



## Effects of coconut oil on body weight and haemorheology in rabbits

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**Abstract :** The dietary effects of *Cocos nucifera* oil meal on the body weight and haemorheological properties of blood of rabbits were assessed using weight difference (WD), relative whole blood viscosity (RWBV) and relative plasma viscosity (RPV) indices. Fifteen out of twenty young and healthy white rabbits were fed with *Cocos nucifera* oil meal supplement together with normal animal feeds and water for eight weeks daily with a 0.5 ml/Kg body weight. Baseline blood samples were collected from the animals before feeding them with the coconut extract. Thereafter blood samples were collected from each of the animals in the 1<sup>st</sup>, 4<sup>th</sup> and 8<sup>th</sup> weeks and analyzed for RWBV and RPV by Viscometer Method. The body weight was measured gravimetrically. Results obtained showed a significant weight loss as well as reduced RWBV and RPV compared with the baseline data. The observed results indicated that obesity/related cardiovascular diseases can be controlled and microcirculatory blood flow properties in Rabbits improved using coconut oil meal as food supplement.

**Key Words :** Obesity, Haemorheology, Coconut oil, Cardiovascular diseases.

### Introduction

Obesity is a growth condition associated with overweight. It increases risk for a number of diseases especially the psychological consequences in youths and its persistence in adult age. Poplem noted that the development of obesity early in life may compound the risk factors for cardiovascular diseases than later phase in life (Poplem, 1994). Researchers had reported that obesity independently increases ones risk of cardiovascular morbidity and mortality (Bjorntorp and Brodoff, 1992). It may predispose to disease conditions such as high blood pressure, heart diseases, hypertension, stroke, atherosclerosis, myocardial infarction and adult onset diabetes mellitus, orthopaedic and respiratory disorders (Arstmune *et al.*, 1984; and Neutzling, *et al.*, 2008).

Haemorheology is the science of deformation

and blood flow (Nash and Staurt, 1990). Haemorheological variations due to alteration of blood cells and the plasma components may lead to hyper-viscosity, which limits blood flow rate. This condition facilitates occlusive events through erythrocytes rouleaux formation and platelet aggregation (Lucia, *et al.*, 2007). Studies have also shown that increased blood viscosity is a precursor of the pathogenesis of many cardiovascular diseases and some inflammatory syndrome (Belhassen, *et al.*, 2001; Verma *et al.*, 2003). It has also been reported that low blood viscosity leads to an improvement in microcirculatory rheology (Klingel, *et al.*, 2000).

The use of *Cocos nucifera* oil as an effective weight loss food additive has been reported (Kabara, 2000) and its medium chain triglyceride (MCT) was identified as the most effective factor in enhancing weight loss

(Seaton et al, 1986; Crozier et al, 1987 and St-Onge et al, 2003). Interestingly, the MCT (saturated fatty oil) of the *Cocos nucifera* are not known to raise serum cholesterol and therefore would not cause coronary thrombosis (Kauntz and Dayrit, 1992).

At present, there are no records of the effect of *Cocos nucifera* oil on the haemorheological properties of blood. This study is aimed at investigating the potential of coconut oil on the rheological properties of blood/plasma and the relationship between body weight and blood flow properties. The results of this study may be useful in addressing disease conditions arising from obesity and hyper-viscosity in human blood or plasma.

### Materials and Methods

The materials used include ethylene diaminetetraacetic acid, EDTA containers, butterfly needle, syringes, xylene, New Zealand white rabbits, animal blood, coconut oil and cotton wool.

Fifteen New Zealand white rabbits with initial mean weight of 2.25kg on delivery were purchased from Adamawa Cattle Market in Benin City, Nigeria. The rabbits were conditioned in a stainless steel animal cage with wire mesh floor. The animals were acclimatized on growers mash purchased from Bendel Feed and Flour Mill Limited, Ewu Nigeria, for two weeks before commencing the study. Food and water were given *ad libitum*. At the end of the adaptation period, a baseline blood sample was collected from each of the animals before feeding them routinely with both the conventional animal feed and supplemental coconut oil meal. Animal management and experimental procedures were carried out in accordance with the requirements of the National Research Council's guide for the use of laboratory animals (NRC, 1985). Baseline blood samples were drawn from the rabbit's ear

vein using butterfly needle and 21- gauge syringes. This served as the control for subsequent blood samples collected after feeding 15 of the animals with the coconut oil meal. The body weights of the animals were also obtained and mean body weight (BWT) recorded. The blood samples were put into the EDTA container for laboratory analysis. The blood samples were collected on monthly basis to avoid possible anaemia in the animals.

Traditional method of extraction of coconut oil was employed in this study. Freshly harvested coconut seeds were grated and the milk was expressed mechanically into a container. It was allowed to ferment for 24 to 36 hours. During this period the water separated from the oil and then removed. The oil was heated slightly for 5 minutes to remove excess moisture, and then filtered. The realised coconut oil was clear and retained the distinct scent and taste of coconut. The oil was analyzed for nutrient contents using Clark's Vitros 250 Chemical Analyzer, U.S.A Model 5546.

The body weights of the animals were measured using a triple beam balance; Ohaus Model MB-2610 and mean values were recorded in the 1<sup>st</sup>, 4<sup>th</sup> and 8<sup>th</sup> weeks. The whole blood viscosity (WBV) and plasma viscosity (PV) were analyzed using Reid and Ugwu Syringe Viscometer Method (Reid and Ugwu, 1987). A 1.0 ml calibrated capillary syringe was used to draw distilled water slightly above the 1.0 ml mark excluding air bubbles and clamped vertically onto a retort stand. The plunger was then removed and the fluid was allowed to drain up to the meniscus at the 1.0 ml mark before timing the Stopwatch. The time it took for the fluid to drain off from the 1.0 ml syringe was recorded. The procedure was repeated with equal volumes of whole blood and plasma samples and the flow rates determined under the same conditions of temperature and pressure. Three determinations for each sample including the control (distilled water)

were made and the mean flow rates were calculated. Relative to the flow rate of the distilled water, the RWBV or RPV were obtained from the expression:

$$\text{RWBV} = \frac{\text{Mean blood or plasma sample flow rate}}{\text{Mean flow rate of distilled water}}$$

**Analysis of Results.** The data obtained were analyzed using Students' T-test at 95 % confidence limit and results were expressed as mean  $\pm$  standard error of the mean (SEM). P-Values  $< 0.05$  indicate significant difference and  $P > 0.05$  shows no significance. All analyses were done with the Microcal 5.0 Statistical Package and Excel Microsoft Office, 2007.

**Table 1.** Data on the biochemical analysis of coconut oil.

Nutrients	Levels
Glucose	< analyzer range
Cholesterol	< analyzer range
Triglyceride	< analyzer range
Total protein	< 1.0 g/dl
Albumin	< 0.5g/dl

haemorheological parameters are presented in Table 2.

The nutrient analysis of the coconut oil extract showed total protein and albumin below 1.0 g/dl and 0.5 g/dl respectively, while glucose, cholesterol and triglyceride levels were below detection limits of the analyzer. The nutrient content of the oil, especially the medium chain triglycerides necessitated the use of coconut oil as food additive to enhance weight loss (Kabara, 2000; Seaton *et al.*, 1986; Crozier *et al.*, 1987 and St-Onge *et al.*, 2003).

The variations in the mean body weights of the animals used as control and those fed with the coconut oil supplement (Test group) are shown in Fig. 1. There was relative increase in the body weights of the animals used as control from  $2.14 \pm 0.23$  kg in week 1 to  $2.88 \pm 0.90$  kg in week 8 by approximately 16 %, while the body weights of the Test group animals rather decreased from  $2.42 \pm 0.15$  kg to  $2.35 \pm 0.16$  kg representing about 6 % weight loss over the same periods. There occurred weight loss in the Test group animals compared with the control from 0.28 kg in week 1 to -0.35 kg in week 8.

**Table 2.** The mean body weight (Kg) and Haemorheological parameters in the experimental Rabbits

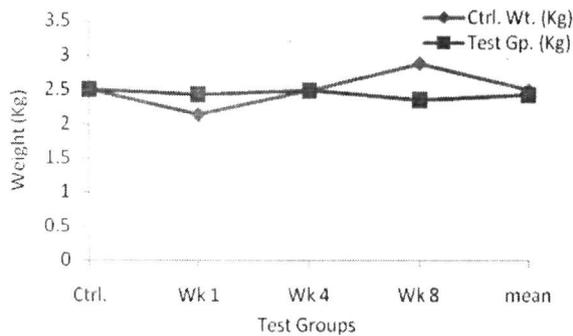
Parameter	Control	WK 1	WK 4	WK 8	Mean $\pm$ SEM
Wt. of Ctrl Animals (Kg)		$2.14 \pm 0.23$	$2.48 \pm 0.19$	$2.88 \pm 0.90$	$2.50 \pm 0.17$
Test Animals	$2.50 \pm 0.44$	$2.42 \pm 0.15$	$2.49 \pm 0.14$	$2.35 \pm 0.16$	$2.42 \pm 0.01$
Mean diff.		0.28	0.01	0.53	0.08
Sig. level		$P < 0.05$	$P > 0.05$	$P < 0.05$	
RWBV	$4.05 \pm 0.21$	$3.18 \pm 0.21$	$3.52 \pm 0.51$	$3.74 \pm 0.11$	$3.48 \pm 0.28$
Mean diff.		0.87	0.53	0.31	0.57
Sig. level		$P < 0.05$	$P > 0.05$	$P > 0.05$	
RPV	$2.62 \pm 0.02$	$1.51 \pm 0.11$	$1.65 \pm 0.05$	$1.76 \pm 0.06$	$1.64 \pm 0.07$
Mean diff.		0.97	0.86	0.98	1.11
Sig. level		$P < 0.05$	$P < 0.05$	$P < 0.05$	

### Results and Discussion

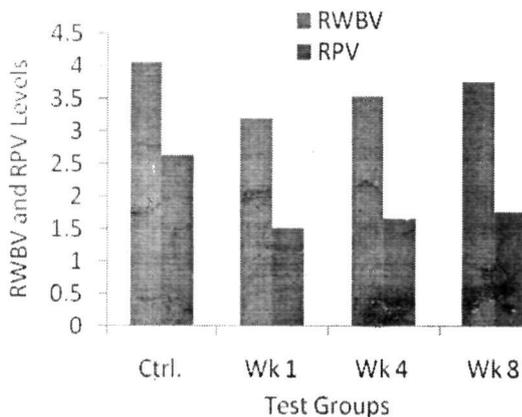
The results of the nutrient content analysis of the coconut oil extract are shown in Table 1, while the average body weights and the

On the average, the weight loss in the Test group animals decreased by 3.2 % compared with the control rabbits.

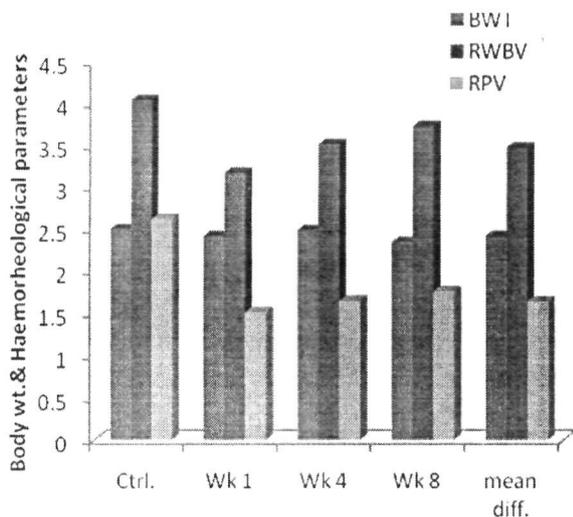
As for the haemorheological parameters both the RWBV and RPV of the Test group animals



**Fig. 1** Variations in Body Weights of the Control and Test Group Rabbits



**Fig. 2** Relative Levels of the Haemorheological parameters, RWBV and RPV, in the Rabbits.



**Fig. 3.** Relationship between Body weight and Haemorheological parameters of Rabbit

decreased relative to the control (Fig. 2). The RWBV decreased from  $4.05 \pm 0.21$  in the control to an average of  $3.48 \pm 0.28$  at the end of the study period. This represents 14.1 % reduction in RWBV. The RPV also decreased from an average of  $2.62 \pm 0.02$  for the control rabbits to  $1.64 \pm 0.07$  representing 37.4 % reduction for the Test group rabbits under the same period. There was significant mean difference ( $p < 0.05$ ) in the RPV values between the Test group and the control animals in the order 42.4 % in Week 1, 37.0 % in Week 4 and 32.8 % in week 8. A reduction in the RWBV of the Test group animals was significant only in week 1. These observations agree with studies by Klingel. *et al.*, (2000) that “low blood viscosity leads to an improvement in microcirculatory blood flow”. High blood viscosity has been identified as a precursor of pathogenesis of many cardiovascular diseases including atherosclerosis, hypertension, stroke, mortality and morbidity (Belhassen *et al.*, 2001). Cardiovascular diseases remain one of the principal causes of adulthood mortality and morbidity in developed and developing countries, accounting for about 20 % of annual deaths worldwide (Mohammed, *et al.*, 2009).

The relationship between body weight and the rheology of blood and plasma in rabbits which is shown in Fig.3 indicates that as the body weight decreases, the relative whole blood viscosity and relative plasma viscosity also decreases. This invariably implies that reduced body weight or obesity could improve blood and plasma flow rate, which is required for any healthy being.

### Conclusion

This study has shown that the use of *Cocos nucifera* oil as food supplement in animal feeds could enhance the rheological dynamics of blood and plasma in addition to a reduction in the risk of obesity. Any factor that decreases body weight such as the coconut oil meal may

increase free flow of blood and plasma through the circulatory system, which according to earlier studies, could help to minimize the risk of cardiovascular diseases (Aristmune, *et. al.*, 1984)

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