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EFFECTS OF FRESH JUICES OF *ANANAS COMOSUS* (PINEAPPLE) AND *CARICA PAPAYA* (PAW PAW) ON GASTRO INTESTINAL MOTILITY

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ABSTRACT

The sweet tastes of *Ananas comosus* and *Carica papaya* fruits coupled with acclaimed health benefits may be the reason for their wide spread consumption. In this study the effects of the juices on the Amplitude and number of rhythmic contractions of an isolated Rabbit jejunum were studied and results obtained along with that of standard parasympathomimetic and sympathomimetic agents were compared to basal values. In the work, fasted Rabbits were euthanized by stunning and the jejunum was carefully isolated. 2-3cm of this tissue was cut and mounted in a $35cm^3$ organ bath supplied with oxygen and maintained at 37^0C. Graded doses of Acetylcholine, Noradrenaline, *Ananas comosus* juice and *Carica papaya* juice were administered at different times. The procedure was repeated five times to obtain mean Amplitudes and number of contractions per minute. Acetylcholine increased both Amplitude and number of contractions while Noradrenaline reduced same. Fresh juice of *Ananascomosus* increased Amplitude of contraction while fresh juice of *Carica Papaya* fruit decreased both Amplitude and number of contractions per minute. *Ananas comosus* may have achieved this effect by enhancing the activity of endogenous Acetylcholine, disrupting the activity of calcium channel and inhibiting endogenous myosin phosphatase, while *Carica papaya* juice may have achieved relaxation of the jejunum due to its effect on adrenergic receptors or by inhibition of the activity of endogenous Acetylcholine. The resultsobtained agree with popular use on *A. comosus* juice but fail to agree completely on *C. papaya* juice.

KEYWORDS: Acetylcholine, Adrenaline, *Ananas comosus*, *Carica papaya*, Jejunum, Parasympathomimetic, Sympathomimetic

INTRODUCTION

The fact that the tropics into which majority of Africa lies is host to about $^2/_3$ of the world's flora and fauna means a lot of medicinal plants including herbs and fruits can be found here for curative or at least management of diseases (Sofowora, 1993). Global statistics have indeed revealed the increasing importance of medicinal plants, fruits and other plants products as alternative medicine in most countries. In fact the wide-spread use of these plants and their products is gradually replacing orthodox finished pharmaceutical products for reasons of cost, tradition, culture and effectiveness. Indeed it is estimated that about 80% of the world's population is relying on medicinal plants and their products (Primela, 1985). Fruits including *Ananas comosus* and *Carica papaya* are therefore generally consumed because of their medicinal values (Upendra, *et al.,* 2009).

Ananas comosus (Pineapple) is a tropical plant with edible fruit consisting of coalesced berries. It is cultivated from a crown cutting of the fruit and flowers possibly in 20-24 months and fruiting in the following 6 months. It isaherbaceous perennial which grows up to 3.3 – 4.9ft high with short stem and tough leaves. Ikeyi, *et al., (*2013),

reported that phytochemically the juice contains saponins, glycosides, flavonoids and tannins with numerous vitamins and minerals including Vitamins B_1, B_2, B_3, B_5, B_6, B_9, C, and Calcium,Magnesium, Phosphorus, Potassium, Sodium and Zinc. The ability of pineapple juice to aid digestion informs its use as a diet for delayed stomach emptying (Gastroparesis) (Frank, 2014).

Caricapapaya is a large woody herb that is often mistaken for a tree which may easily grow up to 10 – 12 feet. The plant is relatively short-lived, averaging 5 – 10 years. *Carica papaya* fruits has been reported to contain Carbohydrates, natural fruit sugars, Acids, Fiber, vitamins A, B_1, B_2, B_3, B_6, C, E, K and Beta carotene, with minerals including Iron, Zinc, Magnesium, Calcium, Copper and Selenium (Ikeyi et al., 2013). The juice has been used as a topical treatment for warts, cancers, tumors and hard skin. A paste of pawpaw when applied to Bee stings is said to take the pain away immediately. The fresh fruits are also eaten to treat rheumatism (Kassidy, 2012).

The widespread consumption of *A. comosus* and *C. papaya* fruits for health promotion and treatment of some gastrointestinal diseases is the motivation for this invitro study which seeks to find out the effects of fresh juices of the fruits on the Amplitude and number of contractions per minute of the intestine using the rabbit jejunum, a tissue with pronounced inherent rhythmic contractions. This is with a view to providing more data on the effects of the fruits on intestinal motility and possible mechanisms involved.

MATERIALS AND METHODS

Collection of Fresh *ananas Comosus* (Pineapple) and *Carica Papaya* (Pawpaw) Fruits and Extraction of Juice

Fresh ripe pineapple and pawpaw fruits were obtained from local fruits dealers in Ahia-eke fruit market, Umuahia North Local Government area of Abia State. The fruits were washed thoroughly with distilled water and allowed to drain water freely. For each fruit, the epicarp was removed and the fruit was juiced using a manual juicer to obtain 480ml of juice for an 850g weighted *Ananas comosus* fruit and 420ml of juice for a 789g weighted *Carica papaya* fruit. The juices was kept refrigerated until needed.

Animals

Six adult male Rabbits (2.5 –3.5kg) obtained from the livestock production unit of the Department of Veterinary Physiology and Pharmacology, Michael Okpara University of Agriculture, Umudike, were used for the study. The rabbits were fed with standard feed with water ad libitum but starved for 12 hour prior to experiments. The study was conducted in the Physiology laboratory of the Department of Veterinary Physiology and Pharmacology, Michael Okpara University of Agriculture, Umudike.

Preparation and Dilutions of Standard Drugs

The standard drugs Acetylcholine and Noradrenaline were prepared and diluted using the method of Arthur (2012). In this method,1g of each standard drugs was dissolved in 10ml of distilled water to give a stock concentration of 1×10^{-1}g/ml. Serial dilutions were subsequently made from the stock to obtain lower concentrations.

Final Bath concentrations (FBC) were calculated using the method expressed by Arthur (2012)

$$FBC = \frac{C_1V_1}{C_2}$$

Where

C_1 = Initial drug concentration

V_1 = Initial drug volume

V_2 = Final volume (volume of Organ bath)

Effects of *Ananas comosus* and *Carica papaya* Juices on the Rhythmic Contractions of the Rabbit Jejunum

Each fasted rabbit was euthanized by stunning in compliance with the guideline for care and use of laboratory animals. The jejunum was isolated and was transferred into a beaker containing tyrode solution maintained at 37^0C in a water bath and oxygenated via an electronic aerator. About 2 – 3 cm of the jejunum was cut and mounted in a 35ml organ bath containing tyrode solution and supplied with oxygen and adequate temperature. The mounted tissue was allowed to equilibrate for 15 minutes after which dose response relationships were established to standard drugs (Acetylcholine and Noradrenaline). The effects of increasing volumes of fresh juices of *Ananas comosus* and *Carica papaya* were also tested and tracings were recorded using the Physiograph and its accessories. The entire procedure was repeated 5 times using the remaining 5 rabbits.

Statistical Analysis

Results were expressed as Means $\pm$ standard error of Means (SEM). Statistical analysis was performed by one-way analysis of variance (ANOVA). Students t-test at 95% level of significance was used to assess significant differences between Amplitude and number of contractions in Basal and treated tissues.

RESULTS

Effects of Acetylcholine, Noradrenaline, *A. Comosus Juice* and *C. Papaya* Juice on the Amplitude of Contractions of the Rabbit Jejunum

Acetylcholine, a cholinergic agonist produced its usual dose dependent increase in the Amplitude of contractions of the rabbit jejunum with mean maximum Amplitude recorded when 0.1ml of 1 x 10^{-3}g/ml was administered to the tissue. This dose raised the amplitude of contraction from 7.00 $\pm$ 0.00mm in basal to 31.50 $\pm$ 0.43mm. Noradrenaline on the other hand reduced the amplitude of contraction as 0.1ml of 1 x 10^{-3}g/ml lowered amplitude from 7.00 $\pm$ 0.00mm in basal to 0.33 $\pm$ 0.21mm. The effects of Acetylcholine Noradrenaline were significantly different from the basal activity of the jejunum. Fresh juice of *A. comosus* produced a dose dependent increase in Amplitude with maximum height of 21.17 $\pm$ 0.60 recorded when 0.5ml of the juice was administered. The Amplitude due to *A. comosus* juice was significantly ($p<0.05$) different from the basal value and was dose dependent. *C. papaya* juice produced a dose dependent lowering of Amplitude of jejenal contraction with 0.5ml of the juice lowering the Amplitude from 7.00 $\pm$ 0.00mm in basal to 1.33$\pm$ 0.33mm.

Effects of *A. comosus* and *C. papaya* on Number of Rhythmic Contractions of the Rabbit Jejunum

Acetylcholine increased the number of contractions per minute while Noradrenaline lowered same. Both effects are significantly ($p<0.05$) different from the basal values. Higher volumes of *A. comosus* juice increased the number of contraction per minute while all doses of *C. papaya* juice significantly ($p<0.05$) lowered the number of contractions per minute when compared to basal values.

Table 1: Effects of Fresh Juice of *Ananas comosus* and *Carica papaya* on the Amplitude Rhythmic Contractions of Rabbit Jejunum

Vol. (ml) and Conc. (g/ml) of Ach & NA	Vol. in ml of Pineapple &Pawpaw Juice	Basal Amplitude (mm)	Amplitude in Response to Ach. (mm)	Amplitude in Response to NA (mm)	Response to Pineapple Juice (mm)	Response to Pawpaw Juice (mm)
0.1 of $1x10^{-7}$	0.10	7.00±0.00	11.33±0.43*	4.50±0.34*	9.83±0.31*	5.83±0.31*
0.1 of $1x10^{-6}$	0.20	7.00±0.00	16.17±0.48*	2.83±0.31*	13.83±0.31*	4.33±0.42*
0.1 of $1x10^{-5}$	0.30	7.00±0.00	22.00±0.38*	1.00±0.37*	18.00±0.37*	2.67±0.33*
0.1 of $1x10^{-4}$	0.40	7.00±0.00	25.67±0.49*	0.33±0.21*	18.83±0.54*	2.00±0.37*
0.1 of $1x10^{-3}$	0.50	7.00±0.00	31.50±0.43*	0.33±0.21*	21.17±0.60*	1.33±0.33*

* = $p<0.05$ when compared to basal Amplitudes
Ach = Acetylcholine
NA = Noradrenaline

Table 2: Effects of Fresh Juice of *Ananas comosus* and *Carica papaya* on the Number of Rhythmic Contractions of the Rabbit Jejunum

Vol. (ml) and Conc. (g/ml) of Ach & NA	Vol.(ml) of Pineapple & Pawpaw Juice	Basal Number	Acetylcholine	Noradrenaline	Pineapple Juice	Pawpaw Juice
0.1 of $1x10^{-7}$	0.10	14.00±0.00	16.67±0.33*	9.00±0.52*	16.33±0.42*	12.83±0.48*
0.1 of $1x10^{-6}$	0.20	14.00±0.00	20.33±0.42*	9.00±0.37*	14.83±0.40	10.83±0.40*
0.1 of $1x10^{-5}$	0.30	14.00±0.00	30.50±0.62*	0.00±0.00*	14.83±0.40	8.50±0.34*
0.1 of $1x10^{-4}$	0.40	14.00±0.00	35.33±1.08*	0.00±0.00*	18.17±0.31*	8.17±0.48*
0.1 of $1x10^{-3}$	0.50	14.00±0.00	38.83±0.60*	0.00±0.00*	19.00±0.37*	6.33±0.33*

* = $P<0.05$ when compared to basal number of contractions per minute
Ach = Acetylcholine
NA = Noradrenaline

DISCUSSIONS

The dose dependent increase in both Amplitude and number of rhythmic contractions produced by Acetylcholine on the Rabbit jejunum is typical of both endogenous and exogenous Acetylcholine and other parasympathomimetic agents (Guyton and Hall, 2002; Sembulingam and Prema, 2009). This result obtained corroborates with existing literature which reports that the increase in Amplitude and number of contractions observed at the administration of Acetylcholine on the isolated rabbit jejunum is due to the binding of the drug molecules to the numerous muscarinic receptors present in the smooth muscles of the jejunum (Rang *et al.*, 2007). Noradrenalin on the other hand reduced the Amplitude and number of rhythmic contractions. This was due to the binding of the drug molecules to the adrenergic receptors in the smooth muscles of the isolated jejunum (Katzung, 1995). Fresh juice of *Ananas comosus* in creased motility in the isolated tissue. This is evidenced by the increased Amplitude of rhythmic contractions.

The effect of *A. comosus* juice was similar to that of Acetylcholineand suggests that *Ananas comosus* juice may contain active principles capable of triggering the release of endogenous Acetylcholine, disrupting the activation of calcium ion channels (Jorg et al, 2006) and inhibiting the activity of endogenous myosin phosphatase, a chain of mechanisms which mediate increase in peristaltic contractions of the intestines (Ohama *et al.*, 2007; Fei, *et al.*, 2012; Jan and Wim, 2009). This is because activation of smooth muscle L – type calcium channel may mediate gastrointestinal and autonomic dysfunction in intestines leading to disruption of motility (Jackson, *et al.*, 2004; Moukarzel and Sabri, 1985). It is also on record that *Ananas comosus* juice contains bromelain, a proteolytic enzyme which has been implicated in both uterine and intestinal contractions (Ikeyi et al., 2013). This activity of *A. comosus* juice is the bane of its

use in promoting digestion and bowel movement. No wonder Frank, (2014), prescribed that the juice should be taken to treat gastroparesis, a condition characterized by delayed stomach bowel movement and constipation.

Carica papaya fruit juice lowered both Amplitude and number of rhythmic contractions per minute when tested on the Rabbit jejunum. An effect which is similar to that of no radrenaline. This may appear to conflict with the popular believe that pawpaw fruit promotes bowel movement but reveal that the bowel movement usually experienced with the consumption of Pawpaw fruits may be attributed of its fiber content, since it is reported that the fruit has high fiber content (Kassidy, 2012). Hence, the juice alone may not contain any intestinal motility enhancing component. It is therefore reasonable to suggest that the relaxation caused by *Carica papaya juice* on the intestine slows down intestinal transit and allows ample time for proper digestion of consumed food. This, coupled with its hydration properties may be the rationale for its use as a laxative and an agent which enhances digestion.

Conclusively, results obtained from this work agrees with popular believe on the use of *A. comosus* (pineapple) juice as an agent which aids digestion and promote bowel movement, but appear to disagree on *Carica papaya* (Pawpaw). However when *Carica papaya* (pawpaw)fruit is to be used for the purpose of bowel movement, it should be consumed along with the fiber because the juice alone will cause intestinal relaxation and may not be useful in managing indigestion, delayed bowel movement and cons

REFERENCES

1. Fei k., Praven, K.Y., Liu, Z.J, (2012). Mechanisms involved in L-type Calcium Channels. Saudi J. Gastroenterol. 18(1): 3-10.
2. Frank W. J. (2014). Gastrointestinal diets for delayed stomach emptying. JACKSON SIEGELBAUM Gastroenterology. Specialists in the health and diseases of the digestive system.
3. Guyton, A.C. and Hall, J.E (2002). Textbook of Medical Physiology 10th Edition. Published by Elsevier, a division of Reed Elsevier Indi Private Limited, Main Ring Road Lajpat Nagar – iv, New Delhi.
4. Ikeyi, A.P., Ogbonna A. O., Iraine, D.E and Ike, A.O (2013). Phytochemical Analysis of Pineapple fruit (*Ananas comosus*) and fluted pumpkin leaves.
5. Jackson M.W. (2004). Disrupting intestinal motility by a calcium channel stimulating autoantibody in type 1 diabetes. Gastroenterology. Mar. 126 (3), 819-28. *Elservier Science*.
6. Jan, D.H., Wim, J.L (2009). Gntperistalsis is governed by a multitude of cooperating mechanisms. *American Journal of physiology, Gastrointestinal and Liver Physiology* Vol. 296 No 61-68.
7. Jorg, W.W., Schulla, V.S., Koller, A., Norbert, K., Robert, F., and Franz, H (2006) Control of intestinal motility by L-type Calcium channel in Mice. FASEB journal. 20:1260-1262. www.fasebj.org.
8. Kassidy, E. (2012). The Health benefits of eating Pawpaw fruit www.rodale.com
9. Moukarzel, A.A; Sabri, M.T (1996). Gastric Physiology and Functions: Effects of Fruit Juices. JAM Coll. Nutr. Vol. 15 (5 suppl.): 185-253.
10. Ohama, T., Hori, M., Ozaki, H. (2007). Mechanism of Abnormal intestinal motility in inflammatory bowel disease: How smooth muscle contraction is reduced. *Journal of Smooth Muscle Research* 2007 43(2): 43-54.

11. Premila, P., Duangth, K., Finn, S. and Roberth, V. (1985). Hypotensive activity of some Tabernaemontana Alkaloids. *Journal of Ethnopharmacology.* Vol 13 pg 165.

12. Sembulingam, K. and Prema, S. (2009). Essentials of Medical Physiology 2nd Edition. Pp 912-913

13. Sofowora, A (1993). Medicinal plants and Traditional Medicine in Africa 2nd Edition pp 7, 100-109.

14. Upendra, B., Akash, Y., Narneet, A., Durga, J., Indranil, K.Y., Hari, P.S., Dinesh, C. and Jain, D.A (2009). Hypnotic effects of essential oil and methanolic extracts of fruits of Zanthoxylum budrungaw. *International Journal of Pharm Tech. Research CODEN (USA)* Vol. 1, No 4, PP 1494 – 1498.