profile showed that 100% of women who were suffered from high cholesterol, 96% upon them suffering from triglyceride and 96% upon them suffering from high blood sugar. At the end of our experiment with the same samples who giving dried apple peel powder, it was found that high statistically significant differences as the percentage of the women who was suffering from high cholesterol decreased from 100% to 80%, and from 96% to 80% for triglyceride and from 96% to 64% for high blood sugar. In addition of that, it was improved the appetite, comfortable feeling and feel painless arrhythmias in elderly ladies in comparison with chemical medicine used and its side effect. Also, for the 25 ladies sample who consummated dried ginger powder tablet daily / for 5-6 weeks, the results showed high statistically significant differences for each blood pressure profile (prehypertension, hypertension stage 1, and hypertension stage 2) and lipid profile (cholesterol, triglyceride, and blood sugar). So we could concluded that, the dried apple peel and the dried ginger almost have the same high positive effect on blood pressure profile and lipid profile, so the possibility of using dietary plants as a tablet instead of chemical drug (medicine) very important for treating human who are suffering from blood pressure and high lipid. So, for all the above facts, this type of studies and researches should be supported and encouraged the National medicine products against the imported chemical medicine.

Keywords: Dried red apple peel flour, Dried Ginger flour, Blood pressure profile (prehypertension, hypertension stage 1, and hypertension stage 2), Lipid profile (cholesterol, triglyceride, and blood sugar).

Introduction

Apples botanically known as *Malus domestica* is said to have originated in the mountains of Central and west Asia. It is one of the earliest and most commonly grown trees. It is eaten as a raw fruit; also, it is a healthy and delicious fruit that can be eaten alone, or added to many foods for taste. Containing large quantities of potassium, sodium, calcium, Iron and phosphorus and high amount of vitamin A, B, and C. It is reported that apple contains 20-25% of daily needs of polyphenol compounds and 10-30% of daily fiber needed by your body by (Auclair et al. 2008). It has been found that apples also contain a variety of healthy chemicals, such as polyphenols, pectin, fiber, and antioxidants (Jeanelle & Rui 2004). Apples have a protective effect against cardiovascular disease may come from its potential cholesterol-lowering ability. It was found that when cholesterol fed rats were supplemented with lyophilized apples; there was a significant drop in plasma cholesterol and liver cholesterol and an increase in high-density lipoproteins HDL (Aprikian et al. 2002). Also, they found that cholesterol excretion increased in the feces of rat fed apples, suggesting reduced cholesterol absorption

Apple pectin may help lower blood pressure, in addition to other health benefits, such as cholesterol lowering effects by inhibition of the plasma cholesteryl ester transport protein CETP (Pornsak, 2003). It was found that about 50% of the fiber pectin found in apples is effective in modulation of lipid metabolism where poly galactouronic acid in pectin which lowers the plasma cholesterol (Marounek et al. 2007). The insoluble part of pectin improves bowel health by increasing the bulk and water content of the bowel. The soluble fiber in apple pectin is converted into gel form in the gut, then normalizes the blood sugar, blood pressure and also reduces cholesterol absorption, due to the degree of methoxylation (Sanchez et al. 2008).

Apple, and especially their skins, is among the fruit richest in polyphenols in high quantities, exert powerful antioxidant, anti-inflammatory, and anti-glycation effects, then protect the body from many of the reversible consequences of aging. Compelling evidence exists for apple polyphenols' ability to prevent, and even reverse changes that produce cardiovascular disease, cancer, elevated blood sugar and even serious infections (George, 2012).

Another content of an apple peel is Anthocyanin which is a group of flavonoids found in its peel, acts to reduce platelet coagulability, and also inhibit lipoprotein oxidation, reduces risk factors for atherosclerosis and is good antioxidants (Giuseppe & Mazza 2007). It was reported that supplementation with apple along with high cholesterol diet in rats, reduce the amount of total cholesterol TC, low-density lipoproteins LDL and triglyceride TG and increase high-density lipoproteins HDL concentration. These effects can be due to antioxidant effect of compounds constituting the food was linked, probably by inhibiting lipid peroxidation and decrease production of cholesterol, LDL and triglyceride (Mirhadi & Ali 2011).

Processing of apples has been found to affect phytochemical content. Apple juice obtained by pulping and straight pressing had 10% of the antioxidant activity of fresh apples, while juice after pulp enzymeing had only 3% of antioxidant activity. Most of the compounds remained in the apple pomace (Van der Sluis 2002).

Apple pomace is a major waste products accumulated mainly during apple juice processing. Phloridzin, chlorogenic acid, epicatechin, and quercetin glucosides have all been isolated from apple pomace. These phenolics isolated from apple pomace have been found to have high antioxidant activity suggesting that apple pomace may have dietary health benefits and commercial use (Lu & Foo 2000). Since apple peels contain a majority of the antioxidant when compared to the flesh (Wolfe & Liu 2003), apple peels have the potential to be a value-added ingredient in food products. Apple peel were blanched and then dried under a variety of condition (oven dried at a range of temperatures between 40° and 80°C, air dried, or freeze-dried). The freeze dried samples had the greatest total phenolic and flavonoid content, and the total phenolic and flavonoid was actually greater than in the fresh peel. So, apple peel powder had strong antioxidant activity and also greatly inhibited cancer cell proliferations.

Zingiber officinale Roscoe, commonly known as ginger belongs to family Zingiberaceae. The plant is indigenous to Southeast Asia and is cultivated commercially India, China, West Indies, Mexico and other countries. Dried zingiber root consumed worldwide as spices, flavoring agent and in many medical properties (Samir & Amrit 2003), due to its different chemical constituents like Amaldehyde, Gingerol, Shogaol, and Paradol etc which have the ability to stimulate digestive enzymes, affect the microbial activity (Dieumou et al. 2009). It has been reported for its various medical properties such as analgesic, antiemetic, antiulcer, antipyretic, cardio depressant, colic and diarrhea, for pregnancy-induced nausea and vomiting (Ghayur & Gilani 2005). Ginger might be useful as a potential anti-tumour agent (Ahmed et al. 2008). Raw ginger possesses hypoglycaemic, hypolipidaemic potential, and it is effective in reversing the diabetic proteinuria observed in the diabetic rats (Akhani et al. 2004). Fresh ginger contains 80.9% moisture, 0.9% fat, 12.3% carbohydrate, 2.3% proteins, 2.4% fiber and 1.2% minerals. Ginger root contains B vitamin, vitamins A and C as well as iron, potassium and phosphorus. It is also rich in dietary fiber. The ground roots has a higher nutritional value than the raw root.

However, most of the studies are based on exploring the curative effect rather than the preventive effect on risk factors of ischemic heart disease like hypertension and hyperlipidemia which have received very little attention. In view of this deficiency, this study was undertaken in order to show the effects of Apple peel and zingiber powder on blood pressure, blood sugar, and serum lipid profile, namely total cholesterol TC, triglycerides TG in human patients who suffer from ischemic heart disease.

Material and Methods

Red apples (*Malus domestica*) were perched from local grocery stores which was imported from Turkey, then washed good, peeled the skin with knife and then air dried first in the lab under the roof fan overnight, then transferred to the Lab Oven Drier (JRADO) on 50°C/2-4 hours, cooled then milled with coffee grinder, filled the tablets with the apple powder, stored in sealable polythene bags into glass jar in a refrigerator at approximately 5°C before analysis and then was begun with the exp. by feeding the 25 women with 3 tablet/day/ 5-6 weeks.

Ginger (*Zingiber officinale*) rhizomes powder were purchased from local markets sterilized in Oven on 65°C /15 minutes, cooled, then filled the tablets with it, stored in sealable polythene bags and putting into glass jar in a refrigerator at approximately 5°C before analysis, then it was given to the women one tablet after each meal (3 tablet/day/ 5-6 weeks).

Dose calculation

It was used the Lab. balance (Satorius BL3100 Max 3100 gm d=0.1g) for weighing the samples for analysis. The weight of whole one dried apple skin (n=5) approximately was 2.71 grams. The weight of empty tablet (n=5) equal 0.1 gm.

The weight of filled apple powder tablet (n=5) approximately were 0.908, so three times per a day for each women, the amount will be taken was 2.724 which is very close to the weight of one dried apple skin which is mentioned above.

The weight of one full tablespoon of ginger powder (n=5) approximately were 3.45 gm which was approximately equal to the recommended amount 4gm from dried ginger powder daily.

Chemical analysis

Moisture and Ash determination

Moisture and Ash determined according (A.O.A.C).

Minerals determination (lead Pb, Iron Fe, Copper Cu, Cobalt Co, Nickel Ni, and Cadmium Cd):

Pb, Fe, Cu, Co, Ni, and Cd were determined in apple and ginger powder according to the method (16) by using Flam Atomic absorption (Fame Emission) from company Shimadzo (Model AA-7000), in lab of consumer research and protection center/Baghdad Univ./Iraq.

Experement protoco

Fifty young women of high pressure, lipids, and total cholesterol were taken in this study. Twenty five of them fed 3 tablet/day/5-6 weeks on apple powder and the other twenty five of women fed 3 tablet/day/5-6 weeks on ginger powder. Control (n=5) normal women. Base line systolic blood pressure (SBP), and lipid profile on day 0 were determined, then blood samples were collected from women and simultaneously centrifuged for 15 min. at 3000 rpm to separate the serum. The serum samples were stored at -20°C for the analysis of serum glucose, cholesterol and triglycerides Franey and Elias 1986 using Randoex and Biomerinx kits.

At the end of the experiment (5-6 weeks), systolic blood pressure and lipid profile were measured to see the preventive effect of apple and ginger powder on hypertension and lipid profile and statistical analysis was done between apple, Ginger, and control group (five women tested on their normal food).

Measurement of systolic blood pressure (SBP)

SBP was measured by tail cuff method with the help of NIBP Controller Machine [ML 125] AD Instruments (Australia).

Biochemical analysis in blood

Blood sample of 1.5 ml volume was taken for chemical analysis and serum was separated with the help of centrifuge at a rate of 4000 rpm for 10 min.

Estimation of lipid profile

Lipid profile was measured with the help of semi autoanalyser (Roche Company) and Infinite Kit (Accurex Biomedical Pvt. Ltd.) was used for plasma lipid estimation.

Estimation of total cholesterol (TC) in serum

Infinite liquid cholesterol reagent is used for the determination of TC based on enzymatic method using cholesterol esterase, cholesterol oxidase and peroxidase.

Estimation of triglyceride (TG) level in serum

Infinite liquid triglycerides reagent is used for the determination of TG based on enzymatic method using lipoprotein lipase, glycerol kinase, glycerol phosphate oxidase and peroxidase.

Blood glucose level in serum

Statistical analysis

The Statistical Analysis System- SAS (2012) was used to effect of different factors in study parameters. Chi-square test was used to significant compare between percentage & Least significant difference –LSD test was used to significant compare between means in this study.

Results and Discusion

As shown in Table 1, there were no significant differences in the chemical composition between the apple peel and ginger powder, except in the ash content. The apples and ginger powder which used were safe to eat from the heavy metal content and follow within the levels of the Iraqi standard (IQS, 2001).

Table (1). The chemical compositions of an apple skin and ginger powder used.

Variable (n=5)	Apple skin powder	Ginger powder	T-test value
Moisture%	5.00	4.50	1.96 NS
Ash%	15.0	10.5	3.75 *
Pb (ppm)	0.38	0.29	0.183 NS
Fe (ppm)	4.80	4.90	0.337 NS
Cu (ppm)	0.36	0.38	0.109 NS
Co (ppm)	0.00	0.00	0.00 NS
Ni (ppm)	0.05	0.03	0.025 NS
Cd (ppm)	0.09	0.05	0.048 NS

* (P<0.05), NS: Non-significant.

A blood pressure level of 140/90 mm Hg or higher is considered high. About two-thirds of people over age 65 have high blood pressure. If your blood pressure is between 120/80 mm Hg and 139/89 mm Hg, that means you have prehypertension. So, that means you don't have high pressure now but are likely to develop it in the future unless you adopt the healthy lifestyle changes as nutritionist sciences brochure. While, if your blood pressure is 140/90 mm Hg or higher, that means you have hypertension and you have to ask the doctor or nurse how to control it as shown in table 2.

Table (2). Classification of Hypertension as mentioned by (Chobanian et al. 2003)

Blood pressure Classification	Systolic Blood Pressure(mm Hg)	Diastolic Blood Pressure(mm Hg)
Normal	120	80
Pre hypertensive	120-139	80-89
Stage 1 hypertension	140-159	90-99
Stage 2 hypertension	160 \geq	\geq 100

Effect of eating apple peels powder on hypertension.

Primarily this study was shown; the high percentage of women had a stage 2 of hypertension which was 56, then 36% of women who had stage 1 hypertension, and 8% of them who had prehypertension as in table 3 according to table 2. Whereas, after consumption of apple skin powder for more than one month daily the percent of women with stage 2 hypertension, stage 1 hypertension, prehypertension were highly decreased significantly to 8, 60, 24 respectively as in table 3, due to anthocyanin and quercetin, which are found in apple peel have an antihypertensive effects and beneficial for decreasing blood pressure level as presented by (Parichatikanond et al. 2012). Also, (Zenis & Simran 2013) concluded that an apple peel is a rich of flavonoid which is directly or indirectly benefits the cardiovascular system and help in lowering of blood pressure. In addition of that, (Jeanelle & Rui 2004) found that women ingesting apples had a 13-22% decrease in cardiovascular disease risk. In contrast, non- significant differences was observed in heart beat among the women, compared with the normal women table 3.

Table (3). Classification of Hypertension of women before and after eating apple peel powder.

Variables	% of women with Hypertension Before exp.		% of women with Hypertension After exp.		Ch-Square – χ^2
	%	No	%	No.	
Normal<120	Zero	Zero	2	8	2.306 NS
Prehypertension (120-139)	2	8	6	24	7.52 **
Stage 1 Hypertension (140-159)	9	36	15	60	9.86 **
Stage 2 Hypertension \geq 160	14	56	2	8	9.73 **
Heart beat (normal=60-100)	Zero	100	Zero	100	0.00 NS
Control (n=5)	1	4	Zero	Zero	1.025 NS
Ch-Square– χ^2	---	11.49 **	---	12.07 **	---

** (P<0.01), NS: Non-significant, No. of sample = 25.

Effect of eating ginger powder on hypertension.

According to the table 2 compared with the results of this study in table 4 primarily, the percent of the women with stage 2 hypertension, stage 1 hypertension, prehypertension were 60, 36, 12 respectively high and significantly differences among them. Whereas, after consumption of ginger powder for more than one month daily the percent of women with stage 2 hypertension, stage 1 hypertension, prehypertension were highly decreased significantly 12, 56, 24 respectively. These results are in agreement with the study by (Ghayur & Gilani 2005) who presented that ginger is having stimulatory action on heart muscle results, stimulated blood circulation, then is believed to stimulate cellular metabolic activity which helps to relief the cramps and tension. It also helps to reduce blood pressure and cardiac workload, due to the hypolipidemia action of ginger supplementation can be used to lower risk factor of the cardiovascular diseases and cancer either in animals or human presented by (Ademola et al. 2009). (Young et al. 2006) also, concluded that a combination of 1 g ginger with 10 g nifedipine would be valuable in cardiovascular complication due to platelet aggregation. Also, (Ansari et al. 2006) suggested that dietary supplementation of ginger might have significance in prevention of cardiovascular disease.

Table (4). Classification of Hypertension of women before and after eating Ginger powder.

Variables	% of women with Hypertension Before exp.		% of women with Hypertension After exp.		Ch-Square – χ^2
	%	No.	%	No.	
Normal<120	Zero	Zero	2	8	2.306 NS
Prehypertension (120-139)	3	12	6	24	7.52 **
Stage 1 Hypertension (140-159)	9	36	14	56	8.66 **
Stage 2 Hypertension ≥ 160	15	60	3	12	10.93 **
Heart beat (normal=60-100)	Zero	100	Zero	100	0.00 NS
Control	Zero	Zero	Zero	Zero	0.00 NS
Chi-Square – χ^2	---	10.427 **	---	11.513 **	---

** (P<0.01), NS: Non-significant.

No. of sample = 25

Effect of eating apple peel powder on lipid profile

According to results of this study, primarily the percent of women with high level in serum cholesterol, triglyceride, and blood sugar were very high 100, 96, and 96 respectively as shown in table 5. But after consumption of an apple peel powder daily for more than one month, the level of serum cholesterol, triglyceride, and blood sugar were highly decreased significantly to 80, 80, and 64% respectively (p<0.01) as shown below in table 5, so that results of this study are consistent with results that was performed about women older than 45 years old suffering from diabetes II, reported that there is a relationship between incident of diabetes and serum values of flavonoids, coarsetin, compferrol, myristin, apigenin, and luteolin and when there is more of these antioxidants in daily diet (like apple), diabetes II is less expanded (Song et al. 2005). Fiber of apple has a main role in reducing plasma sugar and cholesterol. Laboratory finding show that about 50% of fiber is pectin. Pectin has the most influence on glucose and lipid metabolism (Sanchez et al. 2008, Mirhadi et al. 2011) reported that apple juice causes reduce the blood sugar. Also, (Zenis & Simran 2013) found that the flavonoids such as quercetin, Proanthocyanidin present in the peel of an apple along with pectin exhibits there action by inhibition of Angiotensin converting enzyme, improving endothelial function of blood vessels, preventing oxidation of low density lipoprotein and improving high density lipoprotein in circulation, prevent arthrosclerosis and are strong antioxidants. (Mirhadi & Ali 2011) also, showed that supplementation with apple along with a high cholesterol diet in rats, reduced the amount of triglyceride, low density of lipoprotein LDL, and total glyceride and increased high density of lipoprotein HDL concentration. These effects can be due to antioxidant effect compounds constituting the food were linked, probably by inhibiting lipid peroxidation and decrease production of cholesterol, LDL and triglycerides. Also, (Young & Woodside 2001) presented that the antioxidants prevent free radical that produce originating from endogenous or exogenous sources induced tissue damage by preventing the formation of radicals, scavenging them, or by promoting their decomposition.

Table (5). Classification of lipid profile of women before and after eating apple peel powder.

Variable	% of women with lipid level before exp.		% of women with lipid level after exp.		Chi-Square – χ^2
	No.	%	No.	%	
Chloe.(up normal>200)	25	100	20	80	7.25 **
TG (up normal >180)	24	96	20	80	6.79 **
BS (normal=70-100) BS(up normal>100)	24	96	16	64	9.04 **

** (P<0.01).

Effect of eating ginger powder on lipid profile.

The consumption of ginger powder by the women who had hypercholestermia hyperlipidemia and diabetic women significantly reduced plasma cholesterol, hyperlipidemia and glucose level when compared with normal women. The reduction was not enough to reach normal women, but it was still significantly higher when compared with normal women, as shown in Table 6. The percent of women with high level in serum cholesterol, triglyceride, and blood sugar were 80, 92, and 96 respectively as shown in table 6. But after consumption of ginger powder daily for more than one month, the level of serum cholesterol and triglyceride were highly decreased significantly to 64 and 68, and 64% respectively (p<0.01), whereas, the percent of blood glucose decreased slightly as shown in table 6. These finding are in agreement with previous studies (Abd-Elraheem et al. 2009) and (Bhandari et al. 2005). The hypo cholesterol action may be done by ginger playing as a potential inhibitor of cholesterol synthesis as presented by (Said et al. 2010). However, ginger have a positive effect on women performance and lowering effect on blood serum cholesterol, triglycerides, and glucose, which can refer to strong anti-oxidative action and potential anti stress action.

Table (6). Classification of lipid profile of women before and after eating Ginger powder.

Variable	% of women with lipid level before exp.		% of women with lipid level after exp.		Chi-Square – χ^2
	No.	%	No.	%	
Chloe.(up normal>200)	20	80	16	64	6.42 **
TG (up normal >180)	23	92	17	68	8.71 **
BS(up normal>100)	24	96	22	88	4.03 *

* (P<0.05), ** (P<0.01).

Chloe. = cholesterol (mg/dl). TG = triglyceride. BS= blood sugar (mg/dl). b= before consumption ginger. a= after consumption ginger.

The result of this study shows that, the effect of each apple and ginger consumption on hypertension significant, but the effect was more significant in apple compared with ginger as in table 7.

Table (7). Comparison of Baseline systolic blood pressure summary between Apple and Ginger consumption in women's sample (Mean ± SD).

Variable	Control %		Apple peel %		Ginger %		Chi-Square – χ^2
	b%	a%	b%	a%	b%	a%	
Normal<120	4	0	0	8	0	8	4.03 *
Prehypertension (120-139)	0	0	8	24	8	24	8.62 **
Stage 1 Hypertension (140-159)	0	0	36	60	36	56	11.36 **
Stage 2 Hypertension ≥ 160	0	0	56	8	56	12	10.95 **
Heart beat (normal=60-100)	100	100	100	100	100	100	0.00 NS
Chi-Square – χ^2	15.57 **	15.50 **	14.42 **	12.06 **	14.42 **	12.96 **	---

* (P<0.05), ** (P<0.01).

The comparison between an apple and ginger effect on pressure and lipid profile summarized in table 8. The

result of this study shows that, the effect of each apple and ginger consumption on lipid profile significant, but the effect was more significant in apple compared with ginger as in table 8.

Table (8). Comparison of Baseline lipid profile summary between Apple and Ginger consumption in women's sample (Mean ± SD).

Variable	Control %		Apple peel %		Ginger %		Chi-Square – χ^2
	B	A	B	A	B	A	
Chloe.	0	0	100	80	84	72	13.59 **
TG	0	0	96	80	92	80	11.83 **
B Sugar	0	0	96	64	96	80	11.02 **

** (P<0.01)

Chloe. = cholesterol (mg/dl). TG = triglyceride. B sugar= blood sugar (mg/dl). b= before consumption ginger. a= after consumption ginger.

Conclusion

In summary, this study showed that supplementation with apple peel and ginger powder along with a hypertension and high cholesterol, triglyceride, and blood sugar in human patient, reduced the hypertension and lipid profile significantly. These effects can be due to the phenolic compounds have been found to have high antioxidant activity suggesting that apple pomace may have dietary health benefits and commercial use Boyer and Liu 2004. The freeze-dried samples had the greatest total phenolic and flavonoid content, and the total phenolic and flavonoid was actually greater than in fresh peels. Also, it was found that the ginger powder had the strong antioxidant activity and also greatly decreased the blood cholesterol and glucose Ahmed et al., 2002. So that, it is very important to focus on that functional by-product of apple peel (pomace) and it is important further investigation is needed.

Acknowledgment

This work was conducted at pilot scale in Budge Clinic/Al-Rasheed district/Baghdad/Iraq. For their contribution, the author is thankful to the head of the Clinic, Dr. Hattem Al-Ethawi and their staff to give me the required facilities to complete the current work.

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