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Psychosocial determinants of intentions and behaviour towards edible insects in the South-Western part of the Democratic Republic of Congo

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Abstract: Insect consumption provides a solution to the issue of decreasing food security. Despite these benefits, their acceptance by some consumers as a source of human food remains the main obstacle to their consumption. The present study focuses on three locations in the Democratic Republic of Congo (provinces of Kinshasa, Grand Bandundu and Kongo Central) in a context of food shortage. We examined the socio-demographics, socio-cognitive (Theory of Planned Behaviour, TPB), determinants of intentions and insect consumption, and the additional contribution of emotional associations in a sample of 537 participants (mean age = 34.88, SD = 12.39, 47% females). There was a higher consumption in Kinshasa (M = 4.58; SD = 1.62) and in Grand Bandundu (M = 4.36; SD = 1.54), as compared with Kongo Central (M = 2.29; SD = 1.45). Greater insect consumption was associated with a lower education level, when living in Kinshasa or Kongo central, when attitudes, perceived control and intentions to consume were higher, and when participants experienced lower levels of fear and repulsion towards insects. The results provide insights to better understand the determinants of low consumption in Kongo

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Central. They also suggest that most TPB dimensions could be potential targets for future interventions that aim to increase insect consumption.

Subjects: Health Psychology; Social Psychology; Psychological Science

Keywords: Theory of Planned Behaviour; entomophagy; intention; insect consumption; D.R. Congo; emotions

The consumption of edible insects by humans (entomophagy) provides a solution to decreasing food security due to the increase of population, with more than 9 billion people in 2050. Several studies have demonstrated the importance of consuming edible insects to address the scarcity of quality food (Gallen & Pantin-Sohier, 2015) and the nutritional value of insects (Godfray et al., 2010; Okangola et al., 2016; Pal & Roy, 2014). These studies also demonstrate the role of beliefs towards entomophagy in predicting insect consumption (Gallen & Pantin-Sohier, 2015).

Insect consumption is a relatively common practice in certain regions of Africa in general and in the Democratic Republic of Congo (DRC) in particular. However, it still faces many obstacles. In the context of Central Africa, two studies addressed barriers related to emotions and social representations. Negative emotion such as fear and negative social representations in some ethnic groups or tribes can limit or prohibit insect consumption (Balinga et al., 2004; Mabossy-Mobouna et al., 2013). Given the key role of insect consumption, it is essential to unveil the factors that influence this behaviour. In this light, this study has four principal objectives: 1. To understand the differences in the consumption of edible insects between three study regions in the DRC, the province city of Kinshasa and the provinces of Grand Bandundu and Kongo Central; 2. To identify the role of sociodemographic variables in predicting entomophagy; 3. To evaluate the role of socio-cognitive factors on the intention and consumption of edible insects in western southern DRC; 4. To evaluate the additional role of emotions on insects consumption. To our knowledge, no study has been conducted in DRC to identify the psychological and social factors that influence consumer attitudes and behaviours towards insects. There are significant reasons for choosing the three locations (Kinshasa, Grand Bandundu and Kongo Central) in the southwest of DRC. The first reason is that the three locations are involved both in caterpillar natural and industrial production (Grand Bandundu and Kongo Central) and in caterpillar consumption (particularly Kinshasa and Grand Bandundu). The second reason is an opportunity choice. The researchers for this project work in Kinshasa where the UNIKIN university is located. It was therefore easier to reach participants from the neighboring provinces, with Grand Bandundu and Kongo Central being the provinces closest to Kinshasa. These locations, however, differ regarding the attitudes and intentions for insect consumptions, which provide an interesting comparison opportunity. Production and consumption are also high in other provinces such as Equator, but the accessibility is difficult due to the lack of infrastructure.

1. Context of study

The DRC is one of the few regions in the world where insects have been consumed for a very long time despite the fact that there is little literature on the subject (Bomolo et al., 2017). The Congo Basin hosts one of the richest reservoirs of insect species (Lr Payne et al., 2016). In the context of a food and economic crisis such as the one experienced in the DRC, food takes on an essentially quantitative connotation, i.e. people eat to satiate themselves without taking into account its nutritional value. Households turn to the least expensive and high-calorie products at the expense of protein-rich foods, resulting in unbalanced diets (Duquesne et al., 2010). This imbalance is increased by an influx of imported products, often of questionable nutritional quality, but at very competitive prices and responding to new dietary practices of urban consumers (Duquesne et al., 2010). To offset this increased demand for animal proteins and reduce the consumption of imported products, the consumption of insects is proving to be an indispensable alternative in DRC due to their nutritional value.

The large survey of the current study (January until March 2019) was preceded by a pilot study conducted in August 2018 in Kinshasa (Manwanina Kiumba et al., In press). We investigated individual factors (attitudes, perceived control, intent) and collective ones (subjective norms) that can affect insect consumption. The results showed that the majority (82.8%) consumed insects on average once a week. The main reasons for consumption were to maintain good health and avoid diseases (28.3%), the nutritional value of insects (25%), a cultural habit (21.7%), and their taste (16.7%). However, the results of the pilot study have limited generalisability. First, it was conducted with a small sample size and a limited number of predictors. Second, insects are not equally consumed in all regions and in all ethnic groups of the country. Even within the same family, it is still possible to find people who do not consume insects. (Manwanina Kiumba et al., In press).

2. Barriers to insect consumption

Manwanina Kiumba et al. (In press) identified factors that negatively influence consumer attitudes and behaviors. These include high cost, periodicity of availability, the disappearance of certain types of edible insects, and the polluted environment from which some edible insects come. Other factors were allergies and emotions associated with consumption such as fear or disdain. Negative social representations in some ethnic groups or tribes were also found in other studies (Gallen & Pantin-Sohier, 2015). For instance, insects are a taboo food among the Yombe tribe of Kongo Central (Balinga et al., 2004). Furthermore, the rivers and oceans provide fish for the people of Kongo Central and thus other sources of animal protein. These reasons may account for the low insect consumption in places close to the Kongo river or the Atlantic shore (Balinga et al., 2004). These different environmental reasons could lead to a lower consumption in that province as compared to the Great Bandundu, which is located inland. In that province, inhabitants find food essentially from agriculture and hunting in the forest where they can easily catch caterpillars for consumption.

3. Application of the theory of planned behaviour as a basic model

Different models have been developed to identify and better understand the psychosocial factors that predict intention and actual behaviours. We have selected the Theory of Planned Behaviour (TPB; Ajzen, 1991; Fishbein & Ajzen, 2010) which, according to Ross-Plourde (2016), best predicts food consumption. In this model, attitudes, subjective norms (social pressure perceived and experienced by the individual to behave in a certain way), and perceived control over the target behaviour predict intentions. In turn, intentions predict actual behavior.

4. Role of emotions

Regarding the obstacles related to the consumption of edible insects, Rozin et al. (2008) emphasized danger, aversion and disgust as main reasons. Disgust, in particular, highlights that consuming insects may produce unpleasant or even dangerous physical or psychological consequences

5. Objectives/Hypotheses

In order to promote the consumption of edible insects among the Congolese population, we sought to identify the individual and collective factors that influence consumer attitudes and behaviours towards edible insect species in Kinshasa, Grand Bandundu and Kongo Central. We first predict that the consumption of insects would differ according to the provinces with the lowest level of insect consumption in Kongo Central. The second hypothesis is that attitudes, subjective norms, perceived control would predict the intention to consume; and that, in turn, intention predicts the consumption of edible insects. The third hypothesis states that a number of socio-demographic dimensions, such as age, sex, level of education, childhood environment (i.e., urban/rural), number of persons in the household, and province affects insect consumption. For instance, people who are more educated would be more likely to consume insects because they have a better understanding of the nutritional value of edible insects. The consumption behaviour will also be influenced by the childhood environment. The culinary situation of the city differs from that of the village, with more recipes including insects in villages. The fourth hypothesis is that

negative emotions like fear or disgust will negatively influence the consumption of edible insects (Balinga et al., 2004).

6. Methods

6.1. Participants

The initial sample included 551 participants. One participant was excluded because he did not complete most of the questions. Thirteen other participants were excluded because their age was below the threshold of 18 years old. The final sample comprised 537 participants with an average age of 34.88 (*SD* = 12.39, *min* = 18, *max* = 83). A small majority of participants were males (53% males; 47% females) and came from the Kinshasa (54%) followed by the Grand Bandundu (23%) and Kongo Central (23%) provinces. Most grew up in a city: an environment more developed in terms of infrastructure, hospitals, markets, education (45%), followed by villages: very undeveloped environments marked by the absence of markets, etc. (32%) and towns: environments with little infrastructure, etc. (23%). About half (52%) lived in a household composed of less than five persons, and the other half lived in a household with more than five persons (48%). In terms of education, 3% had no education, 5% completed primary school, 45% completed secondary school, and 47% had a superior or university education. Within our sample, 48% of respondents were married, 45.8% single, 5.8% widowed and 0.4% divorced (Table 1). The participants were recruited from the general population of the three different locations (Kinshasa, Grand Bandundu and Kongo Central). The translation procedure involved mostly Lingala for the city of Kinshasa, while both Kikongo and Lingala were used for Grand Bandundu and Kongo Central provinces.

6.2. Measures

Based on results obtained by Manwanina Kiumba et al. (In press), we selected the most relevant variables for the present study. We added questions on emotions and demographic dimensions.

6.2.1. Theory of planned behaviour

The components of TPB, i.e., attitudes, perceived control, intentions, and actual behaviour were measured using 7-level Likert scales, ranging from 1 ("strongly disagree", never, not at all easy) to 7 ("strongly agree, always, extremely easy"). Only subjective norms were measured on a 3-level scale, with the following anchors "never", "sometimes" and "often". In addition to Likert scales, we also had an open-ended format for most questions. These qualitative aspects are:

7. Attitudes

Attitudes were measured through nine items (e.g., general preferences, beliefs in negative or positive effects for health, taste preference and preference for the form of preparation). Five out of nine attitude items were measured by 7-point scales (ranging from 1 = "strongly disagree" to 7 = "strongly agree") assessing whether participants liked to eat edible insects in general. (Five items, α = .89). e.g. item: Do you like to eat insects? The other four items used an open- ended format. They examined for instance the way in which people like to eat insects.

8. Subjective norms

Subjective norms were measured through eight items about the category of people who encouraged them to consume insects, reasons for encouragement; influence of culture and custom in consumption, using a 3-level scale, with the following anchors "never", "sometimes" and "often. The statistical analyses were performed with the average score of the three items α = .86.The first item related to people with whom the participants often eat insects. The second was people with whom they would feel comfortable eating insects. And the last one was about people who encourage eating, e.g. Are there family members who encourage you to eat insects? The other five items were qualitative and participants were free to give as many answers as they wished. e.g. "Explain why family members encourage you to eat insects."

Table 1. Descriptive statistics for insect consumption, demographics variables, and Theory of Planned Behaviour predictors as a function of province

			Province					
	Range (min-max)	**Total**	**Kinshasa**	**Grand Bandundu**	**Kongo Central**	**df**	***F***	***χ2***
Insect consumption	1–7	4.01 (1.82)	4.58 (1.62)[a]	4.36 (1.54)[a]	2.29 (1.45)[b]	2, 534	97.17***	-
Intentions of consumption	1–7	3.99 (1.84)	4.68 (1.72)[a]	4.24 (1.45)[b]	2.52 (1.56)[c]	2, 460	72.55***	-
Age	18–83	34.88 (12.39)	34.43 (12.66)[a]	36.94 (12.06)[a]	33.85 (11.91)[a]	2, 534	2.34	-
Education level	1–4	3.35 (0.73)	3.42 (0.65)[a]	3.19 (0.86)[b]	3.36 (0.74)[a,b]	2, 534	4.30*	-
Sex						2	-	.82
Female	-	250 (47%)	139 (48%)[a]	58 (47%)[a]	53 (43%)[a]			
Male	-	287 (53%)	151 (52%)[a]	66 (53%)[a]	70 (57%)[a]			
Childhood						12	-	100.82***
Village	-	151 (31%)	59 (23%)[a]	50 (48%)[b]	42 (36%)[c]			
Town	-	113 (24%)	61 (23%)[a]	39 (38%)[b]	14 (11%)[c]			
City	-	216 (45%)	140 (54%)[a]	15 (15%)[b]	61 (53%)[c]			
Number of persons at home						4	-	4.40
<5 persons	-	276 (51%)	141 (49%)[a]	63 (51%)[a]	72 (59%)[a]			
>5 persons	-	259 (49%)	148 (51%)[a]	60 (49%)[a]	51 (41%)[a]			
Attitudes	1–7	4.70 (1.73)	5.10 (1.58)[a]	5.13 (1.31)[a]	3.32 (1.73)[b]	2, 532	61.72***	-
-Social norms	1–3	1.77 (0.36)	1.76 (0.31)[a]	2.00 (0.34)[b]	1.46 (0.29)[c]	2, 421	60.68***	-
-Perceived control	1–7	3.98 (1.75)	4.45 (1.68)[a]	3.94 (1.87)[b]	2.95 (1.31)[c]	2, 529	35.62***	-
Emotions								
Fear	-					2	-	5.67
Absent	-	505 (94%)	270 (93%)[a]	122 (98 %)[a]	113 (92%)[a]			
Present	-	32 (6%)	20 (7%)[a]	2 (2%)[a]	10 (8%)[a]			
Rejection	-					2	-	4.38

(*Continued*)

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Table 1. (*Continued*)

			Province					
	Range (min-max)	**Total**	**Kinshasa**	**Grand Bandundu**	**Kongo Central**	**df**	***F***	***χ2***
Absent	-	499 (93%)	264 (91%)[a]	119 (96%)[a]	108 (88%)[a]			
Present	-	38 (7%)	26 (9%)[a]	5 (4%)[a]	15 (12%)[a]			
Repulsion	-					2	-	5.38
Absent	-	491 (91%)	264 (91%)[a]	119 (96%)[a]	108 (88%)[a]			
Present	-	46 (9%)	26 (9%)[a]	5 (4%)[a]	15 (12%)[a]			
Shame	-					2	-	3.66
Absent	-	518 (97%)	278 (96%)[a]	123 (99%)[a]	117 (95%)[a]			
Present	-	19 (4%)	12 (4%)[a]	1 (1%)[a]	6 (5%)[a]			
Disdain	-					2	-	2.18
Absent	-	473 (88%)	252 (87%)[a]	108 (87%)[a]	113 (92%)[a]			
Present	-	64 (12%)	38 (13%)[a]	16 (13%)[a]	10 (8%)[a]			

Note: Mean and standard deviation (in parentheses) is provided for continuous variables. Number of observations and percentage is provided for categorical variables. Values with the same superscript in the same row do not differ, $p > .05$. Multiple comparisons tests were adjusted with the Bonferroni method. $N = 537$. *$p < .050$, **$p < .010$; *** $p < .001$

9. Perceived behavioural control

Perceived behavioral control was measured by four items. Analyses were performed with two items (α= .89) on 7-point scales (ranging from 1 = "Not at all easy" to 7 = "Extremely easy"). The first item reflected the ease for respondents to obtain insects in their environment, and the second was if insects are in large quantities all year round, i.e. "Is it easy to get insects in your area?" The other two items were qualitative and participants were free to give as many answers as they wished. e.g. "What types of insects are permanent in your environment? (Name 3)."

10. Behavioural intention

Behavioural intention was measured through five items. The statistical analyses were performed with the two items (α = .85) on 7-point scales (ranging from 1 = never to 7 = always). The first item assessed participants' intention to eat insects, and the second the intention to consume insects in other forms. e.g. "Are you ready to eat insects in other forms?" The other three items were qualitative and participants were free to give as many answers as they wished. e.g. "What could change your intentions and prevent you from eating insects?"

11. Self-report behaviour

Self-report behaviour was measured by six items related to the practice of eating edible insects; frequency of consumption per week and month, reasons for consumption and non-consumption; types of insects consumed and not consumed. The statistical analyses were performed with one item using 7-point scales (from 1 = never to 7 = always). e.g. Do you eat the insects? The other five items were qualitative and participants were free to give as many answers as they wished. For example, "List 3 insects that you like to eat the most".

11.1. Emotions

Participants indicated whether they felt the following emotions towards insect consumption: fear, anger, shame, repulsion, rejection, disdain. Each emotion was dichotomized, thus signaling its presence vs. absence. The emotion of anger was excluded from the statistical analyses because only three participants reported feeling this emotion toward insect consumption. The statistical analyses were performed with the five remaining emotions.

11.2. Statistical analyses

Analysis of variance was used to compare the differences between the means of Kinshasa, Grand Bandundu and Kongo Central; and the chi-square test to compare the percentages of the variables in the three environments. Analyses were performed in different steps. In the first step, we wanted to test the relevance of the TPB for this specific context. Two hierarchical linear regression analyses were performed to identify a) predictors of consumption intention and b) insect consumption (Benyamini et al., 2016; Hagger et al., 2020). For the prediction of consumption intention, we carried out the regression through a single block of predictors composed of the components of the Theory of Planned Behaviour (TPB), which are attitudes, subjective norms, and perceived control. In the second step we ran an analysis in which intention predicted insect consumption's behaviour. These analyses were carried out with SPSS version 27.

For the second step, we tested a more complete model to predict insect consumption, by considering a) socio-demographic variables, b) components of the TPB, and c) emotions. The TPB has been criticized for its exclusive focus on rational reasoning, excluding unconscious influences on behaviour (Sheeran et al., 2013; Sniehotta et al., 2014) and the role of emotions beyond anticipated affective outcomes (Conner et al., 2013). It is for this reason that we included emotions in our model. The first block comprised demographic variables (age, sex, education level, childhood environment, number of persons living at home, and province), the second included predictors from the Theory of Planned Behaviour (attitudes, social norms, perceived control, and intentions toward insect consumption), and the third block included emotional states. Following the guidelines from Judd et al. (2017), we centered continuous predictors to facilitate interpretation, relied on orthogonal contrast codes for categorical variables, used R^2 to assess model fit, and η_p^2 to

assess each predictors' effect size (small: .02, medium: .13, large: .26; Cohen, 1988; Miles & Shevlin, 2001). Analyses were carried out with R version 4.0.4.

12. Results

12.1. Descriptive statistics

Table 1 shows descriptive statistics for insect consumption, demographics variables, and TPB predictors. Average insect consumption did not differ between Kinshasa and Grand Bandundu but did differ with Kongo Central, which had a significantly lower consumption. Socio-demographics did not differ across provinces, except education level that was higher for Kinshasa and Kongo Central than for Grand Bandundu. Regarding the TPB predictors, attitudes were lower for Kongo Central in comparison to the two other provinces. Social norms were higher for Grand Bandundu, followed by Kinshasa and then Kongo Central. The prevalence of emotions did not significantly differ between provinces. The mean levels for the components of the TPB were around the mid-point suggesting moderate levels of intentions, attitudes, perceived control, and social norms. Regarding the different negative emotions that could be associated with insect consumption, the respondents could only select one among the five proposed as being the dominant emotion that characterised insect consumption. 38% of the total sample experienced one negative emotion, with disdain (12%) and repulsion (9%) being the most often mentioned.

12.1.1. Component: "Attitude"

Participants were asked to indicate whether they like to eat insects or not. In order to facilitate the presentation of the results, we grouped the 7 levels of responses into 3 categories which are high agreement, moderate agreement and disagreement (Table 2). The majority of the participants have a positive attitude towards eating insects, and like to consume them. Participants were given several alternatives to explain their reasons for enjoying edible insects. Among these reasons, the participants consider them as the best food to eat for good health compared to other foods. Taste is an important factor in predicting consumption.

The majority of participants (52.2%) reported that appearance, shape and taste play an important role in the decision to eat insects. The majority of participants (51.6%) indicated that appearance, shape and taste take precedence over the nutritional aspect, while 28.1% think that the nutritional value of insects takes precedence over sensory elements. With regard to the preferred forms of consumption, 77.5% of the participants like to consume cooked insects (For consumption preferences regarding the form of insect preparation see Table 2).

12.1.2. Component: "Subjective norms"

Participants felt comfortable eating insects with family members, alone and with friends. A large majority of the sample reported that they are encouraged by other groups to eat insects (83.6%) (For the social categories that influence consumption see Table 2). A large majority of respondents (73.7%) reported that insect consumption is a custom that is encouraged by their culture. We also asked whether there are individuals within respondents' families who do not consume insects. Only 24% of the participants stated that some members of their family do not eat insects, because of negative emotions, allergies, or sensory issues (odours).

12.1.3. Component: "Perceived behavioural control

A high number indicated that it is relatively easy to find insects in their environment (Table 2). The main difficulties include their scarcity in the markets and their lower availability in areas distant from forests. Regarding the availability throughout the year, 39.4% reported that it is relatively easy to find insects in large quantities all year round. Although many insects are seasonal, some are present all year round. Participants named the ones that are permanent in their environment (see Table 2).

Table 2. Descriptive results for Theory of Planned Behaviour components

Components of TPB	Categories	%
	High agreement	52.4
• **Attitudes**	Moderate agreement	27.2
• Like to eat insect	Disagreement	20.5
• Reason for insect appreciation	Good health	79.2
	Taste	81.9
• Forms of consumption	Incorporated in a preparation, insect invisible and the taste no detectable	29.6
	Incorporated in a preparation, insect visible and the taste detectable	28.5
	To consume them alive	19.3
	Do not consume them in any form	11.7
• **Subjective norms**	Family members	84.2
• Felt comfortable eating insects with	Alone	61.8
	Friends	49.2
• Participants who encourage and influence consumption	Family members	78.4
	Medical profession	74.3
	Salesmen	63.0
	Teachers	58.0
• **Perceived control** • Easiness to find insects	Very easy	25.6
	Relatively easy	48.8
	No easy	24.3
• Easiness to find insects in large quantities all year round	Very easy	29.5
	Relatively easy	39.4
	Difficult	30.4
• Permanent insects	Caterpillars	79.7
	Grasshoppers	55.1
	Termites	48.8
	Locusts and crickets	48.8
	Palm larvae	17.0
	Wood larvae	5.5
• **Intention** • Desire to eat insects	Very often	25.4
	Often	37.9
	Not often	22.7
• Intention to eat insects during the following week	1 glass	52.2
	2 glass	19.7
	3 glass or more glasses	14.4
• Frequency of consumption during the week	Once	24.7
	Twice	39.2
	Three times	10.6
	More than three	4.7

(*Continued*)

Table 2. (*Continued*)

Components of TPB	Categories	%
• Reasons that could weaken the intention	Nothing could change their intention	41.4
	Personal disease	10.5
	Changes of environment like travelling	7.9
	Lack of availability	5.8
	Lack of financial means	5.0

Note: The total percentage of some questions is greater than 100%, because participants could provide several open-ended answers.

12.1.4. Component: "Intention"

Regarding the desire to eat insects, 37.9% of the participants wanted to eat insects often. We asked the intention of participants to buy and eat insects in the short term (immediate intentions). A large majority of participants (79.2%) intended to eat insects during the week. In relation to the quantity they intended to consume during the week, the majority intend to eat 1 glass of insects.[1] Regarding frequency, 39.2% of participants reported consuming insects twice a week. Among reasons that could weaken the intention of participants a high number stated that nothing could change their intention. The main reasons that may encourage participants to consume more insects are a lower purchase cost, increased availability, or better product quality.

12.1.5. Component: Behaviour

The majority of our respondents (86%) consumes insects. In terms of frequency of consumption, 55.5% consume insects once a week. 28% twice or more times a week.

12.1.6. Frequency of insect consumption between regions

We found that in Kongo Central the frequency of insect consumption is low compared to Kinshasa and Grand Bandundu (Table 3).

We then examined the reasons for non-consumption for the 75 people (14.1% of our participants) who never consume insects. We transformed the cumulative percentage to 100% to facilitate the interpretation of the results. We observe that of those that do not consume insects, 42.6% do not eat edible insects because it is not in their cultural habits, 25.3% have never had the opportunity to eat them, 20% do not see any interest in doing so, and 10.7% avoid eating insects because it triggers negative emotions.

12.1.7. Commonly consumed insects

Participants were asked to name three insects they consume the most. We created 3 categories of the most consumed insects according to the 3 levels of preference (first, second, third). We then added the results of the 3 most consumed categories of insects to provide a more complete

Table 3. Frequency of insect consumption across provinces (Kinshasa, Grand Bandundu and Kongo Central)

	Very rarely		Often		Very often		Total
	f	%	f	%	f	%	f
Kinshasa	48	**16.6**	156	**53.8**	86	**29.7**	**290**
Grand Bandundu	24	**19.4**	72	**58.1**	28	**22.6**	**124**
Kongo Central	73	**59.3**	47	**38.2**	3	**2.4**	**123**
Total	**145**		**275**		**117**		**537**

Note : f= frequency

picture of the situation. If we add up the answers of the first three choices, we arrive at the following results: caterpillars (79.0%), locusts and crickets (47.7%) and termites (40.0%) are the most consumed insects.

12.2. Comparison between provinces for insect's consumption and their predictors

The first hypothesis of the study was to examine whether insect consumption was significantly less in the Kongo Central province as compared to Grand Bandundu and Kongo Central. As can been seen in Table 1, the hypothesis was supported, with an average insect consumption that did not differ between Kinshasa and Grand Bandundu but did differ with Kongo Central, F (2, 534) = 97.17, $p < .001$.We then examined whether the three provinces differed for the other variables. Regarding the demographics, the average age, sex ratio, and number of persons per household was not significantly different between the provinces. However, the education level was higher for Kinshasa and Kongo Central than for Grand Bandundu. The childhood environment also differed across provinces, $\chi 2(12) = 100.82$, $p < .001$; the majority of participants in Kinshasa (54%) grew up in the city; on the other hand, those in Grand Bandundu (48%) mainly grew up in the village and those in Kongo Central (53%) mainly in the town (Table 1).

Regarding the TPB predictors, positive attitudes towards insect consumption were lowest for Kongo Central in comparison to the two other provinces that did not differ from each other; F (2, 532) = 61.72, $p < .05$.Participants from Kongo Central also displayed the lowest scores for social norms, perceived control, and intentions; [F (2, 421) = 60.68, $p < .05$; F (2, 529) = 35.62, $p < .05$; F (2, 460) = 72.55, $p < .05$]. This means that they are less influenced by the opinions of others to consume insects, that they perceive the behaviour as more difficult, and that their intentions to consume are the lowest. For social norms, mean scores were the highest for Grand Bandundu, while for perceived control and intentions the highest scores were found for Kinshasa. Finally, the prevalence of emotions did not significantly differ between provinces (Table 1).

12.3. Correlations between insect consumption and its predictors

Bivariate associations between the study variables are provided in Table 4. We will focus specifically on the correlations between intention of consumption and the different potential predictors (attitudes, subjective norm, perceived control). These are overall very strong (ranging from .22 to .80). Among the four components of the Theory of Planned Behaviour, three (intentions, attitudes, and perceived control) were highly and positively correlated with insect consumption, while the correlation for social norms was substantially lower, suggesting a relatively small influence of the social environment. Finally, among the five emotional states investigated, the correlations were of low magnitude, with only fear, repulsion, and shame being negatively related to insect consumption. The correlations between the TPB variables (Attitudes, Perceived Control and Intention) are very strong (ranging from .19 to .80.) The only exception was subjective norms, which show weak correlations with the other components (ranging from .19 to .39).

12.4. Hierarchical models predicting intention and insect consumption

A series of linear regression models were used to identify the independent predictors of intention and insect consumption. In the first step about predicting intention; attitudes ($b = 0.45$, 95%CI [0.35, 0.56], $p = .000$; $\eta_p^2 = .76$)), subjective norms ($b = 0.47$, 95%CI [0.18, 0.77], $p = .002$; $\eta_p^2 = .78$) and perceived control ($b = 0.40$, 95%CI [0.31, 0.49], $p = .000$; $\eta_p^2 = .70$) predicted the intention with a large portion of explained variance ($R^2 = .64$).

In the second step about predicting insect consumption; intention strongly ($b = 0.77$, 95%CI [0.71, 0.83], $p = .000$; $\eta_p^2 = .65$) predicts insect consumption. This model explains 61% of the explained variance.

Table 4. Spearman correlations between study variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1. **Insect consumption**	-																	
2. **Age**	0.19***	-																
3. **Sex** (Male = −1/2, Female = +1/2)	0.02	−0.03	-															
4. **Education level**	0.04	0.16***	−0.15***	-														
5. **Childhood** C1: Village (−2/3) vs. Town and City (+1/3)	−0.12**	−0.25***	−0.01	0.15***	-													
6. **Childhood** C2: Town (−1/2) vs. City (+1/2)	−0.01	−0.19***	−0.07	0.10*	0.27***	-												
7. **Number of persons at hom**e: <5 (−1/2) vs. >5 (+1/2)	0.02	0.19***	0.04	−0.03	−0.11*	−0.06	-											
8. **Province** C1: KC (−2/3) vs. GB and KIN (+1/3)	0.50***	0.04	0.04	−0.01	0.06	−0.13**	0.08	-										
9. **Province** C2: GB (−1/2) vs. KIN (+1/2)	0.21***	−0.08	0.02	0.09*	0.22***	0.21***	0.04	0.32***	-									
10. **Attitudes**	0.70***	0.17***	0.02	0.03	−0.14**	−0.05	−0.04	0.42***	0.16***	-								
11. **Social norms**	0.24***	0.31***	0.08	0.16***	−0.11*	−0.23***	0.02	0.39***	−0.15**	0.19***	-							

(*Continued*)

Table 4. (*Continued*)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
12. **Perceived control**	0.60***	0.07	0.02	0.04	−0.05	0.04	−0.03	0.34***	0.20***	0.71***	0.05	-						
13. **Intentions**	0.75***	0.11*	0.01	0.05	−0.01	−0.04	−0.02	0.48***	0.22***	0.80***	0.22***	0.73***	-					
14. **Fear** (Absent = −1/2, Present = +1/2)	−0.17***	−0.10*	−0.03	0.09	0.08	0.01	0.06	−0.12**	0.03	−0.05	−0.01	−0.06	−0.03	-				
15. **Rejection** (Absent = −1/2, Present = +1/2)	−0.02	0.06	0.01	−0.12*	−0.05	−0.20***	−0.01	0.05	0.03	−0.11*	0.04	−0.14**	−0.04	−0.1	-			
16. **Repulsion** (Absent = −1/2, Present = +1/2)	−0.18***	−0.02	−0.06	0.02	−0.09	−0.01	0.07	−0.16**	−0.01	−0.12*	−0.15**	−0.12*	−0.18***	−0.11*	−0.12*	-		
17. **Shame** (Absent = −1/2, Present = +1/2)	−0.12*	−0.11*	−0.1	0.04	0.06	0.08	−0.12*	−0.09	0.03	−0.07	−0.09	−0.10	−0.17**	−0.07	−0.07	−0.08	-	
18. **Disdain** (Absent = −1/2, Present = +1/2)	−0.01	−0.05	−0.01	−0.06	0.02	0.11	0.01	0.01	−0.04	0.02	−0.04	0.03	0.02	−0.13**	−0.14**	−0.16**	−10*	-

Note: Information in parentheses indicates the contrast code value. C1: Contrast code #1; C2: Contrast code #2.GB: Grand Bandundu; KN : Kinshasa ; KC : Kongo Central. *$p < .050$, **$p < .010$; *** $p < .001$

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Table 5. Linear regression models predicting insect consumption as a function of demographics variables, Theory of Planned Behaviour predictors, and emotions

		b (95% CI)	η^2_p	*b* (95% CI)	η^2_p	*b* (95% CI)	η^2_p
Demographics (Block 1)							
	Age	0.01 (−0.01, 0.02)	.004	0.00 (−0.01, 0.01)	<.001	−0.00 (−0.01, 0.01)	.001
	Sex (Male = −1/2, Female = +1/2)	0.10 (−0.23, 0.44)	.002	0.13 (−0.13, 0.39)	.004	0.13 (−0.13, 0.38)*	.004
	Education level	−0.19 (−0.43, 0.05)	.011	−0.22 (−0.41, −0.03)*	.022	−0.19 (−0.38, −0.00)	.018
	Childhood C1: Village (−2/3) vs. Town and City (+1/3)	−0.24 (−0.64, 0.17)	.006	−0.06 (−0.38, 0.25)	.001	−0.08 (−0.39, 0.24)	.001
	Childhood C2: Town (−1/2) vs. City (+1/2)	0.39 (−0.05, 0.82)	.013	0.26 (−0.08, 0.59)	.010	0.21 (−0.13, 0.54)	.007
	Number of persons at home: <5 (−1/2) vs. >5 (+1/2)	−0.07 (−0.41, 0.27)	.001	−0.03 (−0.29, 0.23)	<.001	0.03 (−0.22, 0.29)	<.001
	Province C1: KC (−2/3) vs. GB and KIN (+1/3)	1.50 (1.07, 1.93)***	.172	0.61 (0.23, 1.00)**	.042	0.43 (0.03, 0.82)*	.020
	Province C2: GB (−1/2) vs. KIN (+1/2)	−0.21 (−0.65, 0.24)	.004	−0.30 (−0.66, 0.05)	.012	−0.20 (−0.56, 0.15)	.006
Theory of Planned Behaviour (Block 2)							
	Attitudes			0.16 (0.00, 0.32)*	.018	0.20 (0.04, 0.36)*	.028
	Subjective norms			0.41 (−0.05, 0.87)	.013	0.41 (−0.04, 0.86)	.014
	Perceived control			0.28 (0.16, 0.41)***	.079	0.28 (0.15, 0.40)***	.082
	Intentions			0.22 (0.08, 0.35)**	.043	0.19 (0.05, 0.32)**	.034
Emotions (Block 3)							
	Fear (Absent = −1/2, Present = +1/2)					−0.65 (−1.07, −0.23)**	.040
	Rejection (Absent = −1/2, Present = +1/2)					0.04 (−0.44, 0.53)	<.001
	Repulsion (Absent = −1/2, Present = +1/2)					−0.59 (−1.01, −0.17)**	.034
	Shame (Absent = −1/2, Present = +1/2)					−0.54 (−1.13, 0.05)	.015
	Disdain (Absent = −1/2, Present = +1/2)					−0.15 (−0.52, 0.21)	.003
Model fit and comparison							
	R^2	.21***		.55***		.58***	
	Change in R^2	-		.34***		.03*	

Note: Information in parentheses indicates the contrast code value. C1: Contrast code #1; C2: Contrast code #2.

GB: Grand Bandundu; KIN: Kinshasa; KC: Kongo Central.

*$p < .050$; **$p < .010$; ***$p < .001$; $n = 238$

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12.4.1. Predicting insect consumption by socio-demographic, TPB, and emotions dimensions
In the third and last step (Table 5); in a series of exploratory analyses, we examined the predictive role of emotions toward insect consumption above and beyond the effects of demographic- and TPB-related variables as illustrated. The demographic variables significantly predicted insect consumption such that significantly increased in the province of Grand Bandundu and Kinshasa (instead of Kongo Central). The TPB variables significantly predicted the dependent variable above and beyond the demographic variables such that insect consumption increased with more positive attitudes, stronger social norms, perceived control, and intentions. To sum up, socio-demographics and TPB variables are key predictors of insect consumption. Although emotion is significant, the additional R^2 is small.

The presence of emotional reactions towards insects significantly predicted insect consumption while controlling for the other predictors such that consumption decreased when participants experienced fear and repulsion towards insects. Interestingly, as can be seen in the full fitted model, the effect of the TPB predictors remained almost unchanged when controlling for emotions. Also, being a female (instead of a male) and coming from Grand Bandundu and Kinshasa provinces (instead of Kongo Central) significantly increased insect consumption when other predictors were controlled.

13. Discussion

13.1. Difference of insect consumption between provinces
Insect consumption was significantly higher in Grand Bandundu and Kinshasa in comparison with the one of Kongo Central. We identified a small set of studies which also described insect consumption in African contexts (Bocquet et al., 2020) and which predicted insect consumption (Balinga et al., 2004). Comparison across studies was often difficult because different dimensions were used across studies. In addition, different types of insects were investigated. Some studies were conducted around 20 years ago (Balinga et al., 2004; Mapunzu, 2002). A more recent study was conducted in the Equator province of DRC, in which the authors reported the different types of insects consumed in that region (Bocquet et al., 2020).

Mapunzu's (2002) study partially supports these results by showing that 70% of the inhabitants of Kinshasa surveyed consume edible insects. Since the insect consumption is a long-standing practice in the target study area, the first trend related to "consumption behaviour" is impacted by several factors identified in this research. The population has become accustomed to consuming edible insects over the past decade. The province of Kinshasa has acculturated those who came from elsewhere but did not consume insects. The results of the study conducted by Manwanina Kiumba et al. (In press) in Kinshasa support our findings because approximately one fifth consume them out of habit.

The high consumption of insects in Grand Bandundu may be explained by several factors. One is that there are more insects available, such as mibamba caterpillars, which is a species appreciated by diabetics because they are considered to prevent complications of the diabetes and have a better taste (Ikonso Mwengi, 2020). The low consumption in Kongo Central may be first explained by the fact that the Congolese of the Yombe tribe consider insects in general and caterpillars in particular as a taboo food (Balinga et al., 2004). Another explanation may be that they were more heavily influenced by the habits of Belgian settlers during their presence in the colonial period, being the first province through which the settlers entered. Furthermore, Kongo Central is the only coastal province of the DRC, where there is an abundance of fish and other sea products. As such, there is less necessity to resort to other alternatives such as edible insects. (Food and Agriculture Organisation, 2013; Looy et al., 2014; Mignon, 2002).

13.2. Role of TPB components
The variables of the TPB significantly predicted intention of consumption such that insect consumption increased with more positive attitudes, stronger social norms of insect consumption and greater perceived control. These results agree with the results from Pambo et al. (2016) who used

TPB as a model to predict insect consumptions. To achieve this objective, six focus group discussions were conducted ($n = 43$). The focus group script was coded using the Theory of Planned Behaviour theoretical framework. The aim of the study was to explore the salient beliefs underlying consumer attitudes towards insect consumption in Kenya. The results showed that taste-related beliefs were the main determinants of the participants' intentions to consume insects in Kenya.

The results of this present study can be explained by the fact that the TPB is often used in the field of social and health psychology, and compared to other models, appears to best predict food consumption using a combination of personal and social factors (Ross-Plourde, 2016). It should be noted that perceived control is the dimension of TPB that is the most important in predicting behaviour in the general model. In contrast, social norms did not play a role.

13.3. Role of emotional factors

We observed the emotion of disdain was more prevalent than the emotions of repulsion, rejection, fear, and shame. This is in contrast to studies conducted in Europe where the emotion of disgust was an obstacle to the consumption of edible insects (Orsi et al., 2019; Tuccillo et al., 2020). In the West, disgust with insect consumption may also have influenced the food preferences of people in tropical countries. For example, according to Silow (1983): It is known that some missionaries condemned the eating of winged termites as a pagan custom and for this reason, a Christian told him, he would never taste such things, for they are strongly un-Christian Goshute Indians. In Malawi, research has shown that people living in urban areas who are devout Christians react with disdain to insect consumption (Morris, 2004).

Emotional reactions towards insects significantly predicted insect consumption while controlling for the other predictors such that consumption decreased when participants experienced fear and repulsion towards insects. These results reinforce those of Balinga et al. (2004) who reported that the Yombe of Kongo Central are afraid to touch and see edible insects. During caterpillar season, for example, Yombe avoid going into the forest for fear of seeing them along the way. This may be one reason for the low consumption of insects.

As the TPB is limited by cognitive aspects, we wanted to add a non-cognitive dimension by including emotional reactions.

13.4. Comparison with pre-survey results

In this section, we will compare the results of the pre-survey conducted in Kinshasa in 2018 (Manwanina Kiumba et al., In press) with the results obtained for Kinshasa in the present study (Large Survey in 2019). We will compare our results only for subjective norms and frequency of consumption, for which important differences were found across studies. A striking observation for the subjective norm is that in the present study participants preferred to consume insects alone, whereas in the pre-survey participants did not want to consume insects alone. An explanation for this difference could be related to habit formation with some people in need of social support to get used to consuming insects. As soon as the consumer develops the habit of consumption, he or she will be able to continue to consume the insects on their own without the influence of others.

In terms of frequency of consumption, 94.5% consumed insects in the present study, compared to 83.8% in the pre-survey. The increase in this frequency of consumption can be explained firstly by the crisis and the food shortage that is increasing in the DRC in general and in Kinshasa in particular. This increase could be due secondly to the recent scarcity of certain common foodstuffs on the market such as fish and meat or to the increase in their sale price, or to changes in eating habits following ethnic mixing or the gradual abandonment of certain food taboos.

13.5. Implications and recommendations for future studies

To better understand the determinants of insect consumption in this province of Kongo Central, where consumption was found to be low in the present study, it is important to conduct qualitative research (e.g., focus groups). This is an ongoing future step. The focus groups will shed light on the determinants in

three different contexts, in a city, a town, and a village. This will test the hypothesis that behaviours and habits are different between the three locations. It would address the influence of tribes, an aspect not investigated in this study. Indeed, as shown in the literature, insect consumption in Kongo Central varies by tribe. For example, Balinga et al. (2004) explain that members of the Yombe tribe do not consume caterpillars and that this remains a taboo subject for them.

With regard to the implications of the TPB variables, the present results suggest developing interventions to increase perceived behavioural control. The high variability in social norms may be explained by the fact that some people are positively influenced and others are negatively influenced by others.

Finally, the assessment of emotions was not detailed in this study. A future objective is to explore this notion in greater depth, for instance by assessing differences across tribes. Balinga et al. (2004) explain that members of the Yombe tribe in Central Kongo, for example, feel fear when eating caterpillars. Hence continuing to measure emotion variable is important for the future, because emotions play an important role in the consumption of insects. Next studies will assess emotions in a continuous way (instead of dichotomous as in the present study). Emotional reactions will also be investigated for each type of insect.

Apart from the emotions, other important barriers to insect consumption include food neophobia or the reluctance to eat and/or avoidance of novel foods (Pliner & Hobden, 1992) and safety concerns (Woolf et al., 2019). Some people feel reluctant to eat new types of food, such as insects they never ate before. This is associated with fear and the feeling of insecurity. Orsi et al. (2019) identified food neophobia as a psychological and personality barrier to insect consumption in Germany. In Italy, food neophobia was one of the main reasons for not eating insects (Tuccillo et al., 2020). This dimension should be assessed in future studies. These studies were conducted in Western contexts and it remains to be seen if they apply to the DRC context.

Another dimension that creates obstacles to insect consumption is the religious context. Food practices are partly influenced by culture, which has been historically relevant to religious beliefs (Chee et al., 2019). In Christian, Jewish and Islamic religious contexts, there are references to the tradition of eating insects (Van Huis et al., 2013). The context of Muslim religion might be different. Among Muslims the term “Halal” denotes food that Muslims are authorized to eat. The Muslim community comprises approximately 24% of the world population and may be considered the second largest religious group (Chee et al., 2019; Michael & Conrad, 2017). When discussing insects for human consumption, Muslims are always baffled as to whether they are halal and can be consumed. There is no universal halal status that can be found in the Islamic context, as it differs for every species of insects and between schools of Sunni fiqh (Maliki, Hanbali, Shafi’I and Hanafi). Some Hanafi scholars have mentioned that it is prohibited to eat insects, while Maliki scholars have the opposite belief, allowing the consumption of insects with the condition that the insect must be dead by any means. These differences in beliefs have been debated by Iman Ibn Rushd (Rushd cited by Chee et al., 2019) that explains the definition of “filth” when God said in the Quran, “and unlawful all that is filthy” (7:157). Based on these verses (ayah), many scholars believe that the consumption of insects is prohibited. However, in Islam, every Quranic verse must be properly interpreted before it can be practiced in reality.

To illustrate, one study conducted in the Adamawa and eastern regions of Cameroon examined collection, processing and consumption of insects. Results showed that the consumption of insects depends on religion and ethnicity factors. Muslims who constitute the majority of the Adamawa population were less receptive to insect consumption (Djouffa et al., 2021). This result suggests that religious affiliation could have a significant influence on the consumption of edible insects. These behaviours are close to the Congolese ethnic group of the Yombe in Kongo Central, who do not eat caterpillars and consider them as taboo food (Balinga et al., 2004).

Another aspect to consider in the future is entomophobia. The symptoms of entomophobia are similar to those of other irrational fears. When a human with entomophobia encounters an insect

they can experience a full-blown series of panic attacks (Matthews et al., 2011) Therefore, bad encounters with insects in the past or a general neophobia may have initiated a dislike towards insects; however, these theories do not explain why current societies in the world have an extremely positive stance of entomophagy while others do not (Harren, 2015).

14. Conclusion

This study examined three categories of variables that predict insect consumption in three provinces of the South western part of DRC. Results first revealed that some socio-demographic dimensions such as education and place of living matter. Second, socio-cognitive determinants from the Theory of Planned Behavior were examined. Intentions, attitudes, and perceived control related to insect consumption predict a very substantial part of the variance, but subjective norms did not play a role. Finally, two specific emotional states (fear, repulsion) had an additional contribution. It also emphasizes the importance of considering emotions as an additional category of predictors. With an estimated world population of nine billion people by 2050, global food production will have to double. Insects are a viable way to fill this need. Ways to increase their production and consumption, including changing attitudes and behaviors, are crucial steps to provide balanced nutrition in countries suffering from malnutrition, such as DRC.

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Note
1. *1 glass of Caterpillars (Cirina forda) = 79.43 g; 1 glass of Caterpillars (Imbrasia) = 88.06 g; 1 glass of Termites = 54.83 g.*

Data Availability Statement (DAS)
Data are publicly available and can be found at the following address: https://osf.io/dhkq6 and material: https://osf.io/8ghjm

References
Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T
Balinga, M. P., Monzambe Mapunzu, P., Moussa, J. B., & N'gasse, G. (2004). *Contribution des insectes de foret a la sécurité alimentaire : l'exemple des chenilles d'Afrique centrale*. FAO. https://www.fao.org/3/j3463f/j3463f.pdf
Benyamini, Y., Jonhson, M., & Karademas, E. C. (Eds). (2016). *Assessment in Health Psychology* (Vol. 2). Hogrefe Publishing. https://eu.hogrefe.com/shop/assessment-in-health-psychology-67618.html
Bocquet, E., Maniacky, J., Vermeulen, C., & Malaisse, F. (2020). A propos de quelques chenilles consommées par les Mongo en Province de l' Equateur (République démocratique du Congo). *Geo-Eco-Trop*, *44*(1), 109–130.
Bomolo, O., Niassy, S., Chocha, A., Longanza, B., Bugeme, D. M., Ekesi, S., & Tanga, C. M. (2017). Ecological diversity of edible insects and their potential contribution to household food security in Haut-Katanga Province, Democratic Republic of Congo. *African Journal of Ecology*, *55*(4), 640–653. https://doi.org/10.1111/aje.12400
Chee, J. Y., Lakshmanan, M., Jeepery, I. F., Hairudin, N. H. B. M., & Sudesh, K. (2019). The Potential Application of Cupriavidus necator as Polyhydroxyalkanoates Producer and Single Cell Protein: A Review on Scientific, Cultural and Religious Perspectives. *Applied Food Biotechnology*, *6*(1), 19 34.
Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Erlbaum.
Conner, M., Godin, G., Sheeran, P., & Germain, M. (2013). Some feelings are more important: Cognitive attitudes, affective attitudes, anticipated affect, and blood donation. *Health Psychology*, *32*(3), 264-272. https://doi.org/10.1037/a0028500
Djouffa, K., Saidou, C., Ali, A., Mohammadou, B. A., & Tchiegang, C. (2021). Edible insects in the Adamawa and eastern regions of Cameroon: Collection, processing and consumption. *Journal of Insects as Food and Feed*, *7*(4), 12. https://doi.org/10.3920/jiff2020.0015
Duquesne, B., Muteba Kalala, D., & Lebailly, P. (2010). Les enjeux de la sécurité alimentaire en RD Congo : approche par l'analyse de la consommation alimentaire des ménages kinois. https://www.researchgate.net/publication/277175995.

Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The reasoned action approach*. Psychology Press (Taylor & Francis).

Food and Agriculture Organisation. (2013). Edible Insects: Future Prospects for Food and Feed Security. Forestry Paper No. 171. *Food and Agriculture Organization of the United Nations*,

Gallen, C., & Pantin-Sohier, G. (2015). The edibility of edible insects: An exploratory study among young French consumers.: Accessed on 09/25/18 https://hal.archives-ouvertes.fr/hal-01208511.

Godfray, H. C. J., Beddington, J. R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J. F., Pretty, J., Robinson, S., Thomas, S. M., & Toulmin, C. (2010). Food security: The challenge of feeding 9 billion people. *Science*, *327*(5967), 812–818. https://doi.org/10.1126/science.1185383

Hagger, M. S., Cameron, L. D., Hamilton, K., Hankonen, N., & Lintunen, T. (2020). *Handbook of behavior change*. Cambridge University Press.

Harren, D. (2015). A Comparison of Attitudes towards Entomophagy. https://hdl.handle.net/11299/199774

Ikonso Mwengi, A. (2020). Représentations sociales de la consommation des insectes dans les villes de la partie ouest de la République Démocratique du Congo. *Mémoire de DEA, Faculté des Sciences Agronomiques, Université de Kinshasa*.

Judd, C. M., McClelland, G. H., & Ryan, C. S. (2017). *Data analysis: A model comparison approach* (3rd ed.). Routledge.

Looy, H., Dunkel, F., & Wood, J. (2014). How Then Shall We Eat? Insect-Eating Attitudes and Sustainable Foodways. *Agriculture and Human Values*, *31*(1), 131–141. https://doi.org/10.1007/s10460-013-9450-x

Lr Payne, C., Mato, B., & Fruth, B. (2016). Entomophagy in the area surrounding luikotale, Salonga National Park, Democratic Republic of the Congo. *African Study Monographs*, *37*(1), 1–12.

Mabossy-Mobouna, G., Kinkela, T., Lenga, A., & Malaisse, F. (2013). Imbrasia truncata aurivillius (Saturniidae): Importance en Afrique Centrale, commercialisation et valorisation à Brazzaville. *Geo-Eco-Trop*, *37*(2), 313–330.

Manwanina Kiumba, N. L., Chang B, O., & Mopendo Mwisomi, E. (In press). Individual and collective factors influencing consumer attitudes and behaviour towards edible insects in Kinshasa: A pilot study. *Health Psychology and Behavioral Medicine*.

Mapunzu, P. (2002). *Contribution de l'exploitation des chenilles et autres larves comestibles dans la lutte contre l'insécurité alimentaire et la pauvreté en République démocratique du Congo*. Rapport de Consultation. FAO.

Matthews, A., Wong, Z., Scanlan, J., & Kirkby, K. (2011). Online Exposure for Spider Phobia: Continuous versus Intermittent Exposure. *Behaviour Change*, *28*(3), 143–155. https://doi.org/10.1375/bech.28.3.143

Michael, L., & Conrad, H. (2017) Why Muslims are the world's fastest-growing Religious group Accessed 24 April 2023 http://www.pewresearch.org/fact-tank/2017/04/06/why-muslims-are-the-worlds-fastest-growing-religious-group/.

Mignon, J. (2002). Entomophagus, a question of culture? *Tropicultura*, *20*(3), 151–155. http://hdl.handle.net/2268/27823

Miles, J., & Shevlin, M. (2001). *Applying Regression and Correlation: A Guide for Students and Researchers*. Sage.

Morris, B. (2004). *Insects and human life*. Routledge.

Okangola, E., Solomo, E., Tchatchambe, W. B., Mate, M., Upoki, A., Dudu, A., Justin, A., Asimonyio, J., Bongo, G. N., Mpiana, P., & Ngbolua, K.T.N. (2016). Valeurs nutritionnelles des chenilles comestibles de la ville de Kisangani et ses environs (Province de la Tshopo, République Démocratique du Congo). *International Journal of Innovation and Scientific Research ISSN 2351-8014*, *25*(1), 278–286. https://www.researchgate.net/publication/305378903

Orsi, L., Voege, L. L., & Stranieri, S. (2019). Eating edible insects as sustainable food? Exploring the determinants of consumer acceptance in Germany. *Food Research International*, *125*, 108573. https://doi.org/10.1016/j.foodres.2019.108573

Pal, P., & Roy, S. (2014). Edible insects: Future of Human food - a Review. *International Letters of Natural Sciences*, *26*, 1–11. https://doi.org/10.56431/p-kt2z1i

Pambo, K. O., Mbeche, R. M., Okello, J. J., Kinyuru, J. N., & Mose, G. N. (2016). Consumers' salient beliefs regarding foods from edible insects in kenya: A qualitative study using concepts from the theory of planned behavior. ajfand. *16*, N°4. https://doi.org/10.18697/ajfand.76.16810

Pliner, P., & Hobden, K. (1992). Development of a scale to measure the trait of food neophobia in humans. *Appetite*, *19*(2), 105–120. https://doi.org/10.1016/0195-6663(92)90014-w

Ross-Plourde, M. (2016). *La théorie du comportement planifié appliquée à l'engagement paternel lors de la transition à la parentalité*. Thèse doctorale, Université de Laval. https://www.researchgate.net/publication/318990067.10.13140/RG.2.2.28119.16800

Rozin, P., Haidt, J. E. M., & R, C. (2008). Disgust. In M. dans Lewis, J. M. Haviland-Jones, & L. F. et Barrett (Eds.), *Handbook of emotions* (pp. 757–776). Guilford Press. 3ème édition .

Sheeran, P., Gollwitzer, P. M., & Bargh, J. A. (2013). Nonconscious processes and health. *Health Psychology*, *32*(5), 460473. https://doi.org/10.1037/a0029203

Silow, C. A. (1983). Notes on Ngangela and Nkoya ethnozoology. Ants and termites. *Etnologiska studier*, *36*(1), 177.

Sniehotta, F. F., Presseau, J., & Araújo-Soares, V. (2014). Time to retire the theory of planned behaviour. *Health Psychology Review*, *8*(1), 17. https://doi.org/10.1080/17437199.2013.869710

Tuccillo, F., Marino, M. G., & Torri, L. (2020). Italian consumers' attitudes towards entomophagy: Influence of human factors and properties of insects and insect-based food. *Food Research International*, *137*, 109619. https://doi.org/10.1016/j.foodres.2020.109619

United Nations (2017). la population de la ville province de Kinshasa Congo autrement Accessed le 01/10/2Nation018. http://www.congo-autrement.com/page/ville-province-de-kinshasa/rdc-la-population-de-la-ville-province-de-kinshasa-estimée-a-26-millions-habitant-a-l-horizon-2040.html#AMB2P2dbwsZZOI.99AO.org

Van Huis, A., Van Itterbeeck, J., Klunder, H., Mertens, E., Halloran, A., Muir, G., & Vantomme, P. (2013). Edible Insects: Future Prospects for Food and Feed Security. *Rome: Food and Agricultural Organization of the United Nations Rome: Food and Agricultural Organization of the United Nations*, *171*, 187.

Woolf, E., Zhu, Y., Emory, K., Zhao, J., & Liu, C. (2019). Willingness to consume insect-containing foods : A survey in the United States. *LWT- Food Science and Technology*, *102*, 100–105. https://doi.org/10.1016/j.lwt.2018.12.010