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Stakeholders' Perceived Experiences with Indigenous Edible Insects in Zimbabwe

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ABSTRACT

Experiences with edible insects are still underexplored circumscribing their acceptance into the mainstream cuisines world over, despite a stable source of supply from rural communities. Edible insects have aroused interest among scholars who seek to create a sustainable food security and healthy eating among nations. The hotel industry is also engineering new and creative cuisines to increase the consumption of the insects. Studies conducted so far have explored methods for harvesting, conserving, packaging, and the cooking of edible insects. This qualitative study therefore assessed the diners and chefs' perceived experiences with edible insects for the mainstream Zimbabwean cuisine. Conclusively perceived experiences with edible insects are still negative to both local and international diners. Therefore, there is need for innovative preparations, production, and presentation of edible insects to increase their uptake.

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Food culture; food tourism; sustainability; edible insects; sustainable food

Introduction

Insects are generally consumed by humans in many countries around the world but predominantly in Asia, Africa, and Latin America (Chakravarthy, Jayasimha, Rachana, & Rohini, 2016). However, in 2015, Van Huis et al. observed that the production of cuisines from insects is currently limited world over. The consumption has been noted by many scholars to have a myriad of paybacks that include environmental, health, social, and livelihood benefits (Chakravarthy et al., 2016; Musundire et al., 2016a; Van Huis, Dicke, & van Loon, 2015). Edible insects have an assortment of benefits(Macheka, Mubaiwa, Ngadze, Murefu, & Manditsera, 2019; Manditsera & Lakemond, 2019; Masheka, Macheka, Mugova, Zvidzai, & Musundire, 2019a, 2019b; Musundire et al., 2016b; Rumpold & Schlüter, 2013; Van Huis, 2015;2014). The insects are recommended for daily dietary requirements and have been found as a nutritious alternative to meat products (Van Huis, 2020). (They have high protein levels (Kinyuru, Mogendi, Riwa, & Ndung'u, 2015). They emit lower greenhouse gases and ammonia than animals (Van Huis et al., 2013,).

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Insect farming can also transform communities and can be used for food security (Chakravarthy et al., 2016; Van Huis & Oonincx, 2017). Edible insects also address issues to do with sustainability, one of the sustainable developmental goals (SDG). In Africa, some of the edible insects include, ants, termites, beetle, grubs, caterpillars, and grasshoppers. According to van Huis, (2015), consumption in rural communities of Africa is diverse from beetles (31%), caterpillars (18%), wasps, bees and ants (15%), crickets, grasshoppers, and locusts (13%), true bugs (11%), and termites, dragonflies, flies and others (12%). Rarely do any of these edible insects appear in the hotels and restaurants for consumption because it is still acknowledged as an odd practice of "primitive man" (van Huis, 2015). In hotels when they do appear they are still sold as delicacies. Table 1 below is a summary of key themes identified on stakeholder perceptions towards edible insects.

Zimbabwe is one nation among many whose rural denizens have gained trust in exploiting and consuming edible insects for an assortment of paybacks. In Zimbabwe there are more than thirty–two (32) edible insect species that can be consumed (Musundire et al., 2016b). However, these insect species are not included in most hotel menus. Findings from different studies have also noted that there are challenges in making these insect dishes tasty and attractive to the diner (see Macheka et al., 2019, Manditsera & Lakemond, 2019 and Musundire, 2016a). The acceptance of edible insects is dependent not only on palatability, nutritional and environmental factors, but also on the emotional and cultural dimensions as well (Looy, Dunkel, & Wood, 2014). These dimensions are usually overlooked by service providers. Noteworthy is that food preferences are influenced more by cultural history, experience, adaptation and education (Van Huis, Van Gurp, & Dicke, 2014). Therefore, this study assessed the diners and chefs' perceived experiences with indigenous edible insects in Zimbabwean hotels.

Problem statement and objectives

Experiences with edible insects are still underexplored circumscribing their acceptance into the mainstream cuisines world over, despite a stable source of supply from rural communities. Edible insects have aroused interest among scholars who seek to create a source for sustainable food security and healthy eating among nations. The hotel industry is also engineering new and creative cuisines to increase the consumption of the insects. Studies conducted so far have explored methods for harvesting, conserving, packaging and the cooking of edible insects. Findings from the studies revealed that edible insects are exploited in the preparation of traditional cuisines among diverse rural communities leaving a gap in how they are experienced by diners of the

Table 1. A summary of key themes.

THEMES	EVIDENCE FROM DATA	MEANING	IMPLICATIONS
(1) Disgusting	. . . they are horrible . . . . . . the mere sight of them in the plate makes me feel like throwing . . . . . . the appearance of some of them is nauseating . . . Their color and their anatomy is yuk, horrifying if presented in whole . . .	The way the respondents described the appearance of the insects had an implication on their uptake and consumption.	The way the dinners describe the insects has an implication on the consumer. This implies that there is need to improve on the appearance and presentation of any related dishes.
(2) Unsafe	Edible insects stay fresh for long. Species are not well known so we fear for our lives. . . . the drying is normally unhygienic . . . . . . skeptical about the way they are harvested or collected and processed . . . . . . no reputable suppliers so we are concerned about the safety of our customers . . . . . . afraid of allergic reactions . . . . . . we do not eat food that we are not sure of its source . . . . . . risk of consuming insects that are in their developmental stages which causing stomach problem . . . . . poor handling and culinary treatment . . .	Insects are perceived as dirty food, which may cause health problems. Most edible insects are found on the ground and they feed on biodegrading materials of any type which they come across making eating them unsafe.	There is need for consumers to have adequate knowledge on insects that are regarded edible. More studies should be conducted to test for consumption safety. Scientific studies to determine the safe of collecting, processing, cooking and packaging are also critical.
(3) Unappealing	. . . Customers expect exceptionally tasty food when they come to us . . . . . . natural taste itself has a lot to be desired. . . . not sensory appealing in terms of size, shape, color and texture if care is not taken during their preparation . . . some are too small and other too big . . . . . . exude an offensive odor . . . some have an intense flavor . . .. served with limited starches some of which have an appealing finger millet or pearl millet . . . Serving them with the other foods and in fillings for pies, stews mixed with beef or as part of the cake ingredients, can improve their appeal.	The nature of some of the edible insects deter the consumer from consuming them. In such cases, hotelier lose out on income to be generated from insect dishes. Consumers thus are particular with the esthetic and sensory appeal of the food that they consume.	There is need to work on esthetic and sensory appeal of a host of insect dishes to make them compatible with other dishes and presentable in different platters. The harvesting and processing of the insects has to allow for product diversification.

mainstream cuisines in hotels. This qualitative study therefore assessed the diners and chefs' perceived experiences with edible insects for the mainstream Zimbabwean cuisine.

Literature review

Despite FAO promoting the consumption of insects from wild harvest or insect farming (Gahukar, 2011; Hanboonsong, Jamjanya, & Durst, 2013; Van Huis et al., 2013), the consumers' perceived experiences with edible insects are still to be investigated in the hospitality sector. According to Ruby, Rozin, and Chan (2015) one of the major, impediments to large-scale increases of human insect consumption, is the strong rejection of insects as food by most of the world's population. More-so research is still centralized around edible insect viability as food and feed in the face of rapid increase in human population and associated food demand; captive breeding as edible insects are seasonal and possible varieties of edible insect products (Gamundani, Chimhanda, & Zingwena, 2019; Masheka et al., 2019a, 2019b; Chemura, Musundire, & Chiwona-Karltun, 2018; Kouřimská & Adámková, 2016; Van Huis, 2015; 2014). Worse off in the restaurants of hotel and lodges in Zimbabwe. Research has noted high levels of edible insect consumption by the rural communities in Zimbabwe (Manditsera et al., 2018, Vantomme, 2015). However, in urban communities the consumption is still low (van Huis, 2015). This low consumption level is explained by the fact that edible insects are still linked with tradition, food culture, familiarity and proximity (Manditsera et al., 2018).

Several strategies have been adopted to try and increase acceptance and consumption of these insects. Such strategies include: (1) To increase familiarity with the product by providing consumers with information about the insects as a sustainable alternative food source (Lensvelt & Steenbekkers, 2014); (2) To make edible insects available and provide knowledge about how to prepare them (Looy et al., 2014); (3) To stress the systematic proximity in animal classification between insects and crustaceans (Caparros Megido et al., 2014); (4) To increase frequencies of edible insect exposure and experimental tasting (Lensvelt & Steenbekkers, 2014; Looy et al., 2014); (5) To develop appropriate products that not only lower the barriers to trying, but also taste good and are appealing to eat (Tan et al., 2015; Deroy, Reade, & Spence, 2015); (6) To incorporate insects into familiar food items (Hartmann, Shi, Giusto, & Siegrist, 2015). In Thailand, other South Asian countries, Latin America, Australia, Sweden, South Africa and Europe, edible insects are ground into powder or paste(Tao & Li, 2018). This paste and powder is then incorporated into other foods to increase insect acceptability. While in a paste or powder form, they can be incorporated into other foods like flour. Other methods of making the insects acceptable

is by making granola, covering the insect in chocolate, for the production of cookies, chocolates, tortilla-style chips, energy drinks and other snacks. This is done all to make them less intimidating to consumers (Hallin, 2020).

Despite all these strategies the appearance, acceptance and consumption of edible insects is still low in hotels and restaurants. For edible insect experiences to increase strategy 4; 5 and 6 are important for hotels but restaurant and hotel consumers, have been noted by (Tan et al., 2015), to still remain inclined toward familiar traditional cuisine than the uncommon fare. At the same time for the hospitality sector their location (proximity) is far away from these edible insects making their availability as cuisines very scarce if not existent at all (Macheka et al., 2019).

Therefore, a study into the perceived experiences with indigenous edible insects in Zimbabwe could provide new insights into food preferences, acceptance and product diversity. The issues of food preferences have been noted to affect consumption patterns (Gerbens-Leenes & Nonhebel, 2005; Sijtsema, Linnemann, Gaasbeek, Dagevos, & Jongen, 2002), hence product diversity can significantly assist to increase consumption patterns. This is true for instance in America, the acceptance of sushi was slow (Carroll, 2009). It took several stages to become a favorite food because Americans considered eating raw fish as unacceptable. However, its popularity came with the influx of Japanese managers and executives who knew how to prepare and serve it. It is also both healthful and light (Hsin-I Feng, 2012). However, consumer preferences are still being affected by either (taste, flavor, appearance), or other intervening variables, such as gender, age and education, individual upbringing and religion. Some religious practices forbid entomophagy, and limit the consumption of edible insects by the wider community (Dube & Phiri, 2013). These effects may continue to affect the consumption and perceptions toward unfamiliar foods.

From another perspective, food neophobia or neophilia (Baker, Shin & Kim; Pliner & Hobden, 1992) is a current personality trait that is commonly used by consumers in deciding or eat to dislike food in this case-edible insects. With neophilia, unfamiliar foods are regarded as novel and consumers seek to derive pleasure from eating them (Armelagos, 2014; Johns, Edwards, & Hartwell, 2011; Veeck, 2010). Whilst food neophobia is the opposite, where the tendency is to dislike unfamiliar food-like edible insects on the hotel menu (Giordano, Clodoveo, De Gennaro, & Corbo, 2018; Hartmann & Siegrist, 2018). According to Veeck (2010) a person with neophobia sees novel or unfamiliar foods as a threat and react negatively to these products. The more familiar the consumer is to the food they are less phobic. Hence, popularity of edible insects on the menu card in hotels is still aversive to the common restaurateur and chef. To increase consumption patterns, perceived experiences are important to gauge tolerance levels and possible product diversification possibilities. To

do this the study used defined experiences as 'emotional, social, physical, spiritual and intellectual well-being of an individual (Andersson, 2007, p. 52; Mossberg, 2007, p. 61) that can be manipulated to cause a reaction in the consumer as they react to stimuli (Mahachi-Chatibura, 2014).The study gives an overview of the current data that is available on these perceived experiences with indigenous edible insects in Zimbabwe as food from a consumer perspective.

Materials and methods

Research philosophy

This study is phenomenological in nature where knowledge is achieved through interaction between the researcher and the participant (Finlay, 2009; Wilson, 2015). This approach allowed the participants' lived experiences to be explored and interpreted by means of qualitative methods (Tufanaru, 2013) yielding results that are inductive, immanent, dynamic, and unique in nature.

Study design

A case study design was deemed appropriate for the present study since it addressed the what, the how and why questions. It focused on individual cases that provided the researchers with an opportunity to analyze cases in a real-life context (Yin, 2003; Baxter & Jack, 2008; Yin, 2009; Abdul Rahim & Wan Daud, 2015; Alnaim, 2015).

Data on consumers' perceived experiences of edible insects was collected through convenience sampling for diners and snowball sampling for chefs (where appropriate). The respondents' experiences with edible insects consumption within mainstream cuisines required the capturing of rich data from participants' personal opinions, sentiments, judgments, observations and personal accounts. Thus, in-depth face-to-face interviews were carried out with diners and hotel chefs at an international conference under the theme "Consolidating innovations, research and development on edible insects for transformation of livelihoods in Africa."

Sample size

Five, (5) chefs experienced in cooking traditional cuisine from CBD hotels in Harare. The sample also include 25 respondents comprising 10 international, 5 regional and 10)domestic diners who attended an international conference on edible insects. This conference was held in Zimbabwe at a 4-star hotel in Harare from 14th to 16th August 2019. Interviews were used as the major data

collection method with the aid of a detailed interview guide to collect data on the perceived consumption experiences with edible insects. Research ethics were considered in all the processes involved.

Results and discussion

From the face-to-face interviews there were various experiences that consumers and chefs expressed. Their responses were grouped into various themes.

Findings

The inclusion of edible insects in traditional cuisines is still unpopular with most dinners who visit the Zimbabwean hotels. Findings from this study also reveal that the consumption of edible insects is still negative with both local and international dinners. A variety of reasons for the poor uptake of these insects were also identified in the process. The majority of the diners displayed negative emotions about the consumption of insects in hotel restaurants. Words associated with insects were highlighted as reducing the willingness to accept insects as part of indigenous cuisine. Insects prove to have many connotations associated with their use as food just like other traditional foods such as vegetables and fruits. The views by most chefs were that insects are regarded as food for the poor. These views were also reinforced by one of the respondent who was a participant at the conference. The elderly participant had this to say, *"I remember insects being the last option as part of a meal in my home area. Where there were other sources of protein no one would go around hunting for these small creatures. No one would want to spend the day collecting them . . . "*

"*The richer families would catch insects for fun and as a hobby and give their children to use as relish during 'mahumbwe' playing house games*," reiterated another elderly participant. Another participant revealed that using insect products in hotels would require a lot of effort to come up with a hotel's standard dishes. The respondent actually said, " . . . *Would one really visit a hotel for insects*? . . . " This query is a revelation of the extent to which insects are undermined. The majority of the participants revealed that insects were generally viewed as food for those who have no animals at their home steads. An interesting response was given by a young participant who said that one would not voluntarily choose to eat insects except if they had no other choice.

Meanwhile, the majority of the chefs who participated in the study revealed that most of the diners who consume these insects do it for fun while think that doing so is fascinating. The chefs also indicated that diners believe that insects are cheaper than most meat dishes. All these views indicate that there is stigma attached to eating insects.

These findings concur with the findings from a study by Shelomi (2016) who also observed that insects have always been regarded as food for paupers and also labeled as the poor man's meat. A study conducted in Belgium also found that only o1% of those willing to eat insects in their natural form while the rest would prefer the processed form (Tucker, 2014; Caparros Megido et al., 2014). The scholars revealed that most insects do not simply fit in the typical person's image of what "food" should look like. Thus, insects remain undermined, limiting their acceptance as food in the mainstream cuisines.

As such, seven (7) themes were derived from the thematic analysis of the results. The themes include the following: disgusting, unsafe, unappealing, inedible, neophobic, unsustainable and nutritive. The first three (3) key themes are presented in the table below while the other four (4) were presented verbatim.

When people go out for a meal they would look forward to eat food with a better taste than what they eat when they are in their homes. With that assumption there were mixed perceptions on the taste and appeal of edible insects with reference to their provision in hotels restaurants. The sentiments given were mixed. One head chef said that ‘

Responses from those who grew up in the rural areas indicated that the edible insects were a delicacy. They were not happy about the rate at which the catering industry was not providing the edible insects. The favorite insects were Mopani worms, crickets, termites and grasshoppers. ‘*We used to eat raw termites as we picked them and they tasted nice and fresh"* indicated one participant. Traditionally most like termites were eaten raw. Edible insects were a delicacy and especially when served as a snack, fried and dried and they have a crispy taste. The point raised was that taste was as a result of being able to prepare and cook the insects well. New dishes should not completely change the natural taste of the food. During cooking insects take the flavor of added ingredients, so it may improve or completely distort the edible insect. The traditional ways of cooking were suggested as most suitable methods where they are served without any sauce. They were sentiments that they can come in as part of what is termed ‘*gochi gochi", and they can form part of that cuisine*", indicated one male respondent. A chef indicated that it is because of the size that not much can be done to prepare them in different methods. *"They are always dry, so all you can do is frying. We have started on new dishes using the powder and crushed products and they are slowly gaining popularity. More should be done, but we are now somewhere."*

Findings from the study concur with the views of diverse author who had a chance to investigate how consuming insects is viewed. It is indeed true that today's customers are more concerned about their health more than anything else when they choose what to eat (Schneider, 2019). Consumption of grasshoppers and locusts without removing their feet can lead to intestinal blockage, which could have fatal consequences (Kouřimská et al., 2016). Eating

insects can also cause allergies (Ribeiro, Cunha, L., Bernardo Sousa-Pinto, & Fonseca, 2017; Taylor & Wang, 2018). The findings agree with Van Huis (2013), who posits that *"the important reasons for consuming insects are sensory/ pleasure considerations."* The exoskeleton of insects has a great influence on the texture. Insects are crunchy and sounds accompanying their eating resemble the sounds of crackers or pretzels (Kouřimská & Adámková, 2016). The point seems valid as diners particularly appreciated taste and texture. For both insect species, salty taste, dry and crunchy texture were preferred (Manditsera et al., 2018).

The other perception was that customers may not be willing to taste the unfamiliar taste of insects, especially the diners. The unfamiliar taste is because they deteriorate fast, worse if not properly processed and stored. Chaffer beetle can be poisonous if not thoroughly cooked because of toxins produced. Even those who are used to stink bug and chaffer beetle indicated that there was need to cook it well and even throw away the first boiling water or two to remove the strong smell. Edible insects have a lot of fat which make them deteriorate fast as well. Popular edible insects included mopani worms, termites and crickets (*gurwe)*. Stink bug, (*harurwa)* was liked by domestic diners who come from Masvingo in Zimbabwe. Most of the domestic and regional diners would want those they have eaten before. All these sentiments agree with Sogari (2015) whose findings were that edible insects cannot be easily included in delicacies from the sensory properties (unpleasant taste and texture) to the perception of health risks.

Inedible

For some respondents edible insects are not considered as food. Some consider them as dangerous species to their host, while others take them as unclean for them to be taken into our holy bodies. This is as result of upbringing and religion. The fact that some religions prohibit the consumption of insects makes hotels hesitant to provide them. Some churches faith goes to the extent of not accepting the sharing of cooking and serving equipment with those used for foods they prohibit. Because of growing numbers of such customers, their clientele base would be shrinking as customers would have a negative attitude toward their food as they would label the outlet using the same pots to cook their food. "*The Beta clam do not consume termite and some end up not consuming anything which flies," It may be difficult to isolate these insects when collecting them as termites may be collected together with termite (majuru) as they may share the same hole*: reiterated a respondent. Food labeling would help so that customers know exactly what is offered, for them not to doubt their choices.

Neophobia

The introduction of edible insect cuisines will be received slowly. As a new food to most generations the issue of food neophobia (fear of new food) comes in. People generally do not want to try new food which is generally very different from what they are used to. One responded stated that; "*these insects are scary or frightening bugs, (zviruma) especially to children*. Meaning they are likened to something which bites. One said that they actually bite or pinch when they are alive. There are also stories about these insects that they can be poisonous. The findings were that the insect types were too many and it is very difficult to tell the difference. One respondent was of the view that: *'enough/ adequate documentation will help. At least one would know exactly what to choose from the list.'* Other descriptions were that: *"they look like cockroaches or houseflies especially the bug family do not look any different."*

Unsustainable

The issues of sustainability because of quantities were cited as likely to hinder acceptability of this nutritious food. Edible insects are small in size and quantities needed by hotels are usually large, to serve more diners. Chefs from the hotels noted this as they remarked *"edible insects are too small for us to innovate into a cuisine or even think of serving a good portion for our diners. We end up not bothering about serving them*." Also most have disappeared in the forest in Zimbabwe due to the land reform and veld fires that destroy forests where they reside. At the same time edible insects are difficult to harness, because of lack of indigenous knowledge of how it is done. For example, to harvest termites they are attracted by lights. That is the only way to harvest them. Though people have started breeding these edible insects, still the quantities may not be enough to serve large groups of guests this concurs with (Manditsera, 2018). Edible insects are also seasonal making it impossible for a consistent supply to hotels. This was noted by many chefs as they said "*our edible insects are only available at certain times of the year, this is a problem as our menu must at least have them if we serve local cuisine to diners, this stops us from even adding them onto the menu*." Though edible insects are sustainable as indicated by many scholars (Gamundani et al., 2019; Masheka et al., 2019a, 2019b; Musundire et al., 2016a; Kouřimská & Adámková, 2016; Van Huis, 2015;2014),the research on seasonality patterns and captive breeding can be the only solution to ensure guaranteed supply.

Nutritive

The issue of edible insects providing vital nutrient was highlighted by many participants. *"There is no doubt that edible insects are nutritious, but what people are not familiar with is the actual information on the ones which are very rich in nutrients. Our ancestors lived linger because of these diets, unlike us"* was a response from another participant. The problem aired was the

some of these seem too small to have significant amounts to really nourish the body considering the quantities which can be consumed. Conference presentations highlighted a lot on the nutritive value of these edible insects to humans and animals. Information dissemination on nutritional and sensory quality of edible insects is due, if the value of edible insects is to be help in marketing the product. The other view aired was that the consumption of edible insects was a good practice, as they were as nutritious as any other animals. Only that people were changed their eating habits and attitude to food by the colonizers. The reintroduction would was gaining popularity bit by bit and that was good for people so that we have our own indigenous cuisine, which is even cheaper. The table below is a summary of findings from the study

Other sentiments include that edible insects are taken for fun and as food which is fascinating.

However, it should be noted that if products are not sensorially satisfying, the aversion to insects is further increased. If the insect product tastes bad when it is first tasted, it is doubtful whether consumers would be prepared to overcome their aversion a second time. Hence edible insects may still remain in the background, yet they are good sources of nutrients.

Conclusion and recommendations

This study noted that perceived experiences related to edible insects were generally negative due to issues of food neophobia, where it comes from, smell, size, production and processing and other factors related to religion, seasonality and upbringing. These negative opinions may represent a significant barrier to introducing edible insects into the mainstream for Zimbabwean hotels. A lot should be done in terms of coming up with innovation for novel dishes. Chefs need to acquaint themselves to these edible insects to engineer cuisines which will be appealing to customers. Consequently, the introduction of insects as a food source in the hospitality industry and urban societies seems more likely to succeed only if edible insects are incorporated into familiar cuisines, which will reduce neophobic reactions and negative attitudes toward insect-based cuisines. Whilst captive rearing and production of the edible insects can also increase quantities needed by chefs and eradicate seasonality harvesting to make the cuisines readily available. Tasting insects, e.g. as part of a so-called "bug banquet," can be engineered to generate diners' positive taste experience and lead to a more positive attitude. However, customers who have eaten edible insects in the past indicate a generally higher willingness to want these edible insects on the hotel menus more frequently.

Considering Millennium Development Goals (MDGs) one and four "eradicate extreme poverty and hunger" and "reduce child mortality," respectively, edible insects can substantially contribute to improving nutrition and livelihoods of communities. Where undernourishment is at a critical level, harnessing and adopting edible insects in the household food supply system can radically improve nutrition and food security. Focus should be more inclined toward driving edible insects into the mainstream through product diversification for community beneficiation and industrialization.

Limitations of the study

The challenges encountered by chefs when they source and prepare edible insects were not included as part of the study.

The results of this study cannot be generalized for other destinations as it took the case study approach. It could have used multiple-case study design to achieve generalization.

The diners were not observed under natural settings, they were at a conference making it difficult to observe and further query them.

The study only used qualitative approaches but a mixed methodology approach could be used to reflect subjective and objective results that can be used for further studies.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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