Plasma Lipid Lowering Potential of Carrot (*Daucus carota*) Extract in male wistar rats

ABSTRACT

Carrots (*Daucus carota*) are widely consumed for their nutritional and medicinal benefits. The aim of the present study was to investigate the effects of *Daucus carota* on lipid profile. The study involved 28 male wistar rats separated into 4 groups of 7 rats each. Group 1 served as control and was given distilled water, whilst groups 2, 3 and 4 served as test groups and were given aqueous extract of *Daucus carota* at daily doses of 200mg/kg, 400mg/kg and 600mg/kg respectively. The experiment lasted for 28 days and thereafter, blood samples collected for determination of lipid profile [total cholesterol (TC), triglyceride (TG), high density lipoprotein (HDL) and low density lipoprotein (LDL)] using standard laboratory techniques. Results showed that oral administration of all three doses of carrot extracts significantly reduced the plasma concentrations of both TC and TG but caused no significant changes in the LDL levels. However, the higher doses; 400mg/kg and 600mg/kg significantly increased the HDL levels in wistar rats. The lipid lowering potential of *Daucus carota* could be based on its fibre content as well as its antioxidant content which possibly enhanced fecal excretion of lipids. Conclusively, moderate consumption of *Daucus carota* decreased the plasma levels of TC and TG, increased HDL but had no significant effect on the LDL.

Commented [A1]: Carrot extract is a liquid so the dosage is in ml not mg, right?

Key words: Lipid Lowering, Potential, *Daucus carota*, Wistar rats.

Introduction

Carrot is an essential and popular root vegetable which was first used as medicine and later gradually used as food (1, 2). There are different varieties of carrots depending on the colour of their roots; orange, white, black, yellow, purple and red (3, 4), with predominantly more of the orange-coloured variety. It is a good source of some bioactive compounds which are beneficial to health including dietary fibre and micronutrients such as vitamins, minerals and antioxidants (5, 6, 7, 8). The colour of the root significantly affects the presence of bioactive compounds. For instance, the orange carrot root contains increased concentration of α-carotene and also very rich source of β-carotene, the black carrot root is a rich source of anthocyanins, red carrot root is endowed with lycopene whereas the yellow variety has been shown to accumulate lutein (9, 10, 11). Furthermore, the growing and season conditions, the degree of ripeness of carrots as well as part of the root to some extent also influence the presence of bioactive compounds (10). Carrots are generally rich in carotenoids (12) as well as phenols (13, 14, 15). Most fruits and vegetables are endowed with abundant phytochemicals, pro-vitamins and vitamins which protects against cellular damage and thus prevent certain diseases (16, 17, 18).

Plasma cholesterol is derived from both hepatic synthesis and diet, although the body balances the absorption of cholesterol by reducing its synthesis (19). The main dietary sources of cholesterol include meat, eggs and milk. However, there may be racial, gender and age variations in the average consumption of cholesterol (20). Studies have linked excessive dietary cholesterol with higher risk of cardiovascular disease (21, 22, 23, 24, 25, 26, 27, 28). Nutritional interventions and lifestyle changes have over the years been used in the prevention and management of these cardiovascular diseases. These interventions include, enriching the diet with dietary fibres, plant proteins and unsaturated fats (29), aside increasing physical activity to prevent obesity. Healthy dietary patterns including the popularized Dietary Approaches to Stop Hypertension (DASH) which are relatively low in cholesterol should be of utmost priority. These patterns involve the consumption of vegetables, fruits, nuts, whole grains, seeds, low-fat or fat-free dairy products, lean protein sources and liquid vegetable oils (24). Hence, the dietary patterns approach would improve diet quality and ultimately promote cardiovascular health.

The aim of the present study was to determine the effect of carrot juice on the plasma lipid profile of wistar rats.

Materials and Methods

The experiment was carried out at animal house of the department of Human Physiology, faculty of Basic Medical Sciences, University of Port Harcourt in the year 2019. Ethical approval was obtained from the university of Port Harcourt Research Ethics Committee with approval number; UPH/CEREMAD/REC/MM67/012. A total of twenty eight male wistar rats weighing 120 to 150g were purchased and acclimatized for a period of two weeks. These animals were grouped and housed in plastic cages and allowed to feed and drink *ad libitum* with Top feed Finisher mash and clean water. Their immediate environment (beddings) was changed daily, the temperature of the environment kept at normal conditions while the external environment was cleaned and disinfected regularly.

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Preparation and administration of carrot extract

Mature carrot tubers were bought from Oil Mill market in Obio Akpor Local Government Area of Rivers State, Nigeria. The plant was identified at the department of Plant Science and Biotechnology, University of Port Harcourt; *Daucus carota L*, in the family; Apiceace with assigned herbarium number; UPH/C/132. The tubers were washed with water to remove soil particles. About 2kg of the fresh carrot was cut into tiny pieces and air dried for seven days. The dried carrots were blended using a blender and carefully poured into a maceration jar containing four liters of water. The mixture was allowed to macerate for 24hours after which a Whatman filter (20-25μm, pore size) was used to get a clear filtrate. The filtrate was now poured into an evaporating dish and dried in a water bath at 45^{o}C to obtain a semi-solid aqueous extract of *Daucus carota*. The dosages administered in the study were based on the lethal dose (LD50) of 5000mg/kg which was previously determined (30). Following acclimatization, the wistar rats were weighed and separated into four groups of seven rats each. Group 1 served as control and was given distilled water, whilst groups 2, 3 and 4 served as test groups and were given aqueous extract of *Daucus carota* at daily doses of 200mg/kg, 400mg/kg and 600mg/kg respectively. The experiment lasted for 28 days. Thereafter the animals were sacrificed under anesthesia and blood samples collected for determination of lipid profile [total cholesterol (TC), triglyceride (TG), high density lipoprotein (HDL) and low density lipoprotein (LDL)] using standard laboratory techniques.

Commented [A3]: What methods are used, the name of reagents, how much blood was taken, through what veins?

Statistical analysis was done using SPSS software version 22.0. Results were presented in tables. Continuous variables were expressed as mean ± Standard error of mean (SEM). Statistical difference was determined using analysis of variance (ANOVA) and at $p < 0.05$.

Results and Discussion

Table 1: Effect of Carrot extract on plasma lipid profile of wistar rats

Group	TC (mmol/l)	TG (mmol/l)	HDL (mmol/l)	LDL (mmol/l)
Control	5.49±0.23	1.57±0.05	0.80±0.07	2.13±0.14
200mg/kg	4.20±0.33*	1.21±0.07*	0.97±0.09	2.12±0.27
400mg/kg	3.30±0.26*	1.08±0.14*	1.26±0.11*	1.76±0.23

600mg/kg	3.28±0.37*	0.93±0.05*	1.67±0.07*	1.78±0.15

* Significantly different compared to control.

Commented [A4]: What statistic test used? P value?

The results of our study showed that the three concentrations of carrot extract respectively caused significant reduction in TC and TG levels compared to the control. Carrots and other plant products (including fruits, vegetables, nuts, seeds and grains) contain dietary fibers (31) which are known to decrease the absorption of cholesterol from the intestines (32, 33, 34). The reduction in TC and TG in the present study could be attributed to the presence of dietary fibers with reduced absorption of cholesterol and possibly increasing the excretion of cholesterol in faeces (34, 35). Previous studies suggest that carotenoids and other antioxidants present in carrot and other plant products greatly reduces the risk of cardiovascular disease (34, 36, 37, 38, 39, 40) and prevent premature deaths. Triglyceride lowering has been linked to reduction in cardiovascular disease risk (41).

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The 200mg/kg of the extract had no significant effect on the plasma HDL levels but higher doses; 400mg/kg and 600mg/kg of the extract respectively increased the HDL levels in a dose-dependent manner. A lowering of the LDL with concomitant increase in the HDL is an important factor in the risk assessment of cardiovascular disease (42). HDL is known to be the ‘good’ cholesterol and whatever factor that increases its plasma concentration will potentially lower the risk of cardiovascular disease (43). The result from present study therefore suggests that moderate consumption of carrot extract would potentially minimize the risk of cardiovascular disease. However, all three concentrations of the extract caused no significant changes in the plasma levels of LDL compared to control even though slight reduction in LDL was observed as dosage of the extract increased.

Conclusively, oral administration of all three doses of carrot extracts for 28 days significantly reduced the plasma concentrations of both total cholesterol and triglyceride but caused no significant changes in the LDL levels. However, the higher doses; 400mg/kg and 600mg/kg significantly increased the HDL levels in wistar rats.

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