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Comparative Effect of Coconut Oil and Milk on the Testis and Weight of Male Albino Rats as it Relates to Fertility

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ABSTRACT: The comparative effects of coconut oil (*Cocos nucifera*) and coconut milk on the testis using male rats as model was studied. A total of 40 rats weighing between 200-240 g were used in the study. Group 1 served as the control and received distilled water only. Groups 2-4 were the test groups and were fed with the coconut extracts orally for 4 weeks. Group 2 was fed with coconut oil; group 3 was fed with coconut milk while group 4 was fed with the mixture of coconut oil and coconut milk respectively. The initial and final weight of the rat and its testis was taken before and at end of administration. The results of the study showed that the administration of coconut oil had a drastic effect on the weight of the rats when compared with the control and that of the mixture of coconut oil and coconut milk. The coconut oil showed a highly significant decrease in the weight of the testis ($P<0.05$) when compared with the control and also with coconut milk. Administration of coconut oil either directly or via our diets should be with caution because of possible impairment of weight loss and reduction in testis size which in turn has an effect on sperm production.

Keywords: Coconut oil, Coconut milk, Weight, Testis.

Introduction

Human body weight is a person's mass or weight. It's usually measured when the person is without any items on, like shoes, watches, chains, phones, wallets, and any other heavy accessories. Body weight in excess or reduced form is an indicator of a person's health condition which include high blood pressure, coronary heart disease, gall bladder disease, sleep apnea, obesity, infertility(Kasen, *et al.,* 2008; Robert *et al.,* 2003).

Fertility is the natural capability to produce children. When a man and woman cannot perform this function or incapable to produce children, they are termed 'infertile'. Infertility in man is a health issue that lowers the chances of his female partner getting pregnant after 12 months of unprotected and regular sex. It affects about 7% of all men (Loffi and Maggi, 2004).

Male infertility is usually caused by testicular damage leading to inability to produce sperm; damaged testicle will not usually regain its sperm-making abilities (Puris, 1993). Furthermore, dramatic changes in the semen quality have been seen during the past three decades (Nagiah *et al.,* 2015). High intake of antioxidants, fruits, vegetables, poultry, sea foods, skim milk and shellfish as well as low intake of full-fat diary, sweet and processed meat, especially with high-saturated fat foods, has favorable association with sperm quality (Daniel *et al.,* 2019).

Studies also has shown that sperm motility can be changed in a short period and seems to be closely coupled to diet (Daniel *et al.,* 2019).

Medicinal herbs gotten from plants and plants extracts have been shown to improve infertility problems in men (Gonzales, 2002).

Infertility is a growing problem worldwide (Okanufa and Odunsi, 2003). Epidemiologic reports indicated that prevalence of infertility ranges from 3.5% to 16.7% in developed countries and from 6.9-9.3% in developing countries (Biovin *et al.,* 2007).

About 8-12% of couples globally are experiencing infertility during their reproductive lives estimated by the World Health Organization in 1991, thus affecting 50-80 million couples with 20-35 million in Africa (WHO, 1991).

It affects about one in every six couples and researchers estimate about one in every three cases is due to fertility problems in the male partner alone (Brugo-Olmedos, *et al,* 2001). Also, despite the numerous advance methods of treatment, there have been increased number of infertile couples at the past decade (Heitman, 1995).

Assisted reproduction methods have been developed to overcome infertility. However, due to high costs most couples cannot afford it (Heitman, 1995). In Nigeria, it is estimated that 3-4 million couples were affected by infertility issues (Thomas *et al.,* 1995). Infertility comes with a high financial and physical price for many couples, this has made a lot of couples to discontinue from their treatments (Akinoye and Truter, 2011), which has led to significant increase in psychological trauma among couples (Umezulike *et al.,* 2004). Despite its high prevalence, not much effort have been made in tackling this problem. The impact of male infertility is likely to increase if adequate measures are not taken.

Although researchers have suggested that the kind of food we eat can play an important role in alleviating fertility related outcomes in both men and women, the current research examining the effect of dairy on fertility is limited in scope.

Plants like coconuts have been used for many studies arising from heart diseases, stress reduction, antioxidant and source of hydration, kidney stone prevention and reduction of blood pressure but only very few research work have been done on the use of coconut with a view to reducing infertility. Most recently, the water of immature coconut was associated with increased fertility by increasing sperm motility and count (Augustine *et al.,* 2019), but no substantial work has been done in consumption of coconut meat which contains coconut oil and milk.

Materials and methods

Sample collection and identification: Solid, dry, mature coconut was purchased from Swali market, Yenagoa, Bayelsa State, Nigeria. The coconuts were identified by the Department of Crop and Pest Management, Faculty of Agriculture, University of Africa, Toru-Orua.

Procurement of experimental animals: Healthy Wister rats, of two months old and weighing between 160-200 g were procured from Human Physiology Department, University of Port Harcourt.

Experimental design: The animals after acclimatization for two weeks, were randomized and grouped, in accordance to the method of Morton and Han (Morton and Han, 2010) and placed in a wooden netted cages and maintained under environmentally controlled room provided with 12:12 hours light and dark cycle approximately at 25 ºC. They were grouped into 4 (n=10 per group).

- Group 1 (Control)
- Group 2 Coconut oil (CO)
- Group 3 Coconut milk (CM)
- Group 4 Mixture of Coconut oil and Coconut milk (CO+CM)

The test group (2-4) were fed orally with the extracts while the control rats were fed distilled water and normal feed. Furthermore, the procedures involving the animal models conformed to the guiding principles in the care and the use of animals by the American Physiological society (American Physiological Society., 2002).

Preparation of coconut milk and virgin coconut oil plant extracts: The coconut milk and Virgin coconut oil were prepared as described by Nevink and Rajmohan (2006). The coconuts were broken, the meat scrapped from the shell and cut into small piece using a sharp knife. The cut pieces were mixed in a grinding machine into a viscous slurry and thereafter squeezed through cheese cloth (filter) to obtain coconut milk which was put into a glass jar]. The glass jar containing coconut milk was kept in a refrigerator for preservation. To produce the virgin coconut oil, the coconut milk produced was left for 24 hours at room temperature to aid the gravitational separation of the milk. Three phases resulted: The lower aqueous phase, a middle emulsion phase and an upper oily phase. The upper oily phase was then decanaled and heated for 10 minutes to remove moisture. The resultant virgin coconut oil (V.C.O) was then filtered with a fine sieve, stored in bottles at room temperature and used for experiment.

Acute toxicity test: The minimum dose required to cause 50% death of the rat, was determined using the arithmetic method of Lorke's (Dietrich, 1983).

Statistical analysis: Data were expressed as Mean ± SEM and their group will be evaluated by one way analysis of variance (ANOVA)**.**

Results

Toxicity test result: Following a 24-hour period of acute toxicity study, no deaths were recorded in the animal groups 1, 2, 3, 4, 5, 6 and 7 treated with 500, 1000, 2000, 3000, 4000, 5000, 6000, mg/kg body weight of *Cocos nucifera* extract. The animals spontaneously regained their activity within one hour of treatment and all survived the acute test. In contrast, one death was recorded in group 8 which was treated with 7000 mg/kg. Hence the acute toxicity value obtained by the application of Looke's after shown in formula was 4.582.56 mg/kg.

Table 1: Comparison of weight changes in the animals fed C*ocos nucfera*

Group	Initial Weight (g)	Final Body Weight (g)
Control	200.00±25.30	250.00±10.22
Coconut Milk	220.00±10.11*****	280.00±20.1
Coconut Oil	220.00±8.00*****	200.00±15.00
Mixture	240.00±15.00*****	290.00±10.00

Results are expressed as Mean±SEM.*****P<0.5 when compared with control,*n=10 in each group

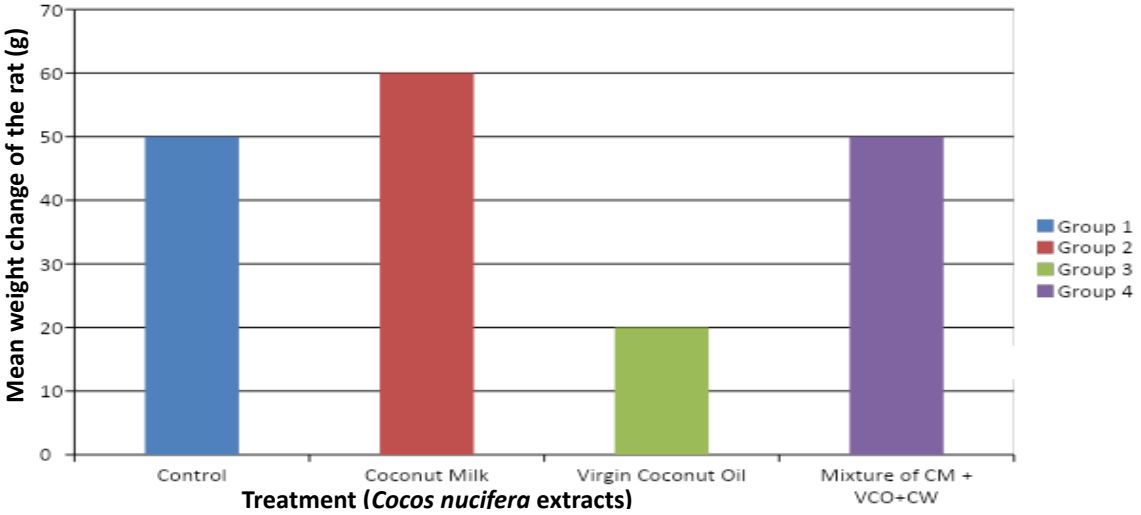

Figure 1: Effects of *Cocos nucifera* on the body weight changes on the animals. The results were graphically represented as mean/standard deviation in each group. One-way ANOVA analysis showed a significant decrease between the initial and final weight of the animal.

Table 2: Comparison of weight changes in the testis (in grams) of the animals fed with C*ocos nucifera*

Group	Initial weight (g)	Final body weight(g)
Control	2.0 ±0.20	2.52±0.118
Coconut milk	220.00±10.11*****	280.00±20.1
Coconut oil	220.00±8.00*****	200.00±15.00
Mixture	240.00±15.00*****	290.00±10.00

Results are expressed as Mean ± SEM.*****P<0.5 when compared with control. Means marked * is significantly different from control while means marked ** is significantly different from other test.

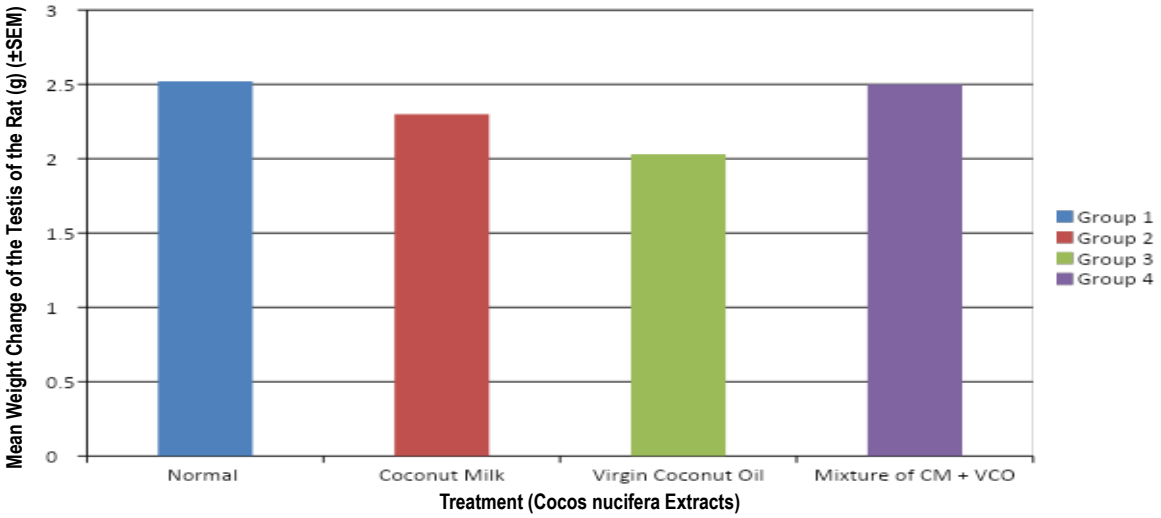

Figure 2: Effects of *Cocos nucifera* on the weight of the testis on the rat. The results were graphically represented as mean/standard deviation in each group. One-way ANOVA analysis showed a significant decrease ($P<0.05$) between the treated and control rats.

Discussion

Administration of coconut milk (CM), as well as a mixture of CM and Coconut oil (CO) have no significant effect on the weight of the rat when compared with the control (P>.05),whereas administration of coconut oil alone resulted in a significant decrease in the weight of the rat compared with the control (p>.50).This weight decrease associated with the administration of coconut oil could be attributed to the facts that coconut oil is a known natural source of medium chain triglycerides (Sigalet and Martin, 1999). The medium chain triglycerides (MCTs) might had helped to reduced appetite and decrease calorie intake thereby causing weight loss when compared to other fats (Han *et al*., 2007). More importantly, during digestion of food, the medium chain triglycerides (MCTs) are converted to medium chain fatty acids (MCFAs) which can lead to reduction in energy expenditure (Noguchi, *et al*., 2000).

MCFAs have been suggested to raise diet-induced thermogenesis, which then contributes to an increase in energy expenditure of its users (Klass, 2004). Furthermore, virgin coconut oil is made up of 50% of lauric acid (Sigalet, *et al*., 1999).Lauric acid is known to promote fatty acid oxidation which directly increases satiety and therefore have a direct effect on weight loss (Lemarie. *et al*., (2016).

So, it is not out of place to conclude that coconut oil may have played a role in the drastic weight loss of the rats fed with coconut oil extracts. The weight of the testis has been closely related to the weight of the animal (Salhad, *et al*., 2001) and the rate of development of the testis of animals is an indication of their sexual performance (Yarney, *et al*., 1990).

Similarly, the weight of the testes also has been found to provide useful information in the evaluation of sperm production, and fertility of the animals (Tohman and Massanyi, 1997).In addition, Perry and Pellerson (2001) suggested that the weight of a testis of an animal is a good indicator of the present and future of sperm production.

Our preliminary findings showed that administration of Cocos nucifera extracts (VCO) was found to have a decreasing effect on the weight of the testis when compared to the other extracts of CM, mixture of CM and VCO and the control respectively, this might be as a result of the high saturated fat contents in the VCO extract, which is in agreement to the work done by, Pamela *et al.* (2015) which showed that diet rich in saturated fatty acids allowed the carbohydrate metabolism and testicular morphology with reductions of seminiferous epithelium height, seminiferous diameter and cell proliferation which could be related to a disturbance of spermatogenesis. Similarly, Lipids have been associated with the weight of testis and sperm function (Nasan, *et al*.,2018). So it is not out of place to conclude that this may have played a role in the decrease in the weight of the testis of the rats which may also have a negative effect on the fertility of the rats fed with the virgin coconut oil.

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