

Effects of Some Selected Solvent Extracts of Avocado Pear (*Persea americana*) on Cholesterol/HDL Ratio in Albino Rats

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Abstract

The effects of some selected solvents extracts of Avocado Pear (*Persea americana*) on Cholesterol/HDL ratio of albino rats was investigated. The avocado fruit was dried at room temperature and was extracted with ethanol and N-hexane using soxhlet extractor. The phytochemical screening of ethanol, aqueous and N-hexane extracts reveals the presence of Alkaloid, Tannin, Phytate, Phenol, Oxalate, Steroid, Saponin and Glycoside. The quantitative analysis shows that Alkaloid; Aqueous Extract 0.96%, Ethanol 1.37%, N-hexane 1.81%, Phytate; Aqueous Extract 0.68%, Ethanol 1.47%, N-hexane 0.88%, Saponin; Aqueous Extract 1.28%, Ethanol 0.76%, N-hexane 1.06%, Phenol; Aqueous Extract 2.75%, Ethanol 2.43%, N-hexane 1.14%, Oxalate; Aqueous Extract 3.36%, Ethanol 2.81%, N-hexane 2.53%, Tannin; Aqueous Extract 0.69%, Ethanol 1.36%, N-hexane 0.72%, Steroid; Aqueous Extract 1.66%, Ethanol 2.04%, N-hexane 2.58%, Glycoside; Aqueous Extract 0.14%, Ethanol 0.52%, N-hexane 0.39%. Eighteen male albino rats were divided into three groups of which six rats per group; the first group were given ethanol extracts while the control receive ethanol, the second group were given N-hexane extracts while the control receive N-hexane and the third group were given aqueous extract while the untreated were feed *ad libitum* which serve as the control. A lipid profile test was carried out in the serum of albino rats in which the values of HDL, TRIG, LDL, CHOL and VLDL was recorded. The TC/HDL ratio was calculated by dividing Cholesterol with HDL and was plotted on a bar chart. Aqueous extract of avocado has the highest concentration in oxalate and phenol compared to ethanol and N-hexane extracts. The Total Cholesterol/HDL Ratio of untreated albino rats feed *ad libitum* has a ratio of 5.468 which is a high risk heart disease. Albino rats fed with aqueous extract has a ratio of 4.615 while ethanol extracts has a ratio of 4.623, they both fell in a low risk heart disease. N-hexane extract has a ratio of 3.553 which falls below average for heart disease. In conclusion, the result obtained from phytochemical concentration shows that oxalate and phenol has the highest percentage in all the solvent extracts of avocado. The cardiovascular disease marker on TC/HDL Ratio of male albino rats fed with aqueous and ethanol extracts fell within the low risk acceptable range while N-hexane extracts fell in very low average risk for CVD. The result shows that Avocado (*Persea americana*) reduces TC/HDL Ratio as well as boosting the "good cholesterol" (HDL) which is good for cardiovascular health.

Keywords: *Persea americana*; TC/HDL ratio; Cardiovascular disease

Introduction

Diet low in cholesterol is one of the essential ways to improve the cardiovascular status. Health issues have been raised because of the strong correlation between high levels of cholesterol in the body and cardiovascular disease. Cholesterol is a soft waxy substance found in every living cell of the body and also one of the building blocks of the cell membrane. It helps to digest fat, strengthen cell membranes and make hormones [1]. Cholesterol are carried around the body by protein when combined they are called lipoproteins. Lipoproteins help to transport fat and show varying patterns that correlate with the risk of having fatal cardiovascular disease. There are two major broad classes of lipoproteins which are High Density Lipoprotein (HDL) and Low Density Lipoprotein (LDL). LDL is considered the "bad" while HDL is considered the "good" cholesterol [2].

Cardiovascular markers also known as cardiac markers are biomarkers measured to evaluate heart function or heart disease. Heart disease or cardiovascular disease (CVD) is one of the leading cause of morbidity and motility from infancy to old age. Early detection and treatment of risk factors helps to prevent the spread of disease as well as morbidity improvement [3]. The Total Cholesterol/HDL Ratio is more indicative of cardiovascular disease than TC (total cholesterol). The amount of HDL and LDL in the blood are added together which indicates the total amount of cholesterol (TC). Cholesterol level can be reduced by eating vegetables and fruits like avocados, walnut, coconut etc. Research has shown that eating fruit like avocado can lower the amount of fat in

the blood, thereby reducing the dangerous LDL cholesterol in the blood at the same time increasing the more beneficial HDL cholesterol. The incidence of cardiovascular disease (CVD) is on the increase in Nigeria population due to high cholesterol. The consumption of avocado has been related to benefits some cardiovascular risk factors as well as to the improvement of the dietary quality and nutrient intake of individuals by increasing the consumption of monounsaturated fatty acid (MUFA), dietary fiber etc.

The fruit of *Persea americana* which is commonly known as Avocado is a native tree of South Central Mexico which is classified as a flowering plant Lauraceae family [4]. Avocado is the fattiest plant food in existence and contains monounsaturated fatty acid as well as lipids such as phytosterols, β -sitosterol, campesterol, and stigmasterol. The β -sitosterol helps to lower LDL level and raises HDL level. Avocados

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is one of the few fruits that give “good” fats because it contains monounsaturated fatty acid which is mainly oleic acid and it also reduces the risk of cardiovascular disease (CVD). Oleic acid is one of the most abundant fatty acid which is known to be effective in lowering serum cholesterol levels and low density lipoprotein [5].

Materials and Method

Collection of fruit

The fruit of *Persea americana* (Avocado Pear) was obtained from rumuokoro market Port Harcourt, Rivers State, Nigeria and brought to the laboratory.

Experimental animals

Eighteen male albino rats weighting between 150-200 g were obtained from the animal farm in University of Port Harcourt (UNIPORT), Nigeria. They were housed in standard rat cages in the department. They were given water and feed *ad libitum* and kept under laboratory conditions for an acclimatization period of seven days before the research commenced.

Preparation of sample

The fruits were thoroughly washed and the pericarp (peel) was removed from the mesocarp (flesh) leaving the mesocarp and the endocarp (seed). The mesocarp (flesh) were cut into smaller pieces and air dried for 5 days at ambient temperature. The dried mesocarp was ground into powdered form using porcelain mortar and pestle.

Extraction

The powdered sample was extracted exhaustively with n-hexane and ethanol using soxhlet apparatus. The extracts were concentrated using rotary evaporator and stored in a clean sterile vials until required.

Phytochemical analysis

Phytochemical screening was carried out on the extracts using standard procedures of Harborne [6] and Trease, et al. [7]. Quantitative analysis was carried out using standard methods. Alkaloids were determined by the method of Harbone [6]. Phytate was determined by the method of Harbone [6]. Saponin was determined by the method of Obadoni and Ochuko [8]. Phenol was determined by the method of Edeoga et al. [9]. Oxalate was determined by the method of Chinma and Igyor [10]; Ihekoronye and Ngoddy [11]. Tannins were determined by the method of Edeoga, et al. [9]. Steroid was determined by the method of Nwosu [12]. Glycoside was determined by the method of Inuwa et al. [13].

Treatment of animals

Eighteen male albino rats were divided into three feeding groups (I-III) of 6 rats per group. Group I were fed aqueous extract of avocado pear while the untreated serve as control. Group II were fed ethanol extract of avocado pear while the control were given ethanol. Group III were fed N-hexane extract of avocado pear while the control were given N-hexane. At the end of the two weeks and after an overnight fast, blood was withdrawn via cardiac puncture when animals were rendered unconscious under pentobarbital anesthesia. The blood was collected in lithium heparin bottles and lipid profile test were carried out.

Lipid profile test

Serum cholesterol, high density lipoprotein (HDL) and triglyceride

were determined using Randox kits produced by Human Diagnostic-Germany [14-16]. The serum very low density lipoprotein (VLDL) and low density lipoprotein (LDL) were calculated using Friedewald formula [17].

Statistical analysis

The mean values of High density lipoprotein (HDL), Low density lipoprotein (LDL), Cholesterol, Very low density lipoprotein (VLDL) and Triglyceride in the three groups were calculated. Values are expressed as Mean \pm SD.

Result and Discussion

The result obtained from qualitative phytochemical constituents of avocado (*Persea americana*) extracts in Table 1 show that it contains Alkaloid, Phytate, Saponin, Phenol, Oxalate, Tannins, Steroid and Glycoside.

The quantification of phytochemical in Table 2 shows that aqueous extract of avocado (*Persea americana*) has the highest concentration in oxalate compared to ethanol and n-hexane extracts. Phenol has the highest percentage in aqueous extracts compared to ethanol and n-hexane extracts. High percentage of phenol is in agreement with the findings of Dabas et al. [18] who reported that avocado are rich in phenol which plays a major role in body system of an individual. The presence of phenol in avocado fruit helps to reduce cardiovascular disease (CVD) risk by reducing oxidative and inflammatory stress [19].

S/No.	Test	Aqueous Extract	Ethanol Extract	N-hexane Extract
1	Alkaloid	+	++	++
2	Phytate	+	++	+
3	Saponin	++	+	++
4	Phenol	+++	+++	++
5	Oxalate	++++	+++	+++
6	Tannin	+	++	+
7	Steroid	++	+++	+++
8	Glycoside	+	+	+

(+)=Present (trace amount), (++)=Present (medium), (+++) (++++)=Present (high).

Table 1: Qualitative screening of avocado (*Persea americana*) extracts.

S/No.	Test	Aqueous Extract	Ethanol Extract	N-hexane Extract
1	Alkaloid (%)	0.96	1.37	1.81
2	Phytate (%)	0.68	1.47	0.88
3	Saponin (%)	1.28	0.76	1.06
4	Phenol (%)	2.75	2.43	1.14
5	Oxalate (%)	3.36	2.81	2.53
6	Tannin (%)	0.69	1.36	0.72
7	Steroid (%)	1.66	2.04	2.58
8	Glycoside (%)	0.14	0.52	0.39

Table 2: Quantitative contents (%) of avocado (*Persea americana*) extracts.

Sample	HDL	TRIG	LDL	CHOL
Control	0.775 \pm 0.156	1.411 \pm 0.163	6.879 \pm 0.011	4.238 \pm 0.067
Aqueous Extract	1.228 \pm 0.221	1.912 \pm 0.779	7.764 \pm 0.640	5.667 \pm 0.067
Ethanol Control	1.245 \pm 0.706	1.982 \pm 0.329	7.275 \pm 0.957	5.130 \pm 0.101
Ethanol Extract	1.232 \pm 0.575	1.562 \pm 0.472	7.637 \pm 0.033	5.696 \pm 0.756
N-hexane Control	1.123 \pm 0.604	2.061 \pm 0.757	8.247 \pm 1.465	6.188 \pm 0.517
N-hexane Extract	1.258 \pm 0.438	2.137 \pm 1.027	6.698 \pm 0.981	4.470 \pm 0.076

Values are expressed as Mean \pm SD

Table 3: Lipid profile of albino rats fed with various extracts of avocado (*Persea americana*).

Sample	CHOL	HDL	CHOL/HDL Ratio
Control	4.238	0.775	5.468
Aqueous Extract	5.667	1.228	4.615
Ethanol Extract	5.696	1.232	4.623
N-hexane Extract	4.47	1.258	3.553

Table 4: Total Cholesterol/HDL Ratio of albino rats.

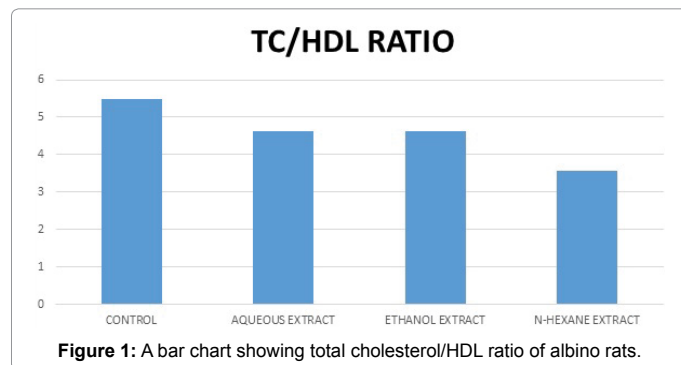


Figure 1: A bar chart showing total cholesterol/HDL ratio of albino rats.

The result obtained from lipid profile test of albino rats is shown in Table 3.

The Total Cholesterol/HDL Ratio of albino rats is shown in Table 4. The result shows that the untreated rats fed *ad libitum* has a cholesterol ratio of 5.468 which is a high risk heart disease. Albino rats fed with aqueous extract of avocado (*Persea americana*) has a cholesterol ratio of 4.615 and ethanol extract has 4.623 both fell in a low risk heart disease. The n-hexane extract has a cholesterol ratio of 3.553 which falls below average for heart disease.

The result obtained from plotting a bar chart of lipid profile test in Total Cholesterol/HDL Ratio is shown in Figure 1. The bar chart of Total Cholesterol/HDL Ratio shows that control has an elevated level compared to aqueous extract, ethanol extract and N-hexane extract.

Conclusion

From the results obtained oxalate and phenol has the highest concentration of phytochemicals in all the solvent extracts of avocado. The cardiovascular disease marker on TC/HDL Ratio of male albino rats fed with aqueous and ethanol extracts fell within the low risk acceptable range while N-hexane extracts fell in very low average risk for cardiovascular heart disease. The result shows that N-hexane extract has the highest HDL level when compared to control, ethanol extract and aqueous extract. Research has shown that HDL has the ability to promote efflux of cholesterol from cells which may minimize the accumulation of foam cells in the artery wall thereby preventing the development of atherosclerosis (CVD). It is now established that diet high in cholesterol and LDL (bad cholesterol) causes an increase in Total Cholesterol/HDL ratio which enhance the risk of cardiovascular disease [20,21]. Therefore avocado pear (*Persea americana*) reduces TC/HDL Ratio thereby boosting the “good cholesterol” (HDL) which is good for cardiovascular health.

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