



## COMPARATIVE EFFECT OF VIRGIN COCONUT OIL (VCO) AND COCONUT MILK ON FERTILITY PROFILE (SPERM ANALYSIS-COUNT AND MOTILITY) USING RATS AS MODE

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**SUMMARY:** The comparative effects of Virgin Coconut oil (*CocosNucifera*) and Coconut milk on fertility using male rats as model was studied. A total of 72 rats (40 adults male and 32 female) weighing between 200-250g were used in this study. Group 1 served as the control and received distilled water only. Group 2-4 were the test groups and were fed orally with the coconut extracts. Group 2 was fed with virgin coconut oil (VCO), group 3 fed coconut milk (CM) while group 4 was fed the mixture of coconut oil and coconut milk. The animals at the end of a given duration respectively were sacrificed and their semen sample were collected for sperm analysis. The result of the study showed that the administration of *Cocos Nucifera*(VCO and CM) extracts significantly decrease ( $p < 0.05$ ) the sperm count of the rat when compared with the control. The virgin coconut oil (VCO) showed a further decrease ( $P < 0.05$ ) when compared with coconut milk and mixture of coconut milk and VCO. Furthermore, there was no significant difference from (CM +VCO) when compared with the control ( $P > 0.05$ ). Also, the results showed that the sperm motility in rats treated with VCO, CM and mixture of VCO + CM showed no significant difference on the immotile sperm when compared with the control. VCO showed a significant decrease ( $P < 0.05$ ) on the motile sperm followed by CM when compared with the control. The administration of Virgin Coconut oil could have deleterious effect on fertility by significantly reducing the motility of the sperm and reducing sperm count as well.

**KEYWORDS:** Virgin coconut oil, coconut milk, sperm count, sperm motility.

## INTRODUCTION

Fertility is the natural capability to produce children. When a man and woman cannot perform this function or capability to produce children, they are termed 'infertile'. That means fertility problems can happen both in women and men, which account for about 40-50% (Hirsh A, 2003).

Male infertility: This is a health issue in a man that lowers the chances of his female partner getting pregnant after 12 months of unprotected and regular sex. It affects 7% of all men (Loffi F, Maggi M, 2004).

Male infertility is usually caused by testicular damage leading to inability to produce sperm; the damaged testicle will not usually regain its sperm-making abilities (Purvisk, Christiansen E, 1992). 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 dairy, sweet and processed meat, especially with high-saturated fat foods, has favorable association with sperm quality (Daniel N et al 2019). Study also has shown that sperm motility can be change in a short period and seems to be closely coupled to diet (Daniel Natt et al., 2019).

Plants like coconuts, have been used for many studies ranging from treatment of heart diseases to stress reduction (Laurence E et al 2016). Coconuts have also proven to be strong antioxidant, and source of hydration in the prevention of kidney stones and reduction of blood pressure (Saat M et al., 2002, Bhagya D, et al., 2012)

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

Infertility is a growing problem worldwide (Okanufa FE, Odunsi OA, 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 (Boivin J et al., 2007).

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

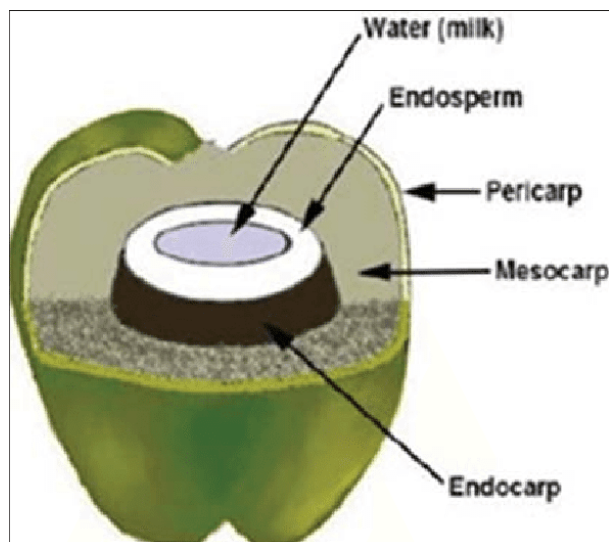
It affects about one in every six couples and researchers estimate about one in every three cases is due to fertility problems in the male partner alone (Brugo-Olmedos, Chilik C, et al., 2001). Also despite the numerous advance methods of treatment, there have been increased number of infertile couples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

Assisted reproduction methods have been developed to overcome infertility. However, due to its cost most couples cannot afford it (Heitman E, 1995).

Fertility incidence has remained very high, despite the increased use of assisted reproductive technologies (ART) in recent years. (Salas-Huktos A, et al., 2017).

In Nigeria, it is estimated that 3-4 million couples were affected by infertility issues (Thomas K D et al., 1995).

In Nigeria, infertility comes with a high financial and physical price for many couples, this has made a lot of couples discontinue from their treatments (Akinoye O, Truter EJ, 2011) which has led to significant increase in psychological trauma among couples (Umezulike A C et al., 2004). Despite its high prevalence, not much efforts has 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 altering fertility related outcomes in both men and women, the current research examining the effect of dairy on fertility is limited in scope. (Cousineau TM et al., 2018).

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. Most recently, the water of immature coconut has been associated with fertility by increasing sperm motility and count (Augustine A. et al., 2019), but no substantial work has been done in consumption of coconut meat which contain the coconut oil and milk. Considering studies done in 2019, the consumption of coconut has increased in Nigeria by over 500% in the past five years ([m-guardian-ng.cdn.ampproject.org/2019](http://m-guardian-ng.cdn.ampproject.org/2019))

#### SAMPLE IDENTIFICATION AND COLLECTION.

Solid dry mature coconut was purchase 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. Healthy Wister rats, two months old and weighing 160-200g were procured from Human Physiology Department, University of Port Harcourt.

**Experimental design.** The animals were randomized and grouped for two(2) weeks in accordance to the method of Morton and Han (Morton D.B, Han J, 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 25C. They were grouped into 4 (n=10 per group)

- Group 1 ( control)
- Group 2 (VCO)
- Group 3 (CM)
- Group 4 (VCO+CM)

The test group (2-4) were feed orally with the extracts while the control were feed 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 plant extracts.** Coconut milk: the coconut were broken, its meat scrapped from the shell and cut into small piece using a sharp knife. The cut pieces were grinded in a grinding machine into viscous slurry and therefore squeezed through cheese cloth (filter) to obtain coconut milk which was put into a glass jar.(Nevin kG, Rajmohan T. 2006). The glass jar containing coconut milk were kept in a refrigerator for preservation.

Virgin coconut oil: This is done by the method as described by Nevin KG and Rajamohan T. (Nevin kG, Rajmohan T. 2006).

The solid matured coconut were crushed manually and the meat was removed and cut into pieces using a sharp knife, the pieces was grinded in a grinding machine into viscous and slurry and therefore squeezed through the cheese cloth to obtain coconut milk. The coconut milk produced was left for 24 hours to aid the gravitational separation of the milk, which was in accordance with (Nevin kG, Rajmohan T. 2006).

Three phases resulted: The lower aqueous phase, a middle emulsion phase and an upper oily phase. The upper oily phase was then decanted 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.

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**The Acute Toxicity test of the study i.e** The minimum dose that is required to cause 50% death of the rat was determined using Arithmetic method of Lorke (Dietrich L.,1983)

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 has recorded in group 8 which was treated with 7000mg/kg. Hence the acute toxicity value obtained by the application of looke's after shown in formula was 4.582.56 mg/kg

**Semen collection and analysis.** The sperm cells were harvested from the testis at the epididymal tissue. The rats were anesthetized by ether and were sacrificed by cervical dislocation and the testis were removed, weighed and macerated in 5mls of warmed buffered normal saline for evaluation. The tissue-free aliquot was loaded onto the Neubauerhaemocytometer (Deep 1/10mm Lambert, Germany). Five squares were counted in triplicate per sample. Sperm count was reported as millions of sperm/ml. ( Saalu LC 2008).

**Statistical analysis.** Data were express as mean+ SEM and their group will be evaluated by one way analysis of variance (ANOVA)

## RESULTS

**Table 1: COMPARISON OF SPERM COUNTS (COUNT/10<sup>6</sup>) IN RATS TREATED WITH COCONUT MILK, VIRGIN COCONUT OIL AND MIXTURE OF VCM + VCO**

GROUP	TREATMENT	MEAN±SEM (Ml/ul/L)	TEST OF SIGNIFICANCE
1	Control (a)	85.48± 3.105	
2	Virgin Coconut Milk (VCM) (b)	45.75±6.520**	aVs b* P<.05
3	Virgin Coconut Oil (VCO) (c)	26.75±12.041**	aVs c* P<.05
4	Mixture of VCM + VCO (d)	84.75± 3.304**	aVs d* P>.05

Mean±SEM marked \* is significantly different from control while means marked \*\* is significantly different from other test.

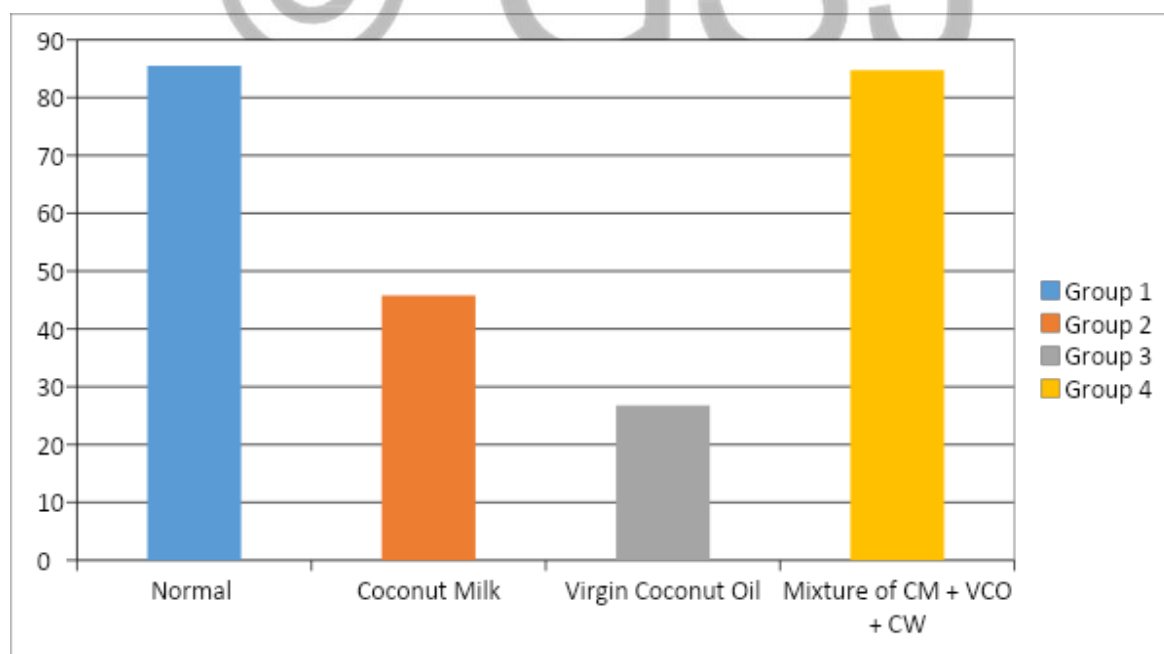


Figure 1: Comparing the Sperm count with different extracts from Cocosnucifera

**Effects of cocos nucifera extracts (VCO, CM) on sperm count**

Effects of *Cocosnucifera* extract on The Sperm Count of the Rat, as represented in table 1 above, the mean values of the sperm count for the control, group 2, 3 and 4 were 85.48± 3.105, 45.75±6.520 and 84.75± 3.304 respectively. Sperm count significantly decrease (P<0.05) due to the effects of the *CocosNucifera* L extracts (CM and VCO) when compared with the control.

The VCO showed a further decrease (P<0.05) when compared to that of CM and CM + VCO. This is illustrated in the figure below.

Furthermore, there was no significant difference from the mixture of VCM + VCO + CW when compared with the control (P>.:05).

**Table 2: COMPARISON OF SPERM MOTILITY IN RATS TREATED WITH COCONUT MILK (CM), VIRGIN COCONUT OIL (VCO) AND MIXTURE OF VCM AND VCO**

GROUP	TREATMENTS	IMMOTILE SPERM (%)	TWITCHING SPERM (%)	MOTILE SPERM (%)	TEST OF SIGNIFICANCE
1	Control (a)	42.20 ± 2.0	26.66 ± 0.60	40.25 ± 5.03	
2	Coconut Milk (450mg/kg) (b)	44.40 ± 3.0	18.72 ± 1.20	24.20 ± 2.0	aVs b* P<.05
3	Virgin Coconut Oil (450mg/kg) (c)	46.80 ± 2.0	16.52 ± 2.2	15.25 ± 1.30	aVs c* P<.05
4	Mixture of CM + VCO (450mg/kg) (d)	44.80 ± 1.5	20.57 ± 1.6	39.92 ± 2.2	aVs d* P>.05

*Mean±SEM marked \* is significantly different from control while means marked \*\* is significantly different from other test.*

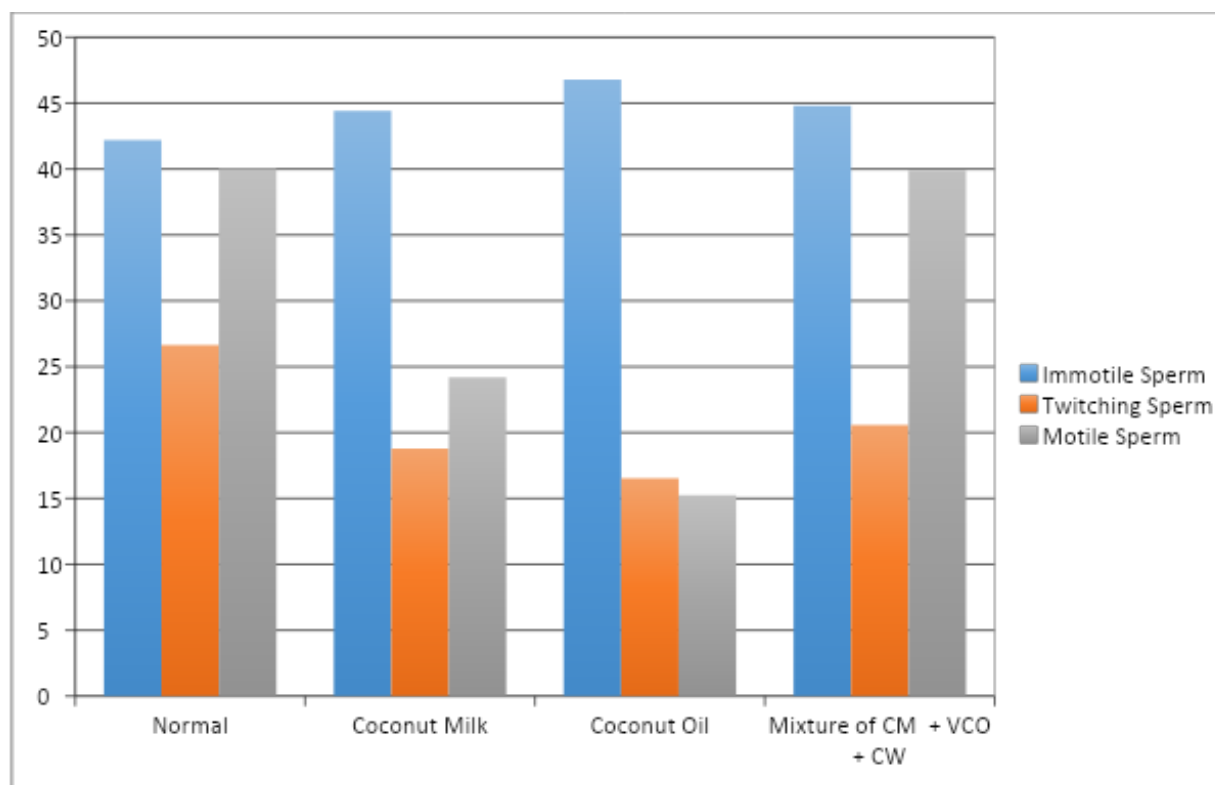


Figure 2 comparison of sperm motility in rats treated with virgin coconut milk (CM), virgin coconut oil (VCO) and mixture of CM, and VCO.

### Effects of *Cocos Nucifera* extracts on sperm motility

Fig. 2 showed the Comparison of sperm motility in rats treated with coconut milk (CM), virgin coconut oil (VCO) and mixture of CM and VCO, there was no significant difference on the immotile sperm of the *Cocosnucifera* extracts when compared to the control. Virgin coconut oil (VCO) showed a significant decrease ( $P < 0.05$ ) of the motile sperm followed by coconut milk when compared with the control

### DISCUSSION

Sperm quality and quantity can be influenced by diet and its effect may be rapid depending on the kind of diets [5] and one of the several factors that can determine sperm quality is sperm motility (Daniel N, 2019). Similarly, diets rich in lipids have been associated with testis maturation, germ cell development and function of the sperm (Nassan F.L, 2018).

In this research study, sperm count and motility in male rats treated with 450mg/kg of virgin coconut oil (VCO) were significantly decreased when compared with the control and other extracts (CM and mixture of CM and VCO). This decrease in sperm count and motility may be connected to the high content of saturated fat in the virgin coconut oil (VCO) given to the animals. This finding is in agreement with previous research work which showed reduced semen quality among young Danish men with high intake of saturated fat after visiting fertility clinic (Tina K J et al., 2013). A similar study by Attanman J et al 2012 showed that 99 men in America had a reduced sperm concentration by 38% in the highest percentile of total fat and saturated fat. In addition (Chavarro JE, 2008) showed that in the highest percentile of saturated fat intake, sperm concentration was reduced to 21% lower than the lowest percentile of saturated fat.

The decrease in sperm motility as seen in this research work might also be linked to saturated fats nature of the extract given to the animals which might have influenced the phospholipid composition of the sperm. This is because lipids like saturated fats are made up of fatty acids with the absence of double bond, monounsaturated fatty acid with a single bond and poly-saturated being two or more double bonds(Hishikawa D,2014).The fluidity, flexibility, fusion and fission of the sperm cell membrane depends on the fatty composition of phospholipids (Hishikawa D, 2017)

Phospholipids with high amount of polyunsaturated fatty acids will increase membrane flexibility due to the multiple bonds whereas saturated fats makes it very rigid causing difficulty in swimming to the ovary(Tohman R and Massanyl P 1997).

It is our belief that the decrease in sperm concentration and motility in our study might be as a result of the presence of high amount saturated fat found in the Virgin Coconut oil extracts.Virgin Coconut milk extracts is preferred to Virgin Coconut oil extracts to improve or burst fertility in men.

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