

## Obstacles and opportunities: An investigation of the acceptance of insect-based foods among young South Africans

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### ABSTRACT

Entomophagy, the practice of eating insects, has long provided essential nutrition in many cultures and offers potential benefits for food security, health, and sustainability. However, in parts of Africa this tradition is declining, and in South Africa, younger generations are often unfamiliar with insect consumption. Western dietary influences and urbanization contribute to the abandonment of traditional food practices, leading to a loss of knowledge surrounding insect consumption. This study aimed to investigate young South Africans' acceptance of eating insects, and to understand main obstacles and opportunities with potential implementation of insect-based food products. Data were collected through an Entomophagy Attitude Questionnaire ( $n = 119$ ), a focus group discussion ( $n = 13$ ) and semi-structured interviews ( $n = 4$ ). The results show gender differences in attitudes toward insects, with females being more reluctant toward entomophagy than men and, for example, scoring significantly higher in disgust when confronted with a statement that a dish contained insects ( $p = 0.07$ ). However, the Entomophagy Attitude Questionnaire revealed no significant attitudinal differences between young people originating from the provinces Gauteng and KwaZulu-Natal. Qualitative findings reveal that younger participants avoid insects due to feelings of disgust and perceptions of them as unclean or unsafe. Yet opportunities exist to reframe insects as appealing food choices. Participants indicated that presenting insect-based products as modern, tasty, fashionable, and aligned with sustainability and nutrition could improve acceptance. This study provides insights into the cultural and psychological barriers deterring entomophagy among young South Africans and highlights the importance of presenting insects and insect-based foods as desirable in contemporary diets.

### 1. Introduction

Entomophagy, the human practice of eating insects, is an indigenous practice that has provided essential nutrition with over 2200 species consumed globally by hundreds of millions of people annually (Evans et al., 2015; Hlongwane et al., 2020; Omuse et al., 2024; Van Huis et al., 2022). In some cultures with a tradition of entomophagy, consumption has declined due to factors such as inadequate harvesting and storage techniques (Müller, 2019) and the loss of natural insect habitats, which in turn has weakened culinary practices and knowledge related to insect consumption (Kumar et al., 2022).

Africa has approximately 250 edible species of insects, making it one

of the most diverse regions of edible insects in the world (Food and Agriculture Organization of the United Nations [FAO], 2026; Van Huis et al., 2022; Ramos-Elorduy, 2005). These varieties include members of the Coleoptera, Hymenoptera, Lepidoptera and Orthoptera insect orders (Omuse et al., 2024). In some African communities, the practice of eating insects is part of the daily diet and considered a traditional heritage (Hlongwane et al., 2020). Despite this, consumption has decreased in some parts of Africa as young people have become less familiar with eating insects compared with older generations (Obopile and Seeletso, 2013). Adopting new food cultures is believed to be one of the main factors contributing to the decreasing consumption of edible insects. Understanding the acceptance of edible insects among young people is

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important as we currently experience fast dietary shifts and as this segment constitutes the future consumer demographic (Wilska, 2017). Investigating attitudes towards entomophagy may provide insights towards promoting sustainable and nutritious food practices.

### 1.1. Insect-based foods

In many Western societies—where entomophagy has traditionally been uncommon—acceptance of insect-based foods has grown noticeably in recent years. Insects have high nutritional value and foods made from them can be produced with less environmental impact than traditional protein sources, making them a viable alternative to other animal protein sources (Kumar et al., 2022; Lange and Nakamura, 2023; Oonincx et al., 2010).

Processing insects into food ingredients for use in common products has become more prevalent in parts of the world where entomophagy was not historically practiced (Niimi et al., 2025). Using insects as a protein source may be an essential component in increasing sustainable circular agriculture and providing nutritious and sustainable food for many people (Moruzzo et al., 2021).

### 1.2. Factors influencing the perception of edible insects

#### 1.2.1. Attitudes towards edible insects

When investigating insects as a potential sustainable food source, it is important to understand consumers' attitudes and perceptions towards entomophagy (Wendin and Nyberg, 2021; Tan et al., 2015). Factors other than nutritional and environmental benefits need to be considered regarding insect-based foods. Social and cultural factors are deeply connected to individuals' food habits; if insect-based foods are to be produced, consumers must first accept them as a viable food option (Van Huis, 2013).

In many Western societies, insect consumption is not well-accepted and barriers to social acceptance include disgust caused by a belief that they are contaminated and unclean (Jensen and Lieberoth, 2019; Willeke et al., 2025). Many people do not consider them edible, leading to skepticism and food neophobia, the tendency to reject novel or unfamiliar foods (Tuccillo et al., 2020). Repeated exposure can improve the acceptance of new foods (Sogari et al., 2019; Verbeke, 2015) and education can help shape a more positive perception of insects as a food source (Van Huis, 2013). To increase people's acceptance of entomophagy, it may be beneficial to use insects in well-known food products (Lee et al., 2025) or through indirect entomophagy, the use of insects as animal feed for animal-based foods (La Barbera et al., 2019).

#### 1.2.2. Social and cultural determining factors

Values and norms regarding food consumption and eating influence people's attitudes toward entomophagy (Barrena et al., 2015). Gender and age can be factors in people's perception of insects as food, especially in Western societies (Tuccillo et al., 2020).

The decrease in entomophagy in developing countries is notable and the acceptance of insects as food is reported to vary depending on which region people originated from and the culture they belong to (Hlongwane et al., 2020). These influences are likely reasons why younger generations, especially in urban areas, are less familiar and more reluctant to eat insects (Hlongwane et al., 2020).

### 1.3. Entomophagy in Africa

In Africa, insects are consumed differently across regions, serving as everyday food, a unique delicacy or an emergency food source. Many of these species are foraged in the wild and are seasonal, however 18 of them are raised on one of the roughly 2300 farms in Africa and are available year-round (Caparros Megido et al., 2024). Preferences for preparing and consuming insects vary; with some people enjoying them raw, while others prefer them fried or roasted (Hlongwane et al., 2020).

An ethnographic field study performed in a small village in Zambia found that the practice of entomophagy could characterize members of society and create differentiation within the group (Stull et al., 2018). Perceptions and attitudes towards edible insects within this village differed mainly relating to gender, age, culture, urbanism, and class; and in some cases, insects were considered food for the poor (Stull et al., 2018).

South Africa is one of the continent's largest economies, where development may be an effect of globalization (Zandt, 2021). Fifty-six species of insects are consumed differently across regions and are more common in provinces such as Limpopo, Gauteng, Mpumalanga, and Northwest (Obopile and Seeletso, 2013), but less so in KwaZulu Natal (Omuse et al., 2024; Hlongwane et al., 2020). This difference appears to be due to Western food influences, unfamiliarity, and limited availability of edible insects in some areas. This study aimed to investigate young South Africans' acceptance of eating insects, and to understand main obstacles and opportunities with potential implementation of insect-based food products.

## 2. Material and methods

### 2.1. Study design

A mixed methods study design was used including both quantitative and qualitative research techniques (Bryman, 2008). Data was collected over a two-month period in 2023 through an Entomophagy Attitude Questionnaire (EAQ) (La Barbera et al., 2020), semi-structured interviews, and a focus group discussion.

The study was conducted as a Minor Field Study in collaboration with research and educational institutions in South Africa. Representatives from the University of Johannesburg and the Council for Scientific and Industrial Research (CSIR) in Pretoria participated in the study. These representatives served as gatekeepers for participant recruitment at their respective organizations, as well as digital channels such as social media and email lists. Participant selection was made based on age as an inclusion criterion, targeting individuals between 18-34 years of age.

### 2.2. Entomophagy attitude questionnaire (EAQ)

The EAQ served as a tool for investigating attitudes towards insect consumption and was performed online using EyeQuestion® (version 5.4.6, EyeQuestion Software, the Netherlands) to collect, manage and analyze data. The first section of the questionnaire contained demographic background questions including the respondent's age, gender, origin, and if they consumed insects. This was followed by the 10 items of the EAQ (La Barbera et al., 2020), that are described in full in Table 3 (Section 3.1), consisting of three subscales:

- 1) Disgust (EAQ-D), five items. Higher values of this subscale indicate a negative attitude to direct entomophagy.
- 2) Interest (EAQ-I), three items. Higher values indicate more interest in direct entomophagy.
- 3) Feeding animals (EAQ-F), two items. Higher values indicate a more positive attitude towards indirect entomophagy.

Answers were collected on a 7-point response scale ranging from 1 (Totally Disagree) to 7 (Totally Agree). Additionally, the questionnaire included one open-ended question regarding the participants' thoughts and experiences with edible insects. This question aimed to provide a deeper understanding of their attitudes towards entomophagy and was analyzed in the same manner as the qualitative data.

### 2.3. Focus group discussion and semi-structured interviews

Qualitative data was collected using an ethnographic approach,

including four semi-structured interviews and one focus group discussion with notes. The same interview guide (Table 1) was used as a base for the three interviews, which were conducted in Pretoria, Gauteng, and Ballito, KwaZulu-Natal, as well as the focus group discussion at the University of Johannesburg. The interviews lasted for approximately 30 minutes and were all recorded and transcribed using voice memo and Word dictation. After the interviews were transcribed by Word dictation, all transcripts were corrected manually.

The focus group discussion was conducted with 13 female university students during a one-hour session in a classroom. Before starting the session, participants were asked for permission to use the notes taken as data in the study. The semi-structured nature of the interviews and focus group discussion, using open-ended questions, allowed for flexibility in relation to the original interview guide (Table 1). This gave opportunities for the participants to share experiences and perspectives spontaneously (Bryman, 2008). The interviews and group discussion provided valuable contextual information to help validate findings, which allowed for a more comprehensive understanding of the participants' attitudes than could be obtained by the questionnaire alone.

## 2.4. Participants

### 2.4.1. Quantitative data

Participants for the EAQ ( $n = 119$ ; 68 females) were recruited using social media and meetings in public areas and universities, as well as an email invitation from an instructor at the University of Johannesburg to their students. The aim was to recruit more participants but practical issues including access to Wi-Fi necessary for accessing the questionnaire limited the number of participants. Participants completed the study digitally, joining by either scanning a QR code or clicking on a link where the participants were informed about the study's aim and that all participation was voluntary and anonymous. By starting and submitting the questionnaire, participation was agreed upon. Participants could also share the link with friends and family which generated additional recruitment through a snowball effect (Bryman, 2008). Nineteen responses with incomplete questionnaires or participants outside the described scope of the study population were excluded. Descriptive characteristics of participants in the EAQ are presented in Table 2, including information regarding gender, age, type of area of upbringing, and province of origin.

### 2.4.2. Qualitative data

Data was collected through a focus group discussion ( $n = 13$ ) and semi-structured interviews ( $n = 4$ ). Participants were recruited through university visits for one of the semi-structured interviews and the focus group discussion, where field notes were recorded from the discussion. The remaining three participants recruited for semi-structured interviews were chosen based on criteria related to the research question, young, urban South Africans between 18 and 34 years old, and were recruited during encounters in public areas and at the Council for

**Table 1**

Interview guide for focus group discussions and individual interviews.

Interview Guide
1. How old are you?
2. Which province are you originally from?
3. What are your thoughts about food consumption and sustainability?
4. What do you know about insects as food?
5. Why do you think some people eat insects while others do not?
6. How do you think age and/or origin (province) may affect people's preferences for eating insects?
7. Do you eat insects?
8. What kind of insects would/do you prefer to consume?
9. Can you imagine tasting insects?
10. Can you imagine tasting food products containing non-visible insects? (E.g. protein bars, pasta, bread, cookies?)
11. What kind of food products would you prefer if it contained insects? (Flavors etc, consistency)
12. In what context would you prefer to eat or try insects?
13. What is your opinion of insect-fed meat?

**Table 2**

Descriptive statistics of participants' demographic background.

Characteristics	Frequency ( $n = 119$ )	Sample (%)
<i>Gender</i>		
Female	68	57
Male	51	43
<i>Age</i>		
18-24	95	80
25-34	24	20
<i>Originated upbringing area</i>		
Rural	10	8
Semi-urban	26	22
Urban	83	70
<i>Originated province</i>		
Eastern Cape	3	3
Free State	-	-
Gauteng	76	64
KwaZulu-Natal	22	18
Limpopo	9	7
Mpumalanga	4	3
Northern Cape	-	-
North West	3	3
Western Cape	2	2

Scientific and Industrial Research.

## 2.5. Data-analysis

Data analysis throughout the study was performed using SPSS. After normality tests, quantitative data was statistically analyzed using Mann-Whitney U tests in which the mean values were compared at a significance level of probability  $< 0.05$ . As most participants ( $n = 98$  of 119 total participants) originated from either Gauteng or KwaZulu-Natal, only these provinces were included in the comparison between "originated provinces" (as seen in Table 1).

The semi-structured interviews, focus group discussion and responses from the open-ended question in the questionnaire were analyzed thematically using open coding in which data is broken down and categorized, then named with descriptive codes to allow identification of patterns and themes within the data (Braun and Clarke, 2006).

The subscales of the questionnaire (EAQ-D, EAQ-I and EAQ-F) were compared with the themes and patterns identified in the qualitative analysis to explore any similarities or differences between the data sets.

## 3. Results

### 3.1. Entomophagy attitude questionnaire (EAQ)

According to the statistical analysis of the EAQ presented in Table 3, gender was a statistically significant factor relating to attitude towards entomophagy except for in one question relating to interest. The difference indicates that males are less disgusted with edible insects, more

**Table 3**

Mean values and standard deviations of the Entomophagy Attitude Questionnaire results, including gender differences analysed using the Mann-Whitney U test.

Description	Item	Total	Female n = 68	Male n = 51	p-value
Disgust (EAQ-D)	I would be disgusted to eat any dish with insects.	4.6 ± 2.1	5 ± 2.1	4.3 ± 2	0.041
	Thinking about the flavour that a bug might have sickens me.	4.6 ± 2.1	5.1 ± 2.1	4.1 ± 1.9	0.004
	If I ate a dish and then came to know that there were insects among the ingredients, I would be disgusted.	4.3 ± 2.2	4.7 ± 2.3	3.7 ± 2	0.07
	I would avoid eating a dish with insects among the ingredients, even if it was cooked by a famous chef.	3.9 ± 2.2	4.2 ± 2.4	3.4 ± 1.9	0.046
	I would be bothered by finding dishes cooked with insects on a restaurant menu.	3.5 ± 2.2	3.9 ± 2.4	2.9 ± 1.8	0.040
Interest (EAQ-I)	I'd be curious to taste a dish with insects if cooked well.	4.4 ± 2.3	3.9 ± 2.4	5 ± 2	0.013
	In special circumstances, I might try to eat a dish of insects.	4.4 ± 2.2	3.9 ± 2.4	5.2 ± 1.7	0.005
	At a dinner with friends I would try new foods prepared with insect flour.	4.2 ± 2.2	3.9 ± 2.4	4.7 ± 1.9	NS
Feeding animals (EAQ-F)	Using insects is a good way of producing meat.	4.3 ± 2	3.9 ± 2.1	4.8 ± 1.9	0.009
	I think it is fine to give insect-based feed to fish that are farmed for human consumption.	5.6 ± 1.7	5.3 ± 1.9	6 ± 1.5	0.025

Note. The answers have been collected on a 7-point hedonic scale starting from 1 (Totally Disagree) to 7 (Totally Agree). NS = non-significant ( $p > 0.05$ ).

interested in insects as food, and more accepting of the use of insect-based feed. Regardless of gender, the highest level of acceptance was found for the question regarding insect-based feed for farmed fish for human consumption, regardless of gender (see Table 3).

The mean values from participants of Gauteng and KwaZulu-Natal did not show a significant difference in any of the responses (Table 4). However, the results indicate a small but consistent tendency in which participants originating from Gauteng are more skeptical than those from Kwa-Zulu-Natal.

### 3.2. Interviews and focus group discussions

The data collected from the interviews and focus group discussion are presented as a mind map in Fig. 1, which visually describes the key themes, sub-themes and patterns that were found during data analysis. Respondents' attitudes were primarily differentiated based on whether the respondents were familiar or unfamiliar with eating insects; thereafter into negative or positive attitudes which in turn are connected to the described associations with edible insects.

#### 3.2.1. Neophobia and stigma

The negative attitudes and perception towards insects as food are shown to be similar whether the respondents are familiar or not with insect consumption. One of the main factors influencing young South Africans' negative attitude seems to be neophobia. Insects as food could either be perceived as something unappealing, or that they fear as they

**Table 4**

Mean values and Standard Deviations of the Entomophagy Attitude Questionnaire including differences between the provinces Gauteng and KwaZulu-Natal (KZN) analysed using the Mann-Whitney U test.

Description	Item	Total	Gauteng n = 76	KZN n = 22	p-value
Disgust (EAQ-D)	I would be disgusted to eat any dish with insects.	4.8 ± 2.1	4.9 ± 2	4.4 ± 2.4	NS
	Thinking about the flavour that a bug might have sickens me.	4.8 ± 2	5 ± 1.9	4.1 ± 2.3	NS
	If I ate a dish and then came to know that there were insects among the ingredients, I would be disgusted.	4.5 ± 2.2	4.6 ± 2.1	3.9 ± 2.4	NS
	I would avoid eating a dish with insects among the ingredients, even if it was cooked by a famous chef.	4.1 ± 2.2	4.3 ± 2.2	3.2 ± 2.1	NS
	I would be bothered by finding dishes cooked with insects on a restaurant menu.	3.7 ± 2.2	3.8 ± 2.2	3.4 ± 2.3	NS
Interest (EAQ-I)	I'd be curious to taste a dish with insects if cooked well.	4.4 ± 2.3	4.2 ± 2.3	4.8 ± 2.2	NS
	In special circumstances, I might try to eat a dish of insects.	4.4 ± 2.2	4.2 ± 2.2	5.1 ± 1.9	NS
	At a dinner with friends I would try new foods prepared with insect flour.	4.2 ± 2.2	4 ± 2.2	4.9 ± 1.9	NS
Feeding animals (EAQ-F)	Using insects is a good way of producing meat.	4.3 ± 2	4.1 ± 2	4.9 ± 2	NS
	I think it is fine to give insect-based feed to fish that are farmed for human consumption.	5.6 ± 1.7	5.6 ± 1.6	5.6 ± 1.9	NS

Note. Provinces with no or low responses have been excluded. Answers have been collected on a 7-point Likert-scale starting from 1 (Totally Disagree) to 7 (Totally Agree). NS = non-significant ( $p > 0.05$ ).

are viewed as being bad or dangerous:

*"I don't find interest in eating insects because of my fear of insects."*  
(Female, originating from Gauteng)

*"I find insects creepy so the thought of eating them wouldn't sit well in my head"*

(Male, originating from Limpopo)

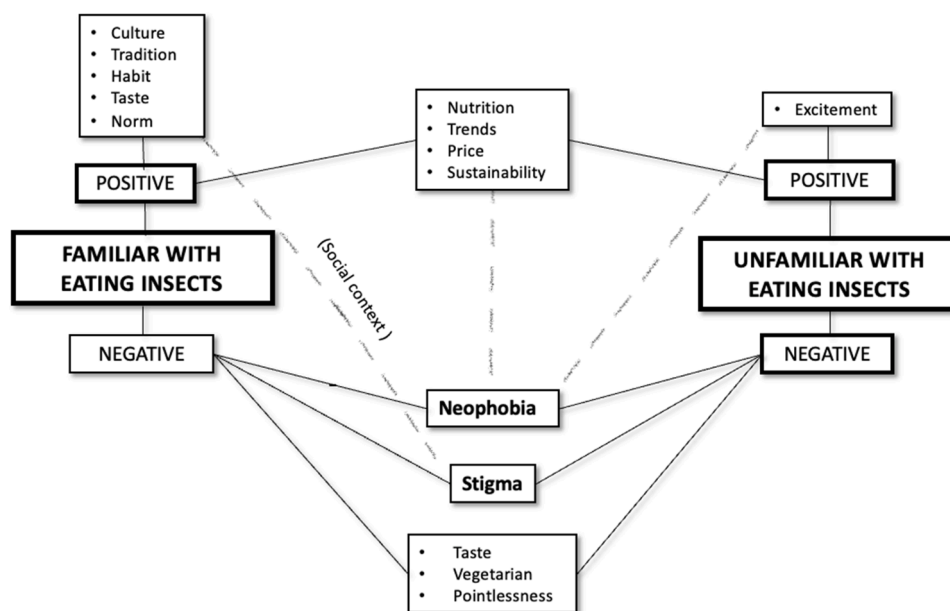
*"I do not consume insects because they are disgusting"*

(Female, originating from Gauteng)

*"I don't think it would be very appetizing to be eating insects in your meals. Might put me off."*

(Male, originating from Gauteng)

Stigma has also been shown to be a factor influencing the respondents' attitudes towards entomophagy, as they have associated the practice with being primitive and unhygienic. Stigma was not found only among those who originally had negative feelings associated with insects as food, but respondents' perception towards insects varied depending on the social context. Individuals who were familiar and positive towards eating insects as food due to their upbringing and cultural traditions became more reluctant when the surroundings changed. This was specifically mentioned during the interview by one woman originating from Limpopo, whose own experience reflected that the knowledge and traditions around entomophagy may decline due to a reluctance when younger generations moved to more urban areas. This perception was also identified in some of the open-ended answers from the EAQ:



**Fig. 1.** Thematic map of the main factors influencing young South Africans' attitudes towards eating insects; showing the two main themes, sub-themes and codewords generated from the qualitative data analysis.

*"I used to eat insects as a relish or snacks as a kid but the stigma of eating insects while growing up has prevented me from further willingly consuming insects."*

(Female, originating from Limpopo)

Eating insects appeared to be associated with specific cultural affiliations or certain regions, particularly in Limpopo. It was mentioned to be something that would only occur in certain tribes or low-income areas, and thereby were seen as primitive, uncivilized and norm-breaking in urban areas where the food culture in South Africa today is highly influenced by Western food.

### 3.2.2. The intersection of sustainability and nutrition

The younger, urban generation of South Africans have a larger focus on healthy diets compared to the older generation who, to a greater extent, value traditions and food culture. Respondents associated sustainable food consumption with factors relating to nutrition and health, emphasizing the importance of protein intake. Meat and poultry served as crucial sources of protein in this regard, and some individuals perceived insects as an unnecessary alternative to their diets.

*"I have enough protein from animal products, so I don't need to substitute with insects."*

(Male, originating from Gauteng)

Furthermore, the price of food played a role in consumption choices, where meat and dairy products were stated to be affordable in South Africa. Some individuals had a hard time seeing the benefits of altering their usual food choices to include insect-based products:

*"...why would you choose an insect over a normally good bar or food?"*

(Male, originating from Mpumalanga)

It was considered inconceivable that an insect-based product could offer greater benefits or be superior to enough to persuade people choose it over the foods they already consume.

For some participants, outside of culture, taste and habits, nutrition was described as one of the main reasons for them consuming insects:

*"I do consume insects because it can produce equivalent amounts of quality protein when compared to animals."*

(Female, originating from Gauteng)

*"I consume them because they are high in protein"*

(Female, originating from Limpopo)

Nutritional aspects were a main reason to consume insect containing foods among individuals who were not already familiar with eating them. However, they described a preference for insects as non-visible in food products where it was stated to be a way to reduce their meat consumption or to increase their protein intake:

*"Would prefer to consume it in some powdered form as a protein supplement and replacement (allow me to eat less meat)."*

(Male, originating from Gauteng)

Regarding participants' views regarding insects as animal feed, the responses were found to be divided based on the animal being considered. Some expressed doubts about the use of insects as feed, as they believed that their scent could negatively impact the quality of the meat produced. Also, feeding herbivores like lambs and cows with insects was seen as unnatural. Despite some indication of a greater willingness to consume chicken or fish that were fed insects, concerns remained about the smell of insects affecting the taste or texture, and thus the overall enjoyment of the product.

## 4. Discussion

### 4.1. Gender and province

The EAQ is a multidimensional questionnaire designed specifically for entomophagy which has been cross validated and was used to investigate attitudes toward insect consumption in this study. Several studies using the EAQ have been previously performed in different contexts and languages, investigating differences in attitudes toward direct or indirect entomophagy.

Results of this study showed males responses ranked lower on disgust, while higher on interest and animal feeding, indicating a higher acceptance of edible insects compared to females, which is consistent with previous research (Chia et al., 2024; Tzompa-Sosa et al., 2023). A greater disgust sensitivity in women indicates that men are less likely to be deterred by the disgust response, making them more open to trying novel, potentially pathogen-related foods like insects. Lower disgust sensitivity among males is a psychological trait that aligns with greater

willingness to experiment with unfamiliar or aversive foods, including insects (Curtis et al., 2011). The reasons males appear to be more accepting towards eating insects may vary, however, there are cultural and biological factors that contribute to different attitudes toward foods between the genders. In some societies, males are expected to be more adventurous and daring, which could explain why they would be more willing to eat insects (Tuccillo et al., 2020).

Acceptance of edible insects varies depending on which province in South Africa individuals were raised (Hlongwane et al., 2020), with consumption of edible insects being common in provinces such as Limpopo, Mpumalanga, Gauteng, and Northwest (Obopile and Seeletso, 2013). This was not something that could be verified in the present study, which could be due to the specific audience in this study or that most of the data collection was done in urban areas where Western culture has already influenced people's food habits.

#### 4.2. Obstacles and challenges

The younger generation tend to avoid consuming insects due to feelings of disgust and perception of them as unclean and hazardous, which were found to be main obstacles to including edible insects in societies where entomophagy is uncommon or unknown (Jensen and Lieberoth, 2019). The idea of insects as vermin rather than food creates fear and unwillingness to even imagine trying them (Tuccillo et al., 2020). This is especially important in South Africa, as it has a long tradition of entomophagy that could be lost.

Individuals' food preferences and neophobia are developed within their social context of eating, in which people often act in a certain manner to avoid breaking away from cultural or societal norms (Bartels and Reinders, 2010). These social norms strongly influence food choices, especially among younger people when the feeling of belonging can be important to the expression of their social identity. Participants in this study found it to be pointless to change their current consumption habits, especially regarding foods containing insects. They felt it would feel strange or norm-breaking to eat something that was not considered normal in their culture or social context. The high accessibility and norms surrounding meat consumption in South Africa may have influenced respondents in this study's view that eating insect-based foods was unnecessary and not worthwhile.

Along with cultural attitudes, it is important to consider personal values and beliefs towards food choices (Barrena et al., 2015). Negative attitudes toward insects and insect-based food consumption could be due to it being viewed as a primitive practice or associated with poverty. Historical and cultural biases in South Africa could be a reason people wouldn't want to be associated with eating something that would indicate either poverty or tribal foods.

Social stigma associated with consuming edible insects poses an obstacle to the advancement of sustainable food production methods. Insects have the potential to increase circular agriculture and be a nutritious component in many food products, while also helping to secure access to food for many people (Moruzzo et al., 2021). Insects are highly nutritious and have a low environmental impact compared with livestock, requiring significantly less water to produce the same amount of protein (Van Huis, 2013). Despite these benefits, insect-based foods also present risks. Insects can accumulate heavy metals in their bodies, including lead, cadmium, and nickel, which can be dangerous for humans, especially children and at-risk individuals, if overconsumed (Gori et al., 2025). Further, the occurrence of food allergies in the form of cross-reactivity between edible insects and crustaceans has been reported as clinically relevant according to Ribeiro et al. (2018).

Additionally, the social stigma puts the preservation of traditional cultural practices and knowledge at risk, and when individuals migrate for education and work, societies risk change due to globalization and urbanization. Changing surrounding leads to new collective norms where people tend to abandon their traditional food habits to adhere to a new social identity.

#### 4.3. Indirect entomophagy

The implementation of indirect entomophagy has been shown to be more accepted than eating whole or processed insects (La Barbera et al., 2021; Sogari et al., 2023), which is also indicated from the EAQs outcome in this study. Indirect entomophagy could be a more sustainable way of feeding fish and animals, as insects are both rich in nutrients and they help process agricultural waste materials creating a circular production system (Chia et al., 2019). While using insects as feed is more accepted than direct entomophagy, knowledge and awareness of the benefits limit its demand and growth (Abro et al., 2025). Overall, young South Africans generally seem to have a negative attitude towards direct entomophagy and are more positive towards indirect entomophagy. The data collected in this study indicated greater unwillingness towards indirect entomophagy in instances where individuals found it unnatural to feed herbivores with insects. There was an indication of greater willingness to consume chicken or fish that had been fed insects, though they were preferred to be included in animal feed as a supplement. This is consistent with other studies which have shown differing opinions on the appropriateness and acceptability of using insects as animal feed (Dolfi et al., 2025; Hamam et al., 2025; Niimi, J. et al., 2025). Thus, highlighting that the issue does not only concern the feed, but also the complexity of people's attitudes in which further research and education could help increase acceptance.

#### 4.4. Promoting insect-based foods

Today, South Africans' food habits are highly influenced by Western food culture, which can lead to cultural traditions and norms being abandoned (Obopile and Seeletso, 2013). The younger generation is highly conscious of their food habits and many claim to strive to eat healthy and nutritious foods. This could become one of the main reasons for young individuals to try insect-based foods in their diets in South Africa.

Data collected in this study revealed an interest in edible insects, but a greater preference for products containing non-visible insects. These findings contrast the results observed in Chile, where it was recommended to produce products containing whole insects to cater the preference of the target audience there (La Barbera et al., 2020). Processing the insects was suggested by participants in this study to reduce the stigma of eating them, and that it would be easier to eat something when you can't see what it is. Participants indicated they would prefer to consume insects in a powdered form used as a protein powder, in bread or pasta, bars or mixed up in familiar meat products such as boerewors (a traditional South African sausage), biltong (traditional South African dried, cured meat) or minced meat. However, if insects were included in ready-to-eat products, it was important that people were informed of why and how they are incorporated. More precisely, which insects were used and how they benefitted the products regarding nutritional value, cost, or reduced climate impact. For instance, desert locust powder has been found not only to add protein and nutrients when used to replace some of the wheat flour in bread but also to improve its aroma (Tanga et al., 2025). Most desirable would be products with insects containing high nutritional value, that were more affordable and that appeared to be something trendy. African consumers have shown a willingness to pay slightly more for products made with insect powder, while consumers from western countries want to pay less for products containing insects (Abro et al., 2025).

Scepticism towards insects in this study could in many cases be due to unfamiliarity, which can play a significant role in people's attitudes and perception towards new food products. By using familiar food products or brands it could be possible to increase individuals' positive attitudes and willingness to consume insect-based foods (Tuccillo et al., 2020). Familiarity could also affect the view of a new product's health and safety, as well as provide indication of how a new product should be consumed.

In South Africa's urban area, some individuals may have adjusted their attitude toward insect-based foods as being exciting or trendy as they have emerged as a popular topic in the Western world. Social context can be a relevant driving force to try edible insects, where curiosity seems to be affected by company and eating place (La Barbera et al., 2020). Marketing also plays a crucial role in creating trends and influencing consumer behaviour, including the introduction of new food products (Belz and Schmidt-Riediger, 2010). It can be a useful tool in overcoming disgust or negative attitudes towards certain foods by using them in familiar food products to make them more acceptable in social contexts (Tuccillo et al., 2020). As young South Africans tend to be highly conscious of their dietary choices, marketing insect-based food products as high in nutrition, especially protein, could be a successful strategy. The close link between sustainability and nutrition highlights the importance of considering both factors when promoting insect-based foods. This approach could also avoid focusing on the product as insect-based, which could help overcome social stigma attached to them.

#### 4.5. Methodological limitations

The use of an approach inspired by mixed methods has provided valuable insights within this research by enabling a more comprehensive understanding of behaviours and emotions, leading to a more holistic view of the topic, which allowed the study's purpose and research questions to be answered. Improvements to the survey questions are needed for future studies, including revision and clarification of the descriptive questions of participants. The question of where the participants *originated* did not explain what was considered rural, semi-urban, or urban areas. The same applied for the question: "Are insects included in your diet?", where no explanation was given as to what was meant by diet. This lack of clarification created confusion and the possibility for misunderstanding for some participants.

Field conditions made it difficult to carry out the study as originally planned, both in recruiting the desired number of participants, diversity of backgrounds and number of interviews. Practical issues such as access to Wi-Fi to participate in the survey limited recruitment, and issues with the safety of the investigators caused the cancelling one planned interview. Throughout the data collection the investigators had to react and adjust to conditions in a pragmatic manner based on the conditions at hand to collect as much data as possible for the study.

South Africa is a developing country and universities there could consist of students with some element of diversity in socio-economic background, which does not reflect the general population. A much more diverse socio-economic background among participants could provide a more realistic view of the topic. However, the choice of universities was suitable for recruiting young people, which was the object of research. The university context was also the reason that no data regarding educational background was collected, although this information could have been relevant. The participants in the focus group were recruited on a voluntary basis, and it happened that only females volunteered. However, it was seen as appropriate as the female perspective was of interest, seeing women are often the more reluctant to try eating insects (Çınar et al., 2021).

Geographical location as a determining factor for acceptance of entomophagy was originally a goal of the study, thus it was planned to collect large amounts of survey responses from all of South Africa's provinces. While this was not possible during this study, sufficient data was collected from two provinces which could be used for analysis and comparison. It can be noted that Gauteng Province is one of the main industrial hubs in South Africa, and thus due to economic opportunities people from other provinces migrate there (Thorne, 2024).

South Africa is a large and diverse country of over 60 million people, where a large part of the population lives in rural areas. Further research within the area should focus on less populated areas to provide a more accurate picture of the country and to gain a more comprehensive understanding within the subject.

## 5. Conclusion

This study examined young South Africans' acceptance of insect-based foods and identified the main obstacles and opportunities for potential implementation. Findings show that while many participants, especially females, expressed reluctance due to disgust, stigma, and unfamiliarity, there was greater openness toward indirect entomophagy and products where insects are incorporated in non-visible forms, such as powders and meat blends. Nutrition, especially protein intake, was a potential motivator, though the abundance of affordable meat made insects seem unnecessary for some. The results suggest that successful promotion of insect-based foods among young consumers in South African will require framing them as, nutritious, sustainable, and socially desirable. By linking entomophagy to health, sustainability, and modern food culture, insect-based foods could play a role in shaping future dietary practices. This study contributes context-specific evidence from South Africa, expanding understanding of youth acceptance and informing strategies for sustainable food innovation.

### Ethical statement

Participants were informed and approved of the use of collected data, and no collection of personally identifiable information was performed. Collected data was solely used for the study's intended purpose, and confidentiality requirements have been maintained. Sensitive information such as recordings have been safely stored and have not been disseminated to unauthorized parties. Ethical approval for this study was obtained from the University of Johannesburg's Faculty of Science Ethics Committee (Approval number: 2023-03-24/Hansell\_Melker).

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### CRediT authorship contribution statement

**Moa Hansell:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Matilda Johansson Melker:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Viktoria Olsson:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Data curation, Conceptualization. **Karin Wendin:** Writing – review & editing, Supervision. **Matthew Pohl:** Writing – review & editing, Visualization. **Oluwafemi Ayodeji Adebo:** Writing – review & editing, Resources, Investigation. **Nomusa Rhoda Dlamini:** Writing – review & editing, Supervision, Resources, Investigation.

### Declaration of competing interest

The authors declare that they have no competing interests that would have influenced the research presented in this article.

### Data availability

Data will be made available on request.

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