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RESEARCH PAPER

THE EFFECT OF *XYLOPIA AETHIOPICA* LEAVES ON BODY WEIGHT AND GROWTH PERFORMANCE

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ABSTRACT

The effect of *Xylopia aethiopica* leaves on body weight and growth performance was studied on growing Wistar rats. The study involved twenty-four rats of comparable sizes and weights ranging from 150 to 300g and divided into four groups of six rats each. Group A served as the control while groups B, C and D served as the test and received 1.2g, 3.0g and 6.0g per day of *Xylopia aethiopica* leaves respectively for 21 days. The feed intake and weights of both the test animal and control were monitored weekly. Results showed that during the 21 days of *Xylopia aethiopica* leaves administrations, the control (Group A) had a greater mean body weight than those of the test groups. On growth performance, the average daily growth increased in the control but decreased in the test groups in a dose dependent manner. On the other hand, the feed conversion rate (FCR) was observed to decrease with time in the control compared to the test groups where it increased with time. Based on the findings of this study therefore, *Xylopia aethiopica* may possibly influence body weight and growth performances.

Keywords: Growth, Feed Conversion Rate, Body weight, *Xylopia aethiopica,* Plants.

INTRODUCTION

Plants and derivatives of plants play a key role in health and have long been known to possess biological activity (Abass, 2012). It is a known fact that thirty percent of all modern drugs are derived from plants and available evidence suggests that approximately 80% of Africans rely on traditional healthcare practitioners and medicinal plants for their daily healthcare needs (Burns, 2000; Johnson *et al.*, 2007; McKay *et al.*, 2007). Also, the World Health Organization (WHO) estimates that almost 75% of the world's population has therapeutic experience with herbal remedies principally because of a belief that herbal remedies may have fewer side effects and can enhance the effects of conventional agents (Liu *et al.*, 2007; Desai *et al.*, 2009).

Of interest is *Xylopia aethiopica*, commonly known as “African guinea pepper” or “Ethiopian pepper”. It is an angiosperm of the Annonaceae family, and grows predominantly in humid forest zones of West Africa (Puri and Talata 1978; Woode *et al*., 2011). In Nigeria, it is found all over the lowland rain forest and most fringe forest in the savannah zones (Sofowara, 1978). It is used as a pepper substitute in Europe and India (Sofowara, 1978) and highly valued in other countries because of its medicinal and pharmacological properties (Okeke *et al*., 2008). The fruits are used as spices and the aqueous decoctions are used especially after child birth, probably due to its antiseptic potential to arrest bleeding (Burkhill, 1985; Okeke *et al*., 2008).

Interestingly, compounds derived from plants could act as potential therapeutic weapons against various human, animal and even plant diseases, and this potential has made plants invaluable and indispensable to human and

animal lives (Ogbonnia *et al.,* 2008). *Xylopia aethiopica* is indeed a plant that has been widely used in traditional medicine and unfortunately, most herbal concoctions are not officially regulated like conventional drugs. This may account for the high prevalence of its misuse and abuse (Riddle, 1992; Onyeyili, 2000; Hashemi *et al*., 2008).

Beyond its therapeutic uses however, *Xylopia aethiopica* has been reported to be widely used as a food supplements (Sofowara, 1978; Evans, 2003; Okeke *et al*., 2008). Moreover, available evidence has shown that every food substance consumed by humans has either a therapeutic, nutritional or toxic effect on the body (Chike and Adienbo, 2010; Uzodike and Onuoha, 2010). In fact, it has been shown that *Xylopia aethiopica* can also induce liver damage (Cotran *et al*., 2005). This study therefore, investigates the effect of *Xylopia aethiopica* leaves on body weight and growth performance using Wistar rats.

MATERIALS AND METHODS

Research design: In all, twenty four adult Albino Wistar rats were used for this study. They were divided into four groups of six rats each. Group A served as the control while group B, C and D served as the test groups. Group A received normal feed and water, while groups B, C and D received 1.2g, 3.0g and 6.0g of *Xylopia aethiopica* leaves respectively. The substance administration was performed daily for 21 days (3 weeks) and the feed intake and weights of both the test animal and control were monitored weekly.

Experimental animals/housing condition: Twenty four (24) adult Albino Wistar rats of comparable sizes and weights ranging from 150 to 300g were procured from the animal farm of Anthonio services Nigeria, Ekpoma, Edo State, Nigeria and transferred to the experimental Laboratory of Anthonio Research Center at No. 40 Ujoelen Extension, Ekpoma, where they were allowed acclimatization for two (2) weeks, in well ventilated wire mesh cages. During this period of acclimatization, the rats were fed with growers' mash from Grand Cereals limited, Zawan Roundabout, Jos, Plateau State, Nigeria, and water was provided *ad libitum*. The animals were maintained and utilized in accordance with the standard guide for the care and use of Laboratory animals.

Study duration: The preliminary studies; procurement (*Xylopia aethiopica* preparation and production), actual animal experiment and evaluation of results, lasted for a period of five months (from September, 2012 to February, 2013). However, the actual administration of *Xylopia aethiopica* to the test animals lasted for 21 days.

Substance of study: Adequate amount of fresh leaves of *Xylopia aethiopica* was collected from a natural habitat at Eke Village of Udi local Government Area of Enugu State and authenticated by a botanist in the Department of Botany Ambrose Alli University, Ekpoma, Edo State, Nigeria.

Substance preparation: The fresh leaves of *Xylopia aethiopica* were spread on a dry table in a ventilated room with total absence of direct sunlight (under a shade) to air dry as described by Fleischer *et al*, (2008). The dried leaves were blended into fine powder using an electric blender. The fine powder was measured using Electric Balance (Denver Company, USA, 200398. IREV.CXP-3000) and packaged in small plastic envelopes and then stored pending usage. The substance preparation process was performed with maximum care in order to avoid any form of contamination and to ensure accurate results.

For the purpose of this study, pastes were prepared by adding measured quantity of *Xylopia aethiopica* powder to feed (grower mesh) and mixed with sprinkles of water as described by Nwaopara *et al.,* (2011). The growth performance, physical observation and feed utilization of the rats were determined at the end of the experiment as described by Dada and Ikuerowo (2009).

Substance administration: The rats were weighed before the administration of the leaves and similar weight measurements were done at the end of each week and the average weight recorded accordingly. The administration of the spices was performed through mixing with feed as follows: Group A (Control) received only normal feed (growers' mash) and distilled water daily for 21days. Group B received 1.2 g (0.2 g per rat) of *Xylopia aethiopica* leaves, 48.8g of feed and distilled water daily for 21days. Group C received 3.0g (0.5 g per rat)of *Xylopia aethiopica* leave , 47.0g of feed and distilled water daily for 21days. Group D received 6.0 g (1.0g per rat) of *Xylopia aethiopica,* 44.0g of feed and distilled water daily for 21days.

Data analysis: Data collected was subjected to statistical analysis using SPSS (version 17). The one way analysis of variance (ANOVA) was performed and the LSD tested while $p<0.05$ was considered significant.

RESULTS

Table 1 presents the summary of notable physical observations and average feed consumption rate during and at the end of the study. Both the control and test groups (B, C and D) presented no observable change in fur colour. On the other hand, there were no comparable changes on the skin, surfaces of the feet, hand, tail, mouth, ears and eyes, but test groups C and D showed aggressive behavioural signs. Similarly, faecal nature (output, texture and quantity) were different amongst the groups. Group A, C and D presented pale, sticky and mucoid stool. The feed intake was observed to be higher in the control group especially in the first week of administration and this observation was statistically significant ($P<0.05$) in group D (35.71± 4.29g) at the end of the second week and group C and D at the end of the third week (30.71± 5.28g and 28.57± 5.20g respectively).

Table 1. Notable physical observations and average feed consumption of rats fed with *Xylopia aethiopica*

OBSERVATIONS		CONTROL	B (1.2g XA)	C(3.0g XA)	D(6.0 g XA)
Fur colour		-	-	-	-
Behavioral changes Skin		-	-	+(aggressive)	+(aggressive)
changes		-	-	-	-
Diarrhoea		-	-	-	-
Death		-	-	-	-
Water rejection		-	-	+	+
Birth		+	-	-	-
Physical agility		Active	Active	Weak	Weak
Feed intake	1	49.29±0.71^{a}	46.43±1.13^{a}	42.14±2.14^{a}	39.29±5.82^{a}
($day^{-1}Gp^{-1}$)	2	48.86±0.55^{a}	45.14±4.29^{a}	37.86±3.06^{a}	35.71±4.29^{b}
	3	47.57±1.45^{a}	44.57±1.60^{a}	30.71±5.28^{b}	28.57±5.20^{b}

Key: + = present; - = negative; XA=*Xylopia aethiopica*; Gp= group. (1, 2 and 3 represents first, second and third week respectively) Values are mean ± Standard error of mean; Values in a row with a different superscript are significantly different at $P<0.05$.

Table 2 presents the body weight changes in the test and control groups. Although at every stage of weight determination, the control group (Group A) showed body weight gains while the test groups (B, C and D) presented body weight loss. Body weights were found to be significantly increased in the control and tests groups at baseline (before acclimatization) and after acclimatization. However, variations in body weight gain and weight loss were observed between the control and test rats respectively. Comparatively, these body weight variations at different weeks of the experiment were significant in group D (242.17 ±22.67g) and B (161.17 ± 7.40g) at the end of the first and second week respectively. Also, significant differences were also observed in groups B (153.83±4.45) and C (180.83±13.38) at the end of the third week of the experiment.

Table 4.2: Body weight changes of rats fed graded doses of *Xylopia aethiopica* at various intervals

WEIGHT	CONRTOL (n=6)	B(1.2XA) (n=6)	C(3.0XA)(n=6)	D (6.0XA)(n=6)
B/4 ACCL	170.33±11.53^{a}	152.50±12.16^{a}	186.33±7.83^{a}	241.17±13.89^{b}
AFACCL	190.50±15.35^{a}	170.17±25.06^{a}	198.83±6.60^{a}	264.67±21.25^{b}
1WK	195.83±10.03^{a}	166.17±10.40^{a}	192.67±4.18^{a}	242.17±22.67^{b}
2WKS	204.67±9.75^{a}	161.17±7.40^{b}	187.50±5.73^{ab}	227.17±22.10^{a}
3WKS	216.67±8.33^{a}	153.83±4.45^{b}	180.83±13.38^{b}	204.50±4.90^{ab}

Values are mean ± Standard error of mean, Wt= weight (grams); XA= *Xylopia aethiopica*; Accl= Acclimatization, WKS=Weeks; B/4 accl= Before Acclimatization; Afaccl= After Acclmatization; PV= P-value; PV= P-value; n: Number of sample. Values in a row with a different superscript are significantly different at $P<0.05$

Table 3 presents the growth performance and feed conversion rate (FCR) of rats fed with *Xylopia aethiopica* leaves. Weight gain (WG), percentage weight gain (%WG) and average daily growth (ADG) in the control increased while

that of the test groups (B, C and D) decreased with increase in dosage of *Xylopia aethiopica* leaves. Feed conversion ratio decreased in the control group when compared with the test groups that presented increases in FCR. In addition, while weight gain and percentage weight gain increased in the control group (Group A), it decreased in the test groups (Group B, C and D) with time (first, second and third weeks). Comparatively, the feed conversion ratio decreased with time in the control group while it increased in the test groups.

Table 3. Growth performance and feed conversion of rats fed graded doses of *Xylopia aethiopica* at various interval.

PARAMETERS		CONTROL (n=6)	B (1.2g XA) (n=6)	C(3.0g XA) (n=6)	D(6.0g XA) (n=6)
Weight gain	1	5.33	-4.00	-6.16	-22.50
	2	14.17	-9.00	-11.33	-37.50
	3	26.17	-16.34	-18.00	-60.17
%Weight gain					
	1	2.72	-2.35	-3.10	-8.50
	2	6.92	-5.29	-5.70	-14.17
	3	12.08	- 9.60	-9.05	-22.73
ADG(g)	1	0.76	-0.57	-0.88	-1.21
	2	1.01	-0.64	-0.81	-1.01
	3	1.25	-0.78	-0.86	-1.08
FCR	1	9.25	-11.61	-6.84	-1.75
	2	3.45	-5.02	-3.34	-0.95
	3	1.82	-2.73	-1.71	-0.47

Key: (1, 2 and 3 represents first, second and third week respectively); Wt. gain= final wt. - initial wt.; % weight gain = (final wt. - initial wt. / initial wt.) x 100; Average daily growth (AVG) = final wt. - initial wt. / number of days; Feed conversion ratio (FCR) = feed intake (g)/ body weight gain (g); initial wt.= Wt after acclimatization.

DISCUSSION

The results of this study suggest that dietary inclusion of crude *Xylopia aethiopica* leaves influences body weight and the growth rate of Wistar rats. Similar findings have been reported by Chike and Adienbo (2011), Woode *et al*., (2012) and Eze (2012) on weight. Specifically, Chike and Adienbo (2011) reported that the decrease in body weight was attributable to the active ingredients of the extract. According to Woode *et al*., (2012), the reduction in body weight was due to the xylopic acid content of the extract.

In this study also, it was observed that the control group had the best growth response (combination of WG, %WG and ADG) despite the finding that group D (fed 6.0g XA) had the highest FCR amongst the test groups. The decrease in growth performance at high FCR appeared to have affected the body weight negatively; and the degree to which this factor contributed to this effect is dose and duration dependent as shown by the result of this study (Table 2 and 3). This agrees with the finding by Adefegha and Oboh (2012) who attributed the reduction in weight following *Xylopia aethiopica* ingestion, to the reduction in the average feed intake.

Considering also, the linkages between obesity, diabetics and hypolipidemia (Ameyaw and Owusu-Ansah, 1998; McCue and Shetty, 2004; Ogbonnia, 2008), a clue may be drawn. In fact, the fruits of *Xylopia aethiopica* has been reported to have anti-oxidant and hypolipidemic properties (Ameyaw and Owusu-Ansah, 1998; Ogbonnia, 2008). It has also been reported that *Xylopia aethiopica* reduces cholesterol and hence, could play a part in weight reduction. This is in line with the reports by Nwozo *et al*., (2008), Nnodim *et al*., (2011), and Adefegha and Oboh, (2012).

In fact, Xylopic acid (an acid derived from *Xylopia aethiopica*) has been identified to decrease serum total cholesterol while increasing High Density Lipoprotein (HDL) cholesterol. The activity of the *Xylopia aethiopica* extract in decreasing both Total Cholesterol (TC) and Low Density Lipoprotein (LDL) cholesterol was earlier reported by Woode *et al*., (2011). In fact, LDL molecules are the major transporters of cholesterol in the

bloodstream and are considered ''bad cholesterol'' because they carry fats out of the liver to the blood vessels and seem to encourage the deposition of cholesterol in the arteries. The observed significant decrease in LDL, TC and triacylglyceride, which in essence increased HDL level, signifies that *Xylopia aethiopica* is a potential hypolipidemic agent (Abass, 2012) and may further explain its popular addition in herbal remedies for diabetes mellitus (Ogbonnia, 2008), and in hypolipidemic therapies (Woode *et al*., 2011). Interestingly, a recent study revealed that *Xylopia aethiopica* serves as hypoglycemic agent (Ameyaw and Owusu-Ansah 1998), which may explain the weight reduction and possibly the dose dependent growth retardation observed in this study.

Furthermore, *Xylopia aethiopica* also has been reported to have anti-androgenic properties due to the presence of xylopic acid (Abass, 2012) and androgens are known to possess anabolic properties (Chowdhury and Steinberger, 1975). This could also be responsible for the observed significant decrease in body weight of the study animals. Based on the finding of this study therefore, *Xylopia aethiopica* may possible influence body weight and growth performance rate.

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AUTHORS' CONTRIBUTIONS

All authors (Obodo B.N., Iweka F.K.,Obhakhan J.O., Oyadonghan G.P. Agbo G.E.) contributed to the completion of this study and were actively involved in the presentation of this manuscript.