Acceptability of African Palm Weevil *(rynchophorus Phoenicis)* Incorporated Pie in a University in the Niger Delta Region of Nigeria

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ABSTRACT

***Background:** The world is recently promoting the innovative inclusion of insects as ingredients in human diet, as part of tackling food insecurity and actualizing zero hunger. Edible insect species especially the African Palm Weevil, Rynchophorus phoenicis is available, affordable and forms the integral part of diets for several communities in Nigeria.*

***Objective:** The acceptance of edible larvae incorporated pie was determined in a university in the Niger Delta region of Nigeria.*

***Methods:** Edible larvae were sourced, processed and incorporated into pie. This was labelled A (unconventional pie) and served as treatment for the experiment. Conventional pie (meat) was labelled B (served as control). A semi-structured questionnaire with attributes that influenced 500 consumer's choice was used. Hedonic test was conducted and responses were obtained.*

***Results:** Female respondents (77%) predominated the acceptance of edible worm pie (mean age of 23.73 years) and majority of which were single, undergraduate students and not financially stable. Over 50% of the respondents had knowledge of edible insects and had tasted them against 16% and 39% who lacked knowledge and have never tried edible insect respectively. Chi-square test show that age ($p= 0.996$ and 0.873), gender ($p= 0.877$ and 0.851), marital status ($p= 0.828$ and 0.672), economic status ($p= 0.959$ and 0.714), occupation ($p= 0.833$ and 0.542), and level of education ($p= 0.999$ and 0.815) attributes did not differ significantly ($p>0.05$) with willingness to eat and smell test samples. Most consumers were willing to continue eating the unconventional pie incorporated with the edible insect, undermining the taste and smell.*

***Conclusion:** More hedonic studies are required to expand the focus of insect inclusion in familiar products and the choice of their acceptance.*

Keywords: Acceptance, Consumers, Edible insects, Foods.

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INTRODUCTION

The world is recently experiencing series of changes in population growth and regulation processes in food legislation that threaten the security of quality food, dietary patterns and actualization of the sustainable development goal such as zero hunger. There is strong evidence that edible insects are the right ingredients that can be incorporated into familiar food products in order to tackle food insecurity [1, 2]. The inclusion of insects into human diets could take the form of

pastries, cookies, pastas, pies, flours, candies, bars, chocolates, amongst other viable forms and drinks such as alcoholic and beverages. Human-mediated efforts have driven the innovative incorporation of some confirmed edible insect species consumed by regions into familiar food across the globe especially in Asia-Pacific region. The study of [3], [4], and [5] included insects such as crickets, and African palm weevil in biscuits, cookies and other fortified forms. In Nigeria, African palm weevil, crickets, termites and many other insects are eaten whole as delicacies. Although the quantity of edible insect harvest and local consumption is underrepresented in scientific literature. A study has it that some consumers have displayed some sense of dissatisfaction and disgust with edible insect consumption, thus, informing their innovative inclusion in familiar diets [6]. This disgust factor is recognized in some developed countries such as America, Australia, Canada, Austria, Belgium, amongst others [7]. The European Union, for instance, forbids the harvest, processing, trading and consumption of whole insects as food [8]. Undermining the limited information on insect acceptance in Europe and other Western world, it is worthy to note that about 2 billion people consume over 2000 species worldwide [9]. More of which is practiced in over 3000 ethnic groups in African, Asian and Latin American countries [6, 10]. Studies have established the nutritional information of most notable edible insect species and their advantages over livestock production [2, 11-12]. For instance, insects under the Order Orthoptera and Coleoptera are rich in B-vitamins, folic acid and iron [2, 13]. Others in the Order, Lepidoptera, Isoptera and Hymenoptera are potential food resources in many areas [14]. Whole snack packs of cricket (*Acheta domesticus*), honeybee (*Apis mellifera*), domesticated silkworm (*Bombyx mori*), mopane caterpillar (*Imbrasia belina*), African palm weevil (*Rhynchoporus phoenicis*) and yellow meal worm (*Tenebrio molitor*) are commercialized [14-15].

African palm weevils, (Coleoptera: *Rhynchophorus* sp.), are the most consumed edible larvae in tropical Africa countries especially Nigeria [16]. As the common name implies, the larvae inhabit mostly palms and sometimes coconut trees, where they are highly distributed [17]. Basically, two species of palm weevils are known and consumed including *Oryctes* sp. (tough skinned) and *Rhynchophorus* sp. (soft skinned) [18]. Indeed, their blind inclusion into food has become a concern for the advocacy of novelty food products globally. The successful acceptance of novel food of insects could put off the prevailing fear factor of trying or continued consumption [2]. It has been noted by [19] that humans have in one way or the other consumed insects directly by eating whole or indirectly by eating insect infested foods. Interesting as it may sound, not all the world population may agree to accept edible insect products, as such this demands gradual assessment and sensitization. Although, the historical precedence of insects has justified that they were alternative options in traditional diets [20], and that their adoption had cultural and religious backings [15, 21]. Consumers are sometimes discouraged by a number of factors outlined by some studies. A study by [22] observed that swarms of insects could trigger superstition in some individuals, thus influencing acceptance and allergic reactions [23]. More so, the practice of eating insects is ascribed to the poor who cannot afford meat [24], and possibilities of food borne pathogens has been raised [25]. For instance, the association of bacteria with *Orcytes monoceros* and *R. phoenicis* grubs has been established [26]. Apart from incorporating African palm weevil into food, their nutritional characteristics and performance has been established by [27-28]. Furthermore, the global evidence supporting insect incorporated food in the grocery stores for human choices can lead to sustained population growth, reduced dependence on common foods, and changes in dietary patterns in coming decades. There is no study that assessed consumer acceptance of African Palm weevil incorporated pie in Nigeria. Therefore, this study determined consumers' acceptance of pies incorporated with African palm weevil in Delta State University, Abraka. To fulfill this objective, we relied on staff and students because it was observed that these groups snack for lunch and by

way of improving the quality of pies, African Palm weevil was blindly incorporated. Their responses were highly important to establish the large scale production and trade of the pies in the university and environs.

MATERIALS AND METHODS

Study Area and Population

The study was conducted in Delta State University, Abraka, Delta State, Nigeria. The university is situated in Abraka (Main campus) with one annexes at Oleh. The Abraka campus is divided into three sites with the school hostels located in site II and III. The population of this study includes students, academic and nonacademic staff and visitors, who may likely not be students.

Species Collection and Production

Live African palm weevil (edible larvae) were sourced from a well-known vendor at Eku and Sapele towns, Delta State, Nigeria. The edible larvae were washed, degutted, dried unsalted, milled and preserved in the refrigerator at 4°C before incorporation.

Study Design

The blind sampling method was adopted for this study using a semi-structured questionnaire sectioned into six including; socio-demographic characteristics, taste and smell of samples, willingness to take a bite, consumer acceptance, frequency of exposure to insects, knowledge and attitude of participants on insects. The quota sampling techniques was equally adopted to collect representative samples from the university [29]. The representatives were divided into subgroups with regards to 'gender', 'occupation' and 'age'. Respondents above the age of 18 years were included. This study adopted the university environment because consumer studies for new products should focus on the young age group. Five hundred participants were selected for this study to consider their choice on acceptance of either unconventional or conventional pies. Five hundred pieces of sample A and another for sample B were produced. Every participant took sample A and B on their right and left hand respectively without knowing their contents. Participant had a bite to determine which tasted and smelt better. It was almost not easy to measure consumer acceptance and as such the empirical model was used to determine the choice of consumers whether they accept or do not accept the product. The ingredients for the two sets of pies were;

Sample A: (Unconventional pie: test group) flour, ground edible worm, Irish potatoes, sugar, butter, salt and other condiments.

Sample B: (Conventional pie: control group) flour, meat, Irish potatoes, sugar, butter, salt and other condiments

At the end of the hedonic test and response obtained, participants were informed on what constituted the samples.

Questionnaire

The questionnaire for this study was designed with modifications from the unpublished master thesis by [30]. Five hundred questionnaires were administered to respondents and their responses were obtained and kept confidential. Questionnaire was sectioned into socio-demographic characteristics, taste and smell of samples, willingness to take a bite, consumer acceptance, frequency of exposure to insects, knowledge and attitude of participants on insects. Financially stable is referred to those with a job or business that earn stable income at least greater than ten thousand naira (approximately $ 20) while the financially unstable respondents were those without a job or business and are financially dependent make below five thousand naira (< $10).

Taste and willingness to take a bite

Each respondent was opportune to taste sample A and B, and decide their willingness to eat and continue eating. Majority of the consumers attested that the samples tasted and smelt well (93% respectively), and choose sample A, the regular meat pie over the edible worm pie (sample B). They equally affirmed that both samples were attractive and the unconventional pie incorporated edible worm had a new taste. A high proportion of the respondents were willing to continue eating the regular pie and agreed to try new products with edible insects in the nearest

future (Table 3). More so, 67% of the consumers confirmed that the samples smelt differently. The variables had $_2\chi$ value of 100.71 and were highly significant ($P < 0.0001$).

Table 1: Questionnaire for respondents

Category 1	**Category 2**
1. How would you measure the taste?	9. What is your knowledge on edible insect consumption?
a. Taste well	a. I have never heard of eating insects
b. Do not taste well	b. I have heard about a few edible insects
2. Which taste better?	c. I have heard of edible insect and I don't know what it is
a. Sample A	d. I have heard of edible insect and I know what it is
b. Sample B	10. What is your exposure frequency to edible insect?
c. Both	a. I have never tried edible insect
3. How would you measure the appearance?	b. I have tried edible insect once
a. Attractive	c. I have tried edible insect occasionally
b. Not attractive	d. I try edible insect regularly
4. Identify attractive and non-attractive sample(s):	11. Will you accept edible insect snack if mass produced?
a. Sample A	a. Yes
b. Sample B	b. No
c. Both	12. Will you accept edible insect food in the nearest future?
6. How would you measure the smell?	a. Yes
a. Smells nice	b. No
b. Smells bad	13. I am willing to continue eating:
7. Does it smell different?	a. Sample A
a. Yes	b. Sample B
b. No	c. Both
8. If yes, which smells different?	14. I am willing to try any new food from edible insect
a. Sample A	a. Yes
b. Sample B	b. No
c. Both	

Age: Male/female, Gender: Single/married/divorced/widowed, Occupation: Student/Staff/None, Level of Education: None/Undergraduate/Graduate/Postgraduate/Professional degree, Economic status: Financially stable/unstable. Category 1: Item 1,2,3,4,5,6,7,8; Category 2: Item 9, 10,11,12,13,14.

Table 2. Consumer's characteristics, knowledge and exposure frequency to regular and edible larvae incorporated pie

Variables	**Mean± SD**
Age	23.73 ± 6.99
Variables	**Frequency, *n* (%)**
Gender	
Female	385 (77.00)
Male	115 (23.00)
Marital Status	
Single	420 (84.00)
Married	80 (16.00)
Divorced	0 (0.0)
Level of Education	
No Education	0 (0.0)
Undergraduates	330 (66.0)
Graduates	135 (27.0)
Postgraduates	35 (7.0)
Occupation	
Staff	120 (24.0)
Students	380 (76.0)
None	0 (0.0)
Economic status	
Financially unstable	310 (62.00)
Financially stable	190 (38.00)
Knowledge of edible insect	
I have never heard of eating insects	80 (16.00)
I have heard about a few edible insects	100 (20.00)
I have heard about edible insects but don't know them	50 (10.00)
I have heard of edible insects and I know them	270 (54.00)
Frequency of exposure to edible insects	
I have never tried edible insect	195 (39.00)
I have tried edible insect once	130 (26.00)
I try edible insect occasionally	125 (25.00)
I try edible insects regularly	50 (10.00)

Data analysis

Questionnaires were coded, cleaned, checked for possible errors and corrected prior to analysis. Chi-square test to determine the significant difference between socio-demographic factors and the taste and smell of samples, willingness to take a bite, and consumer acceptance of edible insect incorporated pies. Data analysis was performed using IBM ® SPSS ® Statistical Software (Version 23). Statistical significance was set at $p \leq 0.05$. Fisher's exact test was equally used to determine p-values within variables.

Results

Consumer's characteristics, knowledge and exposure frequency

Of the 500 respondents administered the edible larvae pie and conventional pie, females predominated (with a mean age of 23.73 years), this consisting of 77% of the participants. Majority of the respondents were single, undergraduates, students and financially unstable (Table 2). Over 50% of the consumers have heard of edible insects and have adequate knowledge on what they are. However, only 16% of the respondents lacks prior knowledge on edible insects. Furthermore, over 50% of the consumers have tried edible insects on a single occasion, occasionally and regularly. Only 39% have not tried edible insects (Table 2).

Table 3. Taste and willingness to eat and continue eating unconventional pie incorporated edible worm and conventional pie.

Variables	Frequency *n* (%)	P-value
Measure of taste		
Taste well	465 (93.0)	0.001**
Do not taste well	35 (7.0)	0.02*
Choice of sample taste		
Sample A	280 (56.0)	0.001**
Sample B	155 (31.0)	0.184
Both Samples	65 (13.0)	0.003*
Choice of attractive sample		
Sample A	195 (39.0)	0.559
Sample B	90 (18.0)	<0.0001**
Both Samples	215 (43.0)	<0.0001**
Identification of new taste		
Sample A	95 (19.0)	<0.0001**
Sample B	360 (72.0)	<0.0001**
Both Samples	45 (9.0)	<0.0001**
Willingness to continue eating		
Sample A	250 (50.0)	0.047*
Sample B	115 (23.0)	0.001*
Both Samples	135 (27.0)	0.336
Willingness to try new edible insect product		
Yes	325 (65.0)	0.654
No	175 (35.0)	0.881
Measure of taste		
Smell nice	465 (93.0)	0.001**
Smell bad	35 (7.0)	0.02*
Determining smell		
Yes smells different	335 (67.0)	0.881
No don't smell different	165 (33.0)	0.654

NB: * shows significance and ** highly significant.

Consumer acceptance

Female consumers that were less than 25 years of age, single, financially unstable, students that were undergraduates responded that they will accept edible insect pies if mass produced and made available in the nearest future. There were no significant differences within the consumer's responses and divorce ($p<0.05$). Female consumers in between 25 and 35 years of age, singles, financially unstable, and undergraduate students attested that the edible worm incorporated pie smelt nice. More so, males within this same group of age attested that the edible incorporated pie smell bad. The differences between the responses was not significant ($p>0.05$). Similar trend was observed for the taste of edible worm incorporated pie except that the financially stable confirmed that the pie tested better. The differences were equally not significant ($p> 0.05$).

Table 4. Taste and willingness to accept edible insect pie with socio-demographics

Variables	Frequency, *n* (%)	χ^2 - value	p-value
Taste well		0.39	0.621
Female	355 (76.3)		
Male	110 (23.7)		
Do not taste well			
Female	30 (85.7)		
Male	5 (14.3)		
Taste well		0.15	0.811
< 25yrs	170 (36.6)		
25-35	175 (37.6)		
36-45	75 (16.1)		
> 45yrs	45 (9.7)		
Do not taste well			
Less than 25yrs	20 (57.1)		
25-35	15 (42.9)		
36-45	0 (0.0)		
Greater than 45yrs	0 (0.0)		
Taste well		0.71	0.418
Single	410 (88.2)		
Married	55 (11.8)		
Divorced	0 (0.0)		
Do not taste well			
Single	10 (28.6)		
Married	25 (71.4)		
Divorced	0 (0.0)		
Taste well		0.041	0.922
Financially stable	275 (59.1)		
Financially unstable	190 (40.9)		
Do not taste well			
Financially stable	35 (100.0)		
Financially unstable	0 (0.0)		
Taste well		0.31	0.713
Student	380 (81.7)		
Staff	85 (18.3)		
None	0 (0.0)		

Do not taste well			
Student	0 (0.0)		
Staff	35 (100.0)		
None	0 (0.0)		
Taste well		0.29	0.726
No Education	0 (0.0)		
Undergraduate	300 (64.5)		
Graduate	130 (28.0)		
Postgraduate	35 (7.5)		
Do not taste well			
No Education	0 (0.0)		
Undergraduate	30 (85.7)		
Graduate	5 (14.3)		
Postgraduate	0 (0.0)		
Will accept if mass produced		0.024	0.877
Female	240 (73.9)		
Male	85 (26.1)		
Will accept in the future			
Female	270 (75.0)		
Male	90 (25.0)		
Will accept if mass produced		0.06	0.996
<25yrs	160 (49.2)		
25-35	85 (26.1)		
36-45	60 (18.5)		
> 45yrs	20 (6.2)		
Will accept in the future			
< 25yrs	180 (50.0)		
25-35	90 (25.0)		
36-45	70 (19.4)		
> 45yrs	20 (5.6)		
Will accept if mass produced		0.047	0.828
Single	285 (87.7)		
Married	40 (12.3)		
Divorced	0 (0.0)		
Will accept in the future			
Single	320 (88.9)		
Married	40 (11.1)		

Divorced	0 (0.0)		
Will accept if mass produced		0.003	0.959
Financially stable	125 (38.5)		
Financially unstable	200 (61.5)		
Will accept in the future			
Financially stable	140 (38.9)		
Financially unstable	220 (61.1)		
Will accept if mass produced		0.044	0.833
Student	280 (86.2)		
Staff	45 (13.8)		
None	0 (0.0)		
Will accept in the future			
Student	310 (86.1)		
Staff	50 (13.9)		
None	0 (0.0)		
Will accept if mass produced		0.027	0.999
No Education	0 (0.0)		
Undergraduate	245 (75.4)		
Graduate	60 (18.5)		
Postgraduate	20 (6.1)		
Will accept in the future			
No Education	0 (0.0)		
Undergraduate	275 (76.4)		
Graduate	65 (18.1)		
Postgraduate	20 (5.5)		

CONSUMER ACCEPTANCE

Female consumers that were less than 25 years of age, single, financially unstable, students that were undergraduates responded that they will accept edible insect pies if mass produced and made available in the nearest future. There were no significant differences within the consumer's responses and divorce ($p<0.05$). Female consumers in between 25 and 35 years of age, singles, financially unstable, and undergraduate students attested that the edible worm incorporated pie smelt nice. More so, males within this same group of age attested that the edible incorporated pie smell bad. The differences between the responses was not significant ($p>0.05$). Similar trend was observed for the taste of edible worm incorporated pie except that the financially stable confirmed that the pie tested better. The differences were equally not significant ($p> 0.05$).

Table 5. Smell of samples with socio-demographics

Variables	Frequency, *n* (%)	χ^2 - value	p-value
Smell nice		0.057	0.851
Female	380 (81.7)		
Male	85 (18.3)		
Smell bad			
Female	5 (14.3)		
Male	30 (85.7)		
Smell nice		0.069	0.873
< 25yrs	110 (23.7)		
25-35	235 (50.5)		
36-45	75 (16.1)		
> 45yrs	45 (9.7)		
Smell bad			
< 25yrs	15 (42.8)		
25-35	15 (42.8)		
36-45	5 (14.3)		
> 45yrs	0 (0.0)		
Smell nice		0.47	0.672
Single	370 (79.6)		
Married	95 (20.4)		
Divorced	0 (0.0)		
Smell bad			
Single	30 (85.7)		
Married	5 (14.3)		
Divorced	0 (0.0)		
Smell nice		0.23	0.714
Financially stable	205 (44.1)		
Financially unstable	260 (55.9)		
Smell bad			
Financially stable	5 (14.3)		
Financially unstable	30 (85.7)		
Smell nice		0.64	0.542
Student	380 (81.7)		
Staff	85 (18.3)		
None	0 (0.0)		

Smell bad			
Student	30 (85.7)		
Staff	5 (14.3)		
None	0 (0.0)		
Smell nice		0.097	0.815
No Education	0 (0.0)		
Undergraduate	295 (63.4)		
Graduate	140 (30.1)		
Postgraduate	30 (6.5)		
Smell bad			
No Education	0 (0.0)		
Undergraduate	30 (85.7)		
Graduate	5 (14.3)		
Postgraduate	0 (0.0)		

DISCUSSION

This present study indicated that half of the consumers had adequate knowledge of edible insects and have tried it on a single occasion. This is not surprising because the study was conducted in a community where whole edible worm consumption is common. The findings of this study showed that majority of the respondents (54%) had prerequisite knowledge of the edible worm which corroborated with the study of [31], who equally reported that majority of the respondents (88%) had adequate knowledge and had consumed some kind of edible insects. Similarly, [32], in this respect, showed that more than 80% of the consumers in their study had eaten termites before, and around 97% of them reported that they have heard edible insects being consumed in Kenya. However, [33] reported that majority of the participants in their study (89.5%) had never tried edible insects as against 10.5% who had consumed. Although in this present study, the knowledge of consumers on edible worm was lower than those reported in some other areas. This could be due to differences in geographical locations. The consumers who indicated familiarity with eating insects were more likely to accept edible worm incorporated pie compared to those who had never tried it. This observation corroborates the study of [34] which indicated that people who claim to be familiar with eating insects were about three times more likely to adopt insect foods than those who said they have never heard of it.

Consumer assessment of food is not only based on potential pro-health benefits but on sensory features which directly influenced consumer choices and selection [35]. Among the sensory properties, taste and smell are the most easily evaluated and an important determinant of food quality [36]. On the aspect of taste, attractiveness and willingness to eat and continue eating, majority of the respondents chose the conventional pie incorporated meat over the unconventional pie incorporated edible worm. Taste, smell and attractiveness influenced consumers' choice of pie and willingness to continue. This is parallel to the observation made in the study of [29], who showed that the same proportion of people who liked the taste of insect products 30%, also disliked it 30%, and this contradicts the findings by [37], on sensory analysis of cookie made with meal worm (*Tenebrio molitor*). The taste of cookie incorporated meal worm attracted the most

positive attitude and choice. The reduced choice of edible larvae pie, due to its novel taste and smell, in this study may be as a result that participant's consumption of whole insect is low. It is not yet certain that the consumption of the unconventional pie would be higher in future as most respondents (>70%) indicated willingness. Human population may be cajoled into trying insect products when edible species of insects are blindly incorporated into familiar products as observed by [38]. This present study is not left out as it blindly incorporated insects into ready to eat pie and this encouraged the willingness to try the edible insect pie. [39] reported that the presence of whole insect in products like pies may significantly increase preference to taste in communities where eating edible insects were encouraged. For other consumers, processing makes the insects invincible and reduces the aversion or disgust associated with consumption of the whole insects [38]. The willingness to try new edible insect product in this study was high. This suggests that new products of insects may have consumer acceptance higher than those recorded in this study when industrially produced with a given trade mark. The willingness recorded in this study corroborate the study of [10], showed that after the hedonic test, people were willing to try out insect based foods in the nearest future. It however did not agree with the study of [40] on consumers' willingness to eat insects in Italy, where consumers were generally unwilling to eat insect-based food.

Due to acceptability in this study, it was observed that staff and students snack a lot at noon in order to compensate for lost calories. Female consumers (mostly undergraduate students and the financially unstable) agreed to accept edible worm pies if mass produced. This does not imply that acceptance of edible worm pies were driven by hunger. The financially unstable respondents in this study referred to financial dependent individuals which included some students. The finding of this study on females having higher consumer acceptance is in concordance with the study of [41], which recorded that potential consumers accepted processed mealworms in fried snacks over 50%, and thus, completely in disagreement with the study of [42], who showed that Italian consumers were not ready to accept insect as foods. A study has shown that some countries in the North of Europe such as Belgium [43] and the Netherlands [44] have shown a relatively high acceptance for edible insects. One possible explanation for this is the fact that Belgium has recently become the first EU country to officially approve the sale of 10 species of insect at the end of 2013 [30]. Also, insects are now being stocked in main supermarkets in Netherlands, due to liberalization laws [30]. The higher acceptance among young consumers in this study may be due to fact that young people were audacious, adventurous and open to new experiences [44]. The young consumers known as the Generation Z may also be willing to try edible insects based on the environmental benefits of using this protein sources compared to animal based products [39].

CONCLUSION

This study revealed that edible worm pies were accepted among consumers in Delta State University, Nigeria. Younger consumers (18-35 years) appeared to be more receptive to consuming edible worm pies. Novel food products involving insects can adopt this age groups. The taste and attractiveness were observed to cause some sense of dissatisfaction. It is hereby recommended that:

i. Taste and attractiveness should be enhanced by the addition of flavours and more ingredients
ii. Consumers should have adequate knowledge of any insect based food products they intend to consume
iii. Edible worm pie should be incorporated into the food diet through the school feeding programmes.Other insects should be incorporated in other forms of snack to reduce malnutrition
iv. Education and enlightenment programmes should be held on the benefits of embracing insect food products.

Declarations':

Ethics Approval and Consent to Participate

Not Applicable

Consent for publication

The authors have declared the publication of this manuscript in your journal. Please contact any of us via email when necessary.

Availability of Data and Material

All the data are analyzed and presented in the article

Competing Interests

The authors declare no competing interest

Funding

Not Applicable

Authors' Contributions

CC conceived and designed the study. CC and VN collected the field data. VN analyzed the data. CC and VN interpreted the analyzed data, wrote and reviewed the manuscript. All authors read and approved the final manuscript.

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