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Effect of Dietary Supplementation Palm Oil, Palm Kernel Oil and Vitamin E on Testicular Development in Albino Rats

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Abstract
In this study 48 male albino rats having an average body weight of 40±4 g and average age of 3 weeks were used to determine the effects of palm oil (PO) and palm kernel oil (PKO) supplementation on the growth performance and testicular function in albino rats. The rats were divided into four groups of nine rats each and further replicated three times, with three rats per replicate in a completely randomized design (CRD). Group II and III rats were given standard rat feed supplemented with 8 ml/kg of PO and PKO respectively as part of the energy source in their diet. Group I and IV were the control groups and did not receive the oils in their diets, however, 100mg/kg/day of vitamin E was included in the diet of the Group IV rats as the positive control. The effect of freshly included oils on growth performance and testicular development was evaluated after 42 days of feeding at two weekly intervals of samples collection, bearing in mind that the spermatic cycle was 9 – 12 days. Effects on seminiferous tubules were assessed and also epididymal sperm reserves. The group that received PKO not only showed destroyed matured sperm cells but also destroyed developing sperm cells. In the study vitamin E and palm oil showed better result on semen qualities while in body weight palm oil had reduced body weight compared to the palm kernel oil, vitamin E and control groups, where the weights were significantly increased. Also, the histopathological observations showed degeneration in the seminiferous tubule and Leydig cells in the palm kernel oil group especially at the first and second collection. Thus palm oil and vitamin E supplemented daily in diet might be helpful in promoting semen qualities and reproductive performance in animals.

Keywords: Albino rats, palm oil, palm kernel oil, vitamin E, testicular development

Introduction

Palm oil (PO) and palm kernel oil (PKO) are vegetable oils gotten from the seed of the African palm *Elaeis guineensis* and has been a nutritious source of oil for thousands of years (Chandrasekharan 2000; Mukhergee and Mitra, 2009). Palm oil and palm kernel oil are the most common edible oils consumed in southern Nigeria. They are also used in the formulation of poultry and pig diets either directly as energy source inclusions or indirectly as part of palm kernel cake and palm oil sludge. While the effect of palm oil on the physiology of animals such as rats have been studied severally, limited published information are available on similar effects of palm kernel oil.

The objective of this study therefore is to determine the effects of palm oil and palm kernel oil supplementation on the growth performance and testicular function in albino rats.

Materials and Methods

Palm oil (PO), palm kernel oil (PKO) and concentrates used in compounding the rat feed were purchased from local dealers in Umuahia, Abia State. The albino wistar rats used purchased from Ogive Integrated Farms Ltd, Osisioma Abia State. The animals were under standard environmental conditions allowing for acclimatization at temperature of 28±5^{O}C and relative humidity of 55±5% in aluminum cages and light sequence of 12 hours light 12 hours dark phases. Clean water and standard rat mash diet were provided *ad libitum*. All animal experiments were conducted in compliance with animal health guidelines for care and use of laboratory animals.

Thirty six clinically healthy male albino wistar rats weighing averagely 40±14g were randomly grouped into four groups (I - IV), with nine rats in each group. Group II and III were fed standard feed containing 8 mls of PO and PKO respectively as part of the energy source. Group I and IV were the control groups and PO and PKO

were not included in their diets as sources of energy, however 80 mg/ml of Vitamin E was included in the diet of the Group IV as the positive control. The experimental diets formulations are shown in table 1.

After 42 days of treatment, each group was randomly divided into three sub-groups and one animal in each sub-group sacrificed at 14±2 day interval to determine there seminal characteristics and weight gain.

Table 1: Experimental diets formulations

Feed ingredients	*Group I*	*Group II*	*Group III*	*Group IV*
Maize	49	40	40	49
Soybean	15	15	15	15
Wheat offal	32.09	33.09	33.09	32.09
Bone meal	1.5	1.5	1.5	1.5
Lime stone	1.32	1.32	1.32	1.32
Methionine	0.19	0.19	0.19	0.19
Lysine	0.15	0.15	0.15	0.15
Grower premix	0.25	0.25	0.25	0.25
Salt	0.5	0.5	0.5	0.5
Palm oil	-	8	-	-
Palm kernel oil	-	-	8	-
Vitamin e	-	-	-	-
Weight (kg)	100	100	100	100
Energy (kilojoule)	2528.5	2536.09	2537	2528.5
Protein content (%)	16	15.62	15.62	16

Results and Discussion

Semen Quality: The result in Table2 shows that, though, there was no significant ($p<0.05$) effect of the different supplements and duration of feeding on the percent progressive motile spermatozoa, but there were significant ($p<0.05$) interactions between the collection period across the treatment groups. However only palm oil appeared to favour sperm motility, Vitamin E initially favored sperm motility however, overtime there seemed to be a decrease in motility.

Table 2: Effect on gross Motility (%) of the semen

Treatment	Duration (Week)			Treatment effect
	1st Collection	2nd Collection	3rd Collection	
Control	$70.00^{ab} \pm 2.88$	$68.00^{bc} \pm 1.15$	$70.00^{a} \pm 1.15$	70.00 ± 2.34
Palm oil	$72.33^{ab} \pm 6.35$	$75.75^{a} \pm 2.39$	$76.16^{a} \pm 4.38$	75.16 ± 2.34
Palm kernel oil	$60.00^{b} \pm 10.00$	$78.00^{a} \pm 2.00$	$69.40^{ab} \pm 1.58$	68.46 ± 2.34
Vitamin E	$75.00^{a} \pm 2.88$	$80.23^{a} \pm 1.12$	$68.20^{ab} \pm 1.06$	74.47 ± 2.34
Duration effect	69.33 ± 2.02	75.30 ± 2.02	72.94 ± 2.02	

The result as presented in Table 4.2.1 shows that both the different supplements and duration of feeding significantly ($p<0.05$) affected the live weight of the experimental rats while the live weight of the rats in the vitamin E group and palm kernel oil group significantly ($p<0.05$) weighed heavier than the rat in the Palm oil group compared to the control, as these agrees with the report of Ibegbulem and Chikezie (2012) as it recorded higher weight gain in rats fed with palm kernel oil and also the report by Ezekwali (2014) as it reported lower weight gain in rats fed with palm oil thus prescribing palm oil as an important antidote for obesity and weight gain.

Table 3: The Effect of different supplements/duration of feeding on the animal live weight in grams

Treatment	Duration (Week)			Treatment effect
	1st Collection	2nd Collection	3rd Collection	
Control	$187.73^{cd} \pm 4.19$	$207.13^{a} \pm 4.19$	$215.06^{de} \pm 4.19$	$201.97^{a} \pm 2.42$
Palm oil	$153.63^{g} \pm 4.19$	$172.50^{ef} \pm 4.19$	$162.26^{fg} \pm 4.19$	$162.80^{b} \pm 2.42$

Palm kernel oil	$186.80^{bcd} \pm 4.19$	$191.03^{d} \pm 4.19$	$188.93^{cd} \pm 4.19$	$188.92^{a} \pm 2.42$
Vitamin E	$155.26^{g} \pm 4.19$	$203.10^{ab} \pm 4.19$	$199.73^{abc} \pm 4.19$	$186.03^{a} \pm 2.42$
Duration effect	$172.10^{c} \pm 2.09$	$192.19^{a} \pm 2.09$	$183.00^{b} \pm 2.09$	

The result as presented in Table 4 showed that the paired testicular relative weight of the experimental rats in Palm Kernel oil group significantly ($p<0.05$) weighed lesser (1.22%) than 1.38% and 1.34% obtained in Palm oil and vitamin E group respectively despite a better live weight, compared to the control group 1.30%, as this agrees with the report by Hamid *et al.* (2009) as it recorded a better weight in rats whose diet where supplemented with vitamin E and palm oil respectively.

Table 4: Effect on paired testicular weight

Treatment	*Duration (Week)*			*Treatment*
	1st Collection	2nd Collection	3rd Collection	*effect*
Control	$1.31^{abcd} \pm 0.06$	$1.17^{d} \pm 0.06$	$1.44^{abc} \pm 0.06$	$1.30^{ab} \pm 0.04$
Palm oil	$1.41^{abc} \pm 0.06$	$1.47^{ab} \pm 0.06$	$1.25^{bcd} \pm 0.06$	$1.38^{a} \pm 0.04$
Palm kernel oil	$1.21^{cd} \pm 0.06$	$1.23^{cd} \pm 0.06$	$1.23^{cd} \pm 0.06$	$1.22^{b} \pm 0.04$
Vitamin E	$1.42^{abc} \pm 0.06$	$1.12^{d} \pm 0.06$	$1.50^{a} \pm 0.06$	$1.34^{ab} \pm 0.04$
Duration effect	$1.33^{ab} \pm 0.03$	$1.25^{b} \pm 0.03$	$1.35^{a} \pm 0.03$	

The effect on the paired epididymis is presented in table 5. The result showed that the paired relative epididymal weights were significantly ($p<0.05$) affected by the various feed supplements and at different collection. The paired epididymal weight significantly ($p<0.0.5$) weighed lesser 0.35, and 0.34% in Palm oil and Palm Kernel oil groups respectively compared to the vitamin E group (0.44%) which was not significantly ($p>0.05$) different from the relative paired epididymal weight recorded in the control group (0.41%).

Table 5: Effects on paired epididymal weight

Treatment	*Duration (Week)*			*Treatment*
	1st Collection	2nd Collection	3rd Collection	*effect*
Control	$0.28^{ef} \pm 0.03$	$0.42^{cd} \pm 0.03$	$0.55^{b} \pm 0.03$	$0.41^{a} \pm 0.02$
Palm oil	$0.27^{ef} \pm 0.03$	$0.52^{bc} \pm 0.03$	$0.27^{ef} \pm 0.03$	$0.35^{b} \pm 0.02$
Palm kernel oil	$0.22^{f} \pm 0.03$	$0.54^{b} \pm 0.03$	$0.28^{ef} \pm 0.03$	$0.^{34b} \pm 0.02$
Vitamin E	$0.35^{de} \pm 0.03$	$0.67^{a} \pm 0.03$	$0.30^{ef} \pm 0.03$	$0.44^{a} \pm 0.02$
Duration effect	$0.28^{c} \pm 0.01$	$0.53^{a} \pm 0.01$	$0.35^{b} \pm 0.01$	

Conclusion

According to this study vitamin E and palm oil had positive impact on the semen quality compared to the palm kernel oil alone the and control, except on the course of duration where palm oil showed to be better than vitamin E. Rat fed with vitamin E and palm kernel oil significantly weighed heavier than the palm oil group. Paired testicular weight of the palm kernel oil fed rats were significantly higher than the palm oil and vitamin E fed ones, the palm oil and palm kernel oil groups had significantly higher paired epididymal weight than the vitamin E and control groups.

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