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# Edible Insect Phobia and Associated Factors Among Women of Reproductive Age in the Central Region of Ghana

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## Abstract

**Background:** Food insecurity and micronutrient deficiencies remain significant public health concerns among women of reproductive age in Ghana. Edible insects offer a nutrient-dense, sustainable protein source. However, edible insect phobia may limit the acceptance and consumption of edible insects. This study explored edible insect phobia and its associated factors among women of reproductive age in the Central Region of Ghana.

**Methods:** A cross-sectional study was conducted between March and June 2024 at a tertiary hospital in the central region of Ghana. Three hundred forty women of reproductive age (15-49 years) were recruited. Data were collected using two validated psychometric scales including the Food Neophobia Scale and Insect Phobia Scale, along with sociodemographic characteristics and insect consumption history. Associations were examined using chi-square tests, Fisher's exact tests, and Spearman's rank correlation in R version 4.5.1.

**Results:** Edible insect phobia was statistically significantly associated with level of education ($p = 0.016$), ethnic group ($p < 0.001$), pregnancy status ($\chi^2(2) = 6.46$, $p = 0.040$, Cramer's V = 0.151, 95% Confidence Interval [CI] = 0.064–0.252), awareness of insects as food ($\chi^2(2) = 17.45$, $p < 0.001$, Cramer's V = 0.234, 95% CI = 0.138–0.330), and prior insect consumption ($\chi^2(2) = 16.54$, $p < 0.001$, Cramer's V = 0.228, 95% CI = 0.123–0.334). Edible insect phobia was negatively correlated with age ($r = -0.223$, 95% CI = -0.325 to -0.116, $p < 0.001$) and number of pregnancies ($r = -0.163$, 95% CI = -0.270 to -0.053, $p = 0.003$), but not with food neophobia score ($r = 0.097$, 95% CI = -0.020 to 0.209, $p = 0.074$).

**Conclusions:** In this sample, predominantly composed of pregnant women attending antenatal care services, higher phobia of edible insects among women of reproductive age was associated with younger age, fewer pregnancies, lower educational level, certain ethnicities, pregnancy status, unawareness, and no previous history of consuming edible insects. Interventions targeting these factors may help reduce edible insect phobia and increase acceptance of edible insects as dietary proteins among similar populations.

**Keywords:** Entomophagy; Alternative protein; Edible insect phobia; Women of reproductive age; Ghana

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## Introduction

Food insecurity and deficiencies in protein, iron, zinc, and other essential nutrients remain a significant public health concern in Ghana and worldwide. Among women of reproductive age, nutrient deficiencies contribute to a heightened risk of anemia, compromised immune function, poor pregnancy outcomes, and intergenerational health consequences [1,2]. As efforts to combat malnutrition evolve, attention has increasingly turned to underutilized, nutrient-dense food sources, particularly edible insects. Edible insects offer a compelling nutritional profile, rich in high-quality protein, unsaturated fatty acids, and micronutrients such as iron, zinc, and vitamin B12 [3,4].

According to van Huis et al. [5], over 2,000 insect species are consumed globally, with beetle larvae, caterpillars, crickets, and termites among the most common. Their nutrient density and lower environmental footprint have led the Food and Agriculture Organization (FAO) to endorse the practice of eating insects as a sustainable food solution in the face of rising food insecurity and climate change [3].

Despite global promotion of edible insects as food, actual consumption patterns vary. A systematic review by Florença et al. [6] identified key determinants of edible insect consumption, including sex, age, food neophobia, disgust sensitivity, cultural norms, nutritional beliefs, safety concerns, and the mode of presentation. Psychological aversion, sometimes referred to as "insect phobia," also emerges as a significant impediment to the widespread practice of consuming insects [3]. These attitudes are particularly concerning among women of reproductive age, who play a central role in household food provisioning and dietary decision-making. However, the bulk of empirical studies have been conducted in Europe, with relatively fewer from Africa, mainly Nigeria, Kenya, and South Africa [6].

In Ghana, the practice of eating insects is not a new phenomenon. Indigenous communities across the country have traditionally consumed species such as termites, grasshoppers, caterpillars, and the African palm weevil larvae [7]. A study by Anankware et al. [4] cataloged the commonly consumed insects in Ghana, including species such as the black soldier fly, shea tree caterpillar, and African termite. These insects are often harvested seasonally and prepared by frying, roasting, or grinding into powder for incorporation into meals. Yet, the 2022 Ghana Demographic and Health Survey reported that only 0.2% of women of reproductive age had consumed any form of edible insect in a certain 24-hour reference period 8. This underutilization contrasts with the nutritional potential of insects and may be partly explained by psychosocial and environmental barriers. In a mixed-methods study in northern Ghana, Kubuga et al. [2] found that while reasons for insect consumption included affordability, cultural familiarity, and perceived health benefits, deterrents were disgust, negative sensory attributes, limited availability, and concerns about hygiene. While most existing Ghanaian research on edible insects focuses on children, the factors influencing edible insect phobia among women of reproductive age remain understudied. This study, therefore, investigated edible insect phobia and its associated factors among women of reproductive age in Ghana. The findings may inform culturally sensitive nutrition education, product development, and policy interventions to harness the nutritional benefits of edible insects, improve dietary diversity, and contribute to sustainable solutions for malnutrition in Ghana.

# Materials and Methods

## Study Design

TThis was a cross-sectional study conducted at the Cape Coast Teaching Hospital, a tertiary hospital located in Cape Coast, Central Region of Ghana. The Cape Coast Teaching Hospital was chosen as the study site because it serves as a regional referral facility for the Central Region of Ghana. The underlying assumption was that selecting the Cape Coast Teaching Hospital would enable a diverse sample to be captured in the study, given the impracticality of obtaining a sampling frame for our target population.

## Sample and Sampling Procedure

The target population for this study was women of reproductive age in the Central Region of Ghana. Eligibility criteria included women aged 15 to 49 years, willingness to participate in the study, and ability to provide informed consent. Individuals who identified as vegetarians were excluded. It was not feasible to use a random sampling method due to the impracticality of obtaining a sampling frame of our target population; hence, the study participants were recruited using convenience sampling. The initial target sample size was 384, determined using Cochran's formula based on an assumed 50% prevalence of edible insect phobia, a 5% margin of error, and a 95% confidence interval. Constraints, including limited participant flow and the end of the data collection period, resulted in a final sample of 340 participants, 88.5% of the target.

## Measures

Data were collected in person between March and June 2024 by five final-year nutrition students under the supervision of a nutrition officer and registered dietitian. The data collection questionnaire included sociodemographic characteristics, awareness, and history of insect consumption, as well as psychological constructs from two validated psychometric scales 3. Although the psychometric scales were originally developed and tested in Italy, we assessed and confirmed their internal consistency for use among women of reproductive age in our setting. We conducted reliability checks on the two psychometric scales prior to full data collection using a sample of 20 women of reproductive age.

### Food Neophobia Scale

The food neophobia scale was used to assess general reluctance to try unfamiliar foods 3. It consists of 10 items, with responses captured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Five items (Q1, Q4, Q6, Q9, and Q10) were reverse-coded to ensure that higher scores across all items consistently reflected greater food neophobia. All item scores were summed up to generate a total food neophobia score. Internal consistency was assessed during a pilot reliability check conducted with 20 women of reproductive age, yielding acceptable reliability (Cronbach's $\alpha = 0.71$, 95% CI: 0.47–0.87, Feldt test).

### Insect Phobia Scale

The Insect Phobia Scale was used to assess emotional and cognitive discomfort related to edible insect consumption [3]. It included six negatively worded items addressing disgust,

perceived hygiene, concerns about taste and texture, and social unacceptability. Responses were rated on the same five-point Likert scale (1 = strongly disagree to 5 = strongly agree), and all items were summed to generate a total insect phobia score. No reverse coding was required, as all items were phrased to align directly with the construct being measured. Internal consistency was evaluated in the same pilot assessment, demonstrating good reliability (Cronbach's α = 0.81, 95% CI: 0.65–0.92, Feldt test).

### Likelihood of Consuming Insect-Based Products

Participants were asked to indicate their likelihood of consuming eight different insect-based food products using a five-point Likert scale (1 = Very Unlikely to 5 = Very Likely). The products included insect nuggets, insect burgers, spreads, crunchy larvae, insect soup, protein shakes, powdered insect spice mixes, and insect flour for baking. The items varied in terms of their visibility and recognizability, capturing a range of psychological responses toward insect-based foods. Responses with higher scores indicate greater willingness to consume the respective product.

### Data Analysis

All statistical analyses were conducted using R version 4.5.1 9. Prior to selecting statistical tests, the normality of continuous variables was assessed using the Shapiro–Wilk test, histograms, and boxplots. Where distributions deviated from normality, log transformations were applied, and normality was reassessed using the same methods. Despite attempts at transformation, the continuous variables remained non-normally distributed. Consequently, non-parametric tests were employed throughout the analysis. Because no formal cutoffs exist for categorization, the insect phobia scale and food neophobia were divided into tertiles (33% increments) to represent low, moderate, and high phobia groups. Associations between total insect phobia scores and continuous variables (e.g., age, number of pregnancies, and food neophobia scores) were assessed using Spearman's rank correlation. Relationships between insect phobia categories and sociodemographic variables were examined using Chi-square or Fisher's exact tests, with Monte Carlo approximations applied when cell counts were sparse. Effect sizes for categorical comparisons were reported using Cramer's V. Descriptive responses on the likelihood of consuming various insect-based foods were visually summarized using a diverging stacked bar chart to display the distribution of Likert-scale responses across food types.

## Results

### Sociodemographic Characteristics and Insect Consumption History of Study Participants.

The median age of the women was 31 years (interquartile range [IQR], 27–35), and they had a median of 2 pregnancies (IQR, 2–3). Most participants were married (69.1%), employed (89.4%), and had completed either senior high school (27.9%) or tertiary education (41.2%). The majority identified as Akan (89.7%) and Christian (92.6%). Most participants were currently pregnant (85.3%). While 72.1% were aware that insects can be eaten as food, only 23.5% reported ever consuming them. Among those who had eaten insects, taste was the most commonly stated reason (13.2%), followed by curiosity (7.4%). Among those who had not eaten insects, the most frequently cited reasons were unfamiliarity (33.8%), disgust (29.4%), fear of illness (14.7%), and a preference for traditional meat (10.3%) (Table 1).

Table 1. Self-Reported Sociodemographic Characteristics of a Sample of Women of Reproductive Age at a Tertiary Hospital in Ghana Between March 2024 and June 2024.

| Variables | N = 340 |
|---|---|
| Age | 31 (27 - 35) |
| Number of pregnancies | 2 (2 - 3) |
| Marital status | |
| Not married | 105 (30.9%) |
| Married | 235 (69.1%) |
| Level of education | |
| None | 10 (2.9%) |
| Primary | 5 (1.5%) |
| JHS | 90 (26.5%) |
| SHS | 95 (27.9%) |
| Tertiary | 140 (41.2%) |
| Employment status | |
| Unemployed | 36 (10.6%) |
| Employed | 304 (89.4%) |
| Ethnic group | |
| Akan | 305 (89.7%) |
| Ga | 10 (2.9%) |
| Ewe | 10 (2.9%) |
| Mole-Dagbani | 5 (1.5%) |
| Hausa | 5 (1.5%) |
| Guan | 5 (1.5%) |
| Religious affiliation | |
| Christianity | 315 (92.6%) |
| Islam | 25 (7.4%) |
| Current pregnant | 290 (85.3%) |
| Aware of insects as food | 245 (72.1%) |
| History of insect consumption | 80 (23.5%) |
| Reason for eating insects | |
| Because it tastes good | 45 (13.2%) |
| By curiousity | 25 (7.4%) |
| Reason for not eating insects | |
| Fear of illness | 50 (14.7%) |
| It disgusts me | 100 (29.4%) |
| Has not seen it before | 115 (33.8%) |
| I prefer real meat | 35 (10.3%) |

Note: Age and number of pregnancies are presented as medians with interquartile ranges (Q1 – Q3). For several items related to insect consumption (e.g., reasons for eating or not eating insects), participants could select more than one applicable response; therefore, the combined percentages in these categories exceed 100%. JHS = Junior High School; SHS = Senior High School. History of insect consumption refers to any prior experience of eating insects, encompassing both regular dietary practice and occasional or one-time exposure.

Table 2. Associations Between Sociodemographic Variables and Insect Phobia Category of a Sample of 340 Women of Reproductive Age at a Tertiary Hospital in Ghana Between March 2024 and June 2024.

| Variable | Test | Statistic | p-value | Cramer's V effect size | 95% Confidence Interval |
|---|---|---|---|---|---|
| Marital Status | Chi-Square | $\chi^2$ (2) = 3.54 | 0.170 | 0.117 | 0.03, 0.224 |
| Level of education | Fisher's Exact (Monte Carlo) | N/A | 0.016 | N/A | N/A |
| Employment status | Chi-Square | $\chi^2$ (2) = 2.72 | 0.256 | 0.106 | 0.022 , 0.216 |
| Ethnic group | Fisher's Exact (Monte Carlo) | N/A | <0.001 | N/A | N/A |
| Religious affiliation | Chi-Square | $\chi^2$ (2) = 1.93 | 0.381 | 0.095 | 0.021 , 0.178 |
| Pregnancy status | Chi-Square | $\chi^2$ (2) = 6.46 | 0.040 | 0.151 | 0.064 , 0.252 |
| Awareness of insects as food | Chi-Square | $\chi^2$ (2) = 17.45 | <0.001 | 0.234 | 0.138 , 0.330 |
| History of insect consumption | Chi-Square | $\chi^2$ (2) = 16.54 | <0.001 | 0.228 | 0.123 , 0.334 |

Note: Statistical tests examine associations between each sociodemographic variable and insect phobia categories (low, moderate, and high). N/A indicates that test statistics and effect sizes were not computed due to the use of Fisher's Exact Test with Monte Carlo simulation for variables with sparse or large contingency tables.

Table 3. Spearman's Correlation Between Insect Phobia and Other Variables of a Sample of 340 Women of Reproductive Age at a Tertiary Hospital in Ghana Between March 2024 and June 2024.

| Variable | Test | Statistic | 95% Confidence Interval | p-value |
|---|---|---|---|---|
| Age | Spearman's Correlation | r = -0.223 | -0.325 , -0.116 | <0.001 |
| Number of Pregnancies | Spearman's Correlation | r = -0.163 | -0.27 , -0.053 | 0.003 |
| Total Food Neophobia Score | Spearman's Correlation | r = 0.097 | -0.02 , 0.209 | 0.074 |
| Note: Spearman's correlation was used to assess the association between the total insect phobia score and the listed variables | | | | |

### Associations Between Sociodemographic Characteristics, Insect Consumption History, and Insect Phobia

Associations between sociodemographic characteristics, insect consumption history, and insect phobia among the study participants are summarized in Tables 2 and 3. The total insect phobia score had a median of 22 (IQR = 8). Among the study participants, 35.3% (n = 120) had low insect phobia, while 32.4% (n = 110) had moderate and 32.4% (n = 110) had high levels of insect phobia. There was sufficient evidence to suggest associations with insect phobia for age, number of pregnancies, participants' level of education, ethnic group, pregnancy status, awareness of insects as a food source, and history of insect consumption. There was insufficient evidence to support associations for marital status, employment status, religious affiliation, or food neophobia score.

### Likelihood of Consuming Different Types of Edible Insect-Based Foods

Figure 1 illustrates the likelihood of consuming various edible insect-based foods among respondents. Figure 2 shows images of insect food products that were shown to the study participants. Overall, there was a higher likelihood of consuming insects in the form of spice mix and flour. In contrast, crunchy larvae and insect-based burgers were least favored, with a majority indicating they were "very unlikely" to consume these products.

## Discussion

The findings of this study indicate that although most women of reproductive age are aware of edible insects as a food source, only a small fraction have consumed them, with unfamiliarity, disgust and fear of illness cited as reasons for not doing so. Insect phobia was associated with factors such as education, ethnicity, pregnancy status, and prior exposure to edible insects. Awareness and previous consumption of insects were associated with lower levels of insect phobia, while younger age and fewer pregnancies were linked to higher levels of fear. Furthermore, insect-based foods in processed forms, such as spice mixes and flour, had a higher likelihood of acceptance.

Several studies have investigated edible insect consumption, with a primary focus on nutritional composition and consumer acceptance in various populations. However, a paucity of research has examined insect phobia specifically among women of reproductive age. For instance, Anankware et al. [4] examined the nutritional profiles of five important edible insect species in West Africa. Ayensu et al. 10 assessed the impact of palm weevil larvae-fortified biscuits on the nutritional status of rats. Similarly, Chamoun et al. [1] and Laar et al. [11] investigated consumer acceptance of insect-fortified foods and the potential of palm weevil larvae as a source of nutrition; however, neither study focused on insect-related fears and phobias. Studies, such as that by Coley et al. [12], have examined the feasibility of insect consumption among pregnant women

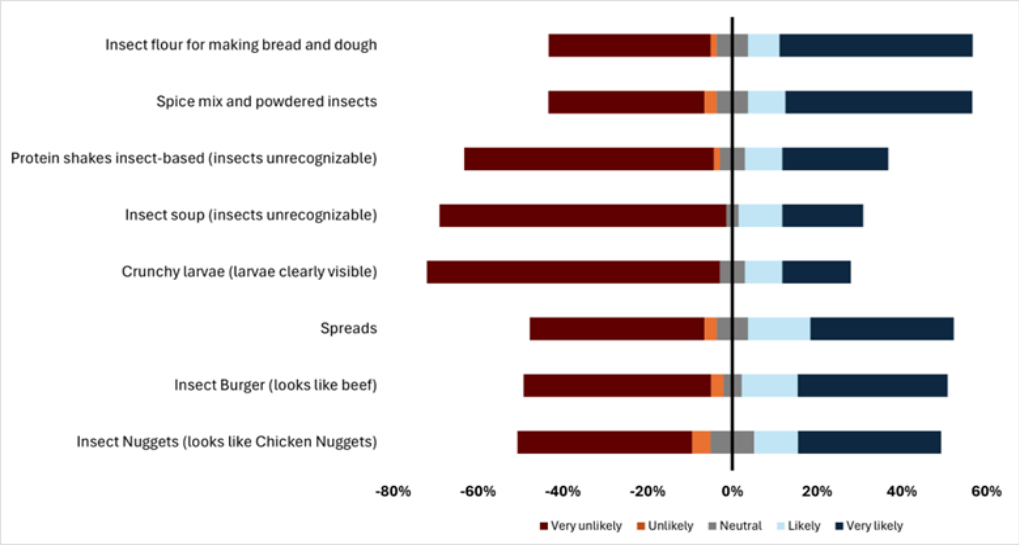


Figure 1. Likelihood of consuming various insect-based food products among 340 women of reproductive age in Cape Coast, Ghana, March–June 2024. The diverging stacked bar chart illustrates the distribution of intent, with the neutral category centered on the zero-axis to distinguish between negative and positive sentiment. Numerical values (Very Unlikely; Unlikely; Neutral; Likely; Very Likely) for each category are as follows: Insect flour for bread/dough (38.2%; 1.5%; 7.4%; 7.4%; 45.6%); Spice mix and powdered insects (36.8%; 2.9%; 7.4%; 8.8%; 44.1%); Protein shakes (58.8%; 1.5%; 5.9%; 8.8%; 25.0%); Insect soup (67.6%; 0.0%; 2.9%; 10.3%; 19.1%); Crunchy larvae (69.1%; 0.0%; 5.9%; 8.8%; 16.2%); Spreads (41.2%; 2.9%; 7.4%; 14.7%; 33.8%); Insect Burger (44.1%; 2.9%; 4.4%; 13.2%; 35.3%); and Insect Nuggets (41.2%; 4.4%; 10.3%; 10.3%; 33.8%).


Figure 2. Insect Food Products Shown to a Sample of 340 Women of Reproductive Age at a Tertiary Hospital in the Central Region of Ghana Between March 2024 and June 2024.

in Liberia. Parker et al. [7] and Kubuga et al. [2] focused on the nutrient contribution of edible insects in children's diets. This study is novel in its specific focus on psychosocial and demographic constructs among women of reproductive age.

Our findings are largely consistent with existing literature. Similar to previous studies, we found that psychological factors such as unfamiliarity, disgust, and fear of illness were identified to influence the willingness to consume insects [6]. Additionally, our results agree with the results from Coley et al. [12] and Chamoun et al. [1] that consumer acceptance increases when insects are presented in less recognizable forms. The statistically significant associations we identified between insect phobia and age, pregnancies, and educational attainment suggest that experiential

exposure and education may mitigate psychological barriers to edible insect consumption. Younger participants likely had fewer opportunities for exposure and thus higher discomfort, which aligns with Kubuga et al. [2]'s assertion that familiarity reduces neophobia. The inverse relationship between educational attainment and insect phobia suggests that knowledge may alleviate fear.

Furthermore, the observed ethnic variations reflect culturally embedded perceptions and practices regarding food, highlighting the need for culturally tailored intervention approaches. The association between pregnancy status and insect phobia may be explained by hormonal and cognitive changes that heighten sensory sensitivity and risk perception during pregnancy. Hormonal fluctuations can trigger neurophysiological and cognitive shifts that amplify disgust responses, making pregnant women more averse to unfamiliar foods such as insects [13]. Additionally, increased concern for food safety during pregnancy may contribute to heightened risk perception, as reflected in participants' reported fear of illness. Furthermore, women with fewer pregnancies may have had less exposure to edible insects, which could contribute to higher phobia levels. The preference for processed forms of edible insects, such as spice mixes and flour, rather than whole insects, strongly indicates that presentation forms and sensory perceptions significantly impact food acceptance. This suggests that strategically designed insect-based products could be essential in normalizing and encouraging edible insect consumption.

This study has limitations that warrant careful consideration. First, the cross-sectional design limits the ability to draw causal inferences regarding the observed relationships. Second, the use of convenience sampling restricts the generalizability of the findings. Importantly, participant recruitment was heavily concentrated among pregnant women, who constituted over 85% of the sample and were primarily accessed through antenatal care services. Consequently, the findings should be interpreted within the context of pregnant women receiving antenatal care. Additionally, reliance on self-reported data introduces the possibility of recall bias and social desirability bias, which may have influenced participants' reporting of insect consumption practices and related psychological responses. The use of specific food vehicles in the visual aids, such as burgers and nuggets, may also have affected participants' willingness to consume insects independently of the insect content itself, as these Western-style food presentations may not align with participants' usual dietary contexts.

Despite these limitations, the study has notable strengths that help mitigate their potential impact. Although the final sample size of 340 participants fell slightly short of the initial target of 384, it is considered adequate to detect meaningful associations given the observed effect sizes (e.g., Cramer's V values ranging from 0.151 to 0.234 and Spearman's correlations of r = -0.223 and r = -0.163). Therefore, the study retains sufficient statistical power to support the robustness of the main associations examined. Data collection was conducted by trained nutrition students under the supervision of a qualified nutrition officer and a registered dietitian, which likely enhanced data quality and minimized measurement error. Furthermore, the use of validated scales to assess insect phobia strengthens the reliability and rigor of the psychological measurements employed in this study.

### Implications for Research and Practice

Future research exploring similar phenomena in diverse settings could provide insights into the cultural influences on insect consumption practices. Additionally, qualitative methods might provide deeper insights into the underlying reasons for insect phobia and attitudes toward entomophagy. The findings of this study demonstrate the importance of considering psychological and sociodemographic characteristics when designing interventions to improve edible insect consumption among women of reproductive age. The preference for insect-based products in processed forms, such as spice mixes and flours, suggests that visibility and texture may play a role in food acceptance. To enhance the acceptability of edible insects, product development efforts should prioritize familiar, less visually identifiable formats that align with local culinary practices. For example, incorporating insect flour into commonly consumed staples (e.g., porridges, pastries, or stews) may reduce aversion and normalize consumption. Public health education should also emphasize the safety, nutritional benefits, and environmental sustainability of edible insects, using culturally relevant messaging to dispel fears and misconceptions. Furthermore, interventions should be tailored to subgroups identified as more likely to exhibit insect phobia, particularly younger women, those with lower education, and women with fewer pregnancies, by integrating experiential learning opportunities such as tasting events, cooking demonstrations, or peer-led campaigns. Engaging ethnic and community leaders in advocacy may also help address culturally rooted perceptions and foster greater social acceptance of insect-based foods.

### Conflict of Interest

The authors state no conflict of interest.

### Author contribution.

Dr Opoku-Antwi conducted a literature search, read every reference, evaluated every article and exported the data. The paper was initially written by JAK, and then it was edited by both authors. The final manuscript was reviewed and approved by all authors.

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