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RESEARCH PAPER

WEIGHT CHANGES AND GROWTH PERFORMANCE IN SPRAGUE DAWLEY RATS FED DIET CONTAINING GRADED DOSES OF *CARICA PAPAYA* SEEDS

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ABSTRACT

Carica papaya is not left out among plants reported to be of herbal and therapeutic importance. Hence, this study investigates the effect of ingestion of *Carica papaya* seeds on weight gain and growth in growing Sprague Dawley rats. The study involves 40 growing rats (95.0 ± 10.0 grams) within the ages of 7 ± 1weeks. They were divided into four groups of two stages; A (control; n = 5), B (n = 10), C (n = 10) and D (n = 10). The rats were fed varying doses of powdered *Carica papaya* seed (6, 8, 10grams). Animal weights were measured before and after acclimatization (2 weeks); after three weeks (acute; Stage 1); and 6 weeks (chronic; Stage 2). The data obtained were compared using the ANOVA at $P \leq 0.05$ level of significance. At all stages of weight determinations, Group A, B, C and D presented body weight gain from the preceding weight. Comparatively, those of Group B, C and D were lower during the pre-treatment periods (3 weeks and 6 weeks) and presented the most retarded growth impact in a dose depended fashion. The observations suggest *Carica papaya* seeds may have weight reduction potentials and may induce growth retardation.

Key words: Weight, growth, *Carica papaya* seed, Herb.

INTRODUCTION

The genus *Carica papaya* Linn (pawpaw) is the most widely cultivated and best known species of the four genera that belongs to a small family called *Caricaceae* (Krishna et al., 2008). In Nigeria, pawpaw is one of the most popular and economically important fruit tree grown and consumed for its nutritional content (Baiyewu and Amusa, 2005). Its ripe fruit is cooked as soup with melon seeds and other spices (Gill, 1992). According to Puangsri, et al. (2005), the seeds account for about 16 % of the fruit weight and each made up of sarcotesta and endosperm.

Several medicinal properties have been attributed to the fruit and seed extracts of *Carica papaya* which include; anti- ulcer (Hewitt et al., 2002), anti-fertility (Lohiya, et al., 2008), antibacteria (Emeruwa, 1982) and nephro-protective (Olagunju, et al., 2009) effects. As well as its use in the treatment of urinogenital disorder (like trichomoniasis) (Calzada et al., 2007) and as a diuretic (Sripanidkulchai et al., 2001). Previous human studies have shown that *Carica papaya* slows down the heart beat and reduce blood pressure (Gupta *et al*., 1990).

On the other hand, the increase prevalence of obesity in the general population has become an issue of public concern. Interestingly, Krishna et al. (2008) has suggested that *Carica papaya* is a preferred fruit for obese people considering weight reduction due to its comparative low calories content. Hence, judging by the fact that as many as 80% of the world's population depend on traditional medicines for their health care (Azaizeh et al., 2003), and the growing interest in alternative therapies with economic considerations, we hypothesize that adding *Carica papaya* seed to diet might influence weight. This study therefore, investigates the effect of graded doses of unripe *Carica papaya* seeds powder on body weight and growth performance in growing Sprague Dawley rats.

MATERIALS AND METHODS

Experimental Animals: Forty Sprague Dawley rats of 7 ± 1 week old and weights ranging from 95.0 g to 105.0g and comparable sizes were procured from the animal house of the College of Medicine, Ambrose Alli University, Ekpoma, Nigeria. They were moved to the site of the experiment at No. 23 St. Mary Street, Ekpoma, where they were allowed 2 weeks of acclimatization.

Substance of Study: Unripe *Carica papaya* was collected from the premises of the animal house, College of Medicine, Ambrose Alli University, Ekpoma, and authenticated by a botanist in the Department of Botany, Faculty of Natural Science, Ambrose Alli University, Ekpoma.

Substance Preparation: The outer peel of unripe Carica papaya was removed and the seeds obtained and sun dried. The dried seeds were then crushed into fine powder using 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 feeds (grower mesh) produced by Grand Cereals Ltd, a subsidiary of UAC of Nigeria Plc, Jos, Plateau State, were weighed using a goat scale weighing balance (China).

For the purpose of this study, pellets were prepared by adding measured quantity of *Carica papaya* to feed (grower mesh) to add up to 50 grams as described by Nwaopara et al. (2011).

Animals Grouping: The experiment involved two stages; stage one (1) which lasted a period of 3 weeks (acute test) and stage (2) which lasted a period of 6 weeks (chronic test). The animals were assigned into eight groups of 5 rats each: Group A1 and A2 served as the acute and chronic control respectively. Group B1, C1 and D1 served as the acute test while group B2, C2 and D2 served as the chronic test.

Experimental design: The animals were weighed on the first day of the acclimatization period and fed 50 grams of feed with water giving *ad libitum*. They were housed in well ventilated labeled wooden cages at the site of the experiment. The cages were designed to secure the animals properly especially from wild animals/insects and cleaned daily.

Administration: The preliminary studies, animal acclimatization, ingredients procurement (Carica papaya preparation and production), actual animal experiment and evaluation of results, lasted from October, 2011 to February, 2012. However, the actual administration of *Carica Papaya* to the test animals lasted for 6 weeks (acute: 3 weeks; chronic: 6 weeks).

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Stage 1 administration: Group A1 (control group) received 50.0g of feed and distilled water alone. Test Groups B1 to D1 received as follows; 44.0g feed, distilled water plus 6g of CP; 42.0g feed, distilled water plus 8g of CP; 40.0g feed, distilled water plus 10g of CP respectively. Stage 2 administration: All the groups in stage two received as stated for stage 1; the difference is that the feeding period lasted for six weeks unlike stage 1 which lasted for 3 weeks.

Sample Collection and Analysis: Weight was measured before and after acclimatization, similar weight measurements were done at the end of the acute and chronic treatment periods and the average recorded accordingly.

The growth performance and feed utilization of the rats were determined at the end of the experiment as described by Steffens (1981) as in Dada and Ikuerowo (2009).

The obtained data were then subjected to statistical analysis using SPSS (version 17). The test groups' values were compared with the values of the control group using ANOVA (LSD) at 95% level of confidence.

RESULTS

Table 1 presents the summary of notable physical observations and average feed consumption rate during and at the end the study. The test groups presented change in fur colour compared to the control and that before the study. On the other hand, there were no comparable changes in behavior pattern, skin surfaces on the feet, hand, tail, mouth, ears and eyes. Similarly, fecal nature (output, texture and quantity) were not different in the entire groups. However, one death was recorded in group A2. An unexplainable (idiopathic) dead occur in the control of stage 2 (A2). The feed intake was observed to be higher in the test group particularly in groups D1 and D2, though this observation was not statistically significant ($p>0.05$).

Table 1: Notable physical observations and average feed consumption of rats fed *Carica papaya*

Observations	Stage	Control Group A	Test groups		
			B (6g CP)	C (8g CP)	D (10g CP)
Fur colour	1 2	- -	- +	+ ++	+ ++
Behavioral Changes	1 2	- -	- -	- -	- -
skin surfaces changes	1 2	- -	- -	- -	- -
Diarrhea	1 2	+ -	+ -	- -	- -
Death	1 2	_ + (1)	_ _	_ _	_ _
Feed intake ($day^{-1}Gp^{-1}$)	1 2	42.37±4.22 41.11±4.72	44.31±3.12 42.31±5.22	44.63±4.71 44.31±3.19	46.17±3.37 45.53±4.11

Key: + = present; - = negative; CP= Carica papaya; Gp= group

Table 2 shows the body weight changes in the test groups. Although at every stage of the weight determinations, the entire groups (A1/A2, B1/B2, C1/C2 and D1/D2) presented body weight gains. Body weights were similar in the control and tests groups at baseline (before acclimatization) and after acclimatization. However, variations in body weight gain were observed between the control and test rats. Comparatively, these body weight variations were significant in group D1 (134.13 ± 5.25g), C2 (152.25 ± 2.71g) and D2 (151.25 ± 4.56g).

Table 2: body weight changes of rats fed graded doses of *Carica papaya* at various interval.

Stages of weight measurement	Control Group A	Test groups		
		B (6g CP)	C (8g CP)	D (10g CP)
Weight. Before Acclimatization	102.85 ± 4.98^{a}	101.39 ± 5.17^{a}	103.97 ± 5.33^{a}	100.68 ± 6.68^{a}
Weight. After Acclimatization	112.71 ± 5.09^{a}	111.25 ± 2.76^{a}	111.75 ± 4.98^{a}	113.25 ± 3.11^{a}
Weight. After acute ingestion CP	140.86 ± 6.26^{a}	137.00 ± 4.99^{ab}	137.38 ± 4.41^{ab}	134.13 ± 5.25^{b}
Weight. After chronic ingestion of CP	160.86 ± 8.11^{a}	155.75 ± 6.09^{ab}	152.25 ± 2.71^{b}	151.25 ± 4.56^{b}

Values are mean ± SD, Wt= weight; CP= Carica papaya; value in a row with different superscripts are significantly different at $P < 0.05$.

Table 3 presents the growth performance and feed conversion rate (FCR) of rats acutely and chronically fed unripe *Carica papaya* seeds diet. While weights gain (WG), percentage weight gain (%WG) and average daily growth (ADG) decreased with increased dosage of *Carica papaya* seeds, feed conversion ratio increased. In addition, while weight gain and percentage weight gain increase with time (acute versus chronic), average daily growth and feed conversion ratio (FCR) decreased with time.

Table 3: Growth performance and feed conversion of rats fed graded doses of *Carica papaya* at various interval.

Parameters	Stage	Control Group A	Test groups		
			B (6g CP)	C (8g CP)	D (10g CP)
Wt. gain (g)	1 2	28.15 48.15	25.75 44.50	25.63 40.50	20.88 38.00
% weight gain	1 2	24.98 42.72	23.15 40.00	22.94 36.24	18.44 33.55
Average daily growth (g)	1 2	1.34 1.15	1.23 1.06	1.22 0.96	0.99 0.90
Feed conversion ratio	1 2	1.51 0.85	1.72 0.95	1.74 1.09	2.21 1.20

Wt. gain= final wt. - initial wt.; % weight gain = (final wt. - initial wt. / initial wt.) x 100; Average daily growth (g) = final wt. - initial wt. / number of days; Feed conversion ratio = feed intake (g)/ body weight gain (g); initial wt.= Wt after acclimatization.

DISCUSSION

The present results show that dietary inclusions of unripe seed powder of *Carica papaya* decreases the weight gain and growth rate of growing Sprague Dawley rats. As earlier reported by Afolabi et al. (2011) and Adeneye and Olagunju (2009) on weight. Similarly, fetal weight has been reported to depreciate in *Carica papaya* ingestion (Oderinde et al., 2002; Raji et al., 2005) and was suggested it may adversely effect fetal development (Raji et al., 2005).

The mechanism of this decrease in weight gain by the ingestion of *Carica papaya* seed is yet to be determined. However, in the study of Afolabi et al. (2011) the decrease in body weight was reported to be due to the food or water rejection caused by their reduced palatability, diet-induced anorexia, or systemic toxicity as reported by Abdulazeez, et al. (2009). Interestingly, the result of the study shows that the best overall growth response (combination of WG, %WG and ADG) was obtained in the control group even when it was observed that group D1 and D2 (fed 10g CP) had the most FCR. In accordance to this finding, weight loss without decreased feed intake has been documented (Wight et al., 1987). The decrease in growth performance at high FCR appeared to have affected weight gain 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). Hence, our findings support the suggestion by Krishna et al. (2008) that *Carica papaya* seed may be considered as weight reducing regimen. The inhibition of lipoprotein lipase activity, increased energy expenditure, inhibition of nutrient absorption from the gastrointestinal tract, and suppression of the appetite (Dyer, 1994) are some likely reasons for the reductions in body weight and growth retardation upon feeding on unripe *Carica papaya* seed.

Furthermore, considering the linkages between obesity and hypertension, diabetics and hyperlipidemia (Modan *et al*., 1985; NCEP, 1990), a clue may be drawn. This is based on the fact that *Carica papaya* seed and fruit is a popular herbal remedy for traditional antidiabetic (Danese et al., 2006; Gbolade, 2009), antihypertensive (Eno et al., 2000), and antihyperlipidemic theraphy. (Banerjee et al., 2006). Similarly, a recent study revealed that *Carica papaya* is an intermediate glycemic index food (Robert et al., 2008), which may explain the weight reduction and possibly growth retardation with increased consumption.

Based on our findings therefore, *Carica papaya* may increase feed intake and feed conversion ratio, but this does not translate into enhanced growth rate and weight gain.

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AUTHORS' CONTRIBUTIONS

Bankole J.K. supervised this study. Dikibo E. and Onokhua V. actively took charge of the daily experimental animal care, substance administration to test animals, and data collection; while Eidangbe AP, Aremu AO and Uhumnwangho EJ, provided the necessary technical and financially assistance. All the authors contributed towards the successful presentation of this report.