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Consumption of cowpea-based dishes in Benin: Main motives and barriers, and spatial and temporal changes

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Abstract

In Benin, cowpea products are commonly consumed traditional dishes. Urbanization and income changes contribute to eating habit modifications in low- and middle-income countries. Therefore, the aims of this study were (i) to identify factors influencing cowpea consumption and (ii) to document generational changes in cowpea consumption in rural and urban areas. A Food Frequency Questionnaire, which considered nine cowpea-based dishes classified in three groups (doughnuts, stews, and mixed dishes), was filled in by 1,217 adults in Cotonou (urban area) and in Adjohoun and Allada (rural areas). Sixteen focus group discussions ($n = 7$–13 participants/each) were also carried out. Cowpea-based dishes were consumed by 90%–95% of respondents. Socioeconomic and demographic factors had little or no influence on cowpea-based dish consumption. The main motivations for their consumption were health benefits and satiety provided at low cost. The main barriers to cowpea consumption, identified by participants, were preference for other foods, lack of availability as street food, and ignorance of some traditional dishes. Digestive discomfort was also identified as a factor that reduced the frequency of cowpea-based dish consumption, but not as a factor of non-consumption. Changes in cooking methods and consumption patterns were pointed out by the respondents for some of these cowpea-based dishes with the aim to reduce cooking time or improve the dish attractiveness. Our findings bring knowledge on cowpea consumption in urban and rural areas in the south of Benin that could help to develop strategies for limiting the nutritional transition-linked decrease of cowpea consumption in the future.

KEYWORDS
consumption barriers, dietary habits, pulses, traditional dishes

1 | INTRODUCTION

Pulses are valuable dried seeds with excellent nutritional properties and many bioactive compounds, including phytochemicals, bioactive

Claire Mouquet-Rivier and D. Joseph Hounhouigan have equivalent roles.

peptides, and fermentable fibers (Padhi & Ramdath, 2017). However, their nutritional quality is limited by the presence of heat-labile and heat-stable anti-nutrients (Phillips et al., 2003) that can also influence their consumption.

Consumers' preferences for pulses are based on different factors, such as storage capacity, cooking time, and sensorial characteristics of the seeds (Pushpamma, 1975). Pulse consumption is also affected by economic factors (consumers' income and selling price). Changes in terms of taste, eating habits, and awareness of the pulse nutritional potential also influence trends in pulse consumption (Rawal & Navarro, 2019). Moreover, understanding how consumers perceive dishes, how their needs are shaped and influenced, and how they make food choices is crucial when studying the consumer behavior (van Kleef et al., 2005). Cultural and historical backgrounds influence food preferences, food preparation methods, and eating habits (Bovell-Benjamin et al., 2009). However, urbanization also could affect consumer behavior. Nowadays, people are away from home during the whole day and often purchase their meals outside. Therefore, their food habits have been modified because they have more choices, less time to cook, and access to processed foods (Leterme & Carmenza Muñoz, 2002). The rapid economic growth observed in developing countries has led to changes in food processing that also contribute to nutrition transition (Galbete et al., 2017). These changes could also decrease the consumption frequency and the quantities of traditional dishes consumed, such as pulse-based dishes. For example, despite the promotion efforts by the food industry and national authorities, pulse consumption by the French population decreased from 7.2 to 1.7 kg/person/year from 1920 to 2016 and has remained very low since then (Melendrez-Ruiz et al., 2020).

In West Africa, cowpea (*Vigna unguiculata* [L.] Walp.) is the most produced and consumed pulse (Phillips, 2012). It is usually grown as an intercrop with pearl millet (*Pennisetum glaucum*) or sorghum (*Sorghum bicolor*) and less frequently with maize (*Zea mays*), cassava (*Manihot esculenta*), or cotton (*Gossypium* sp.) (Timko & Singh, 2008). Cowpea is a major staple food for the sub-Saharan African populations, especially in the dry savannah regions of West Africa. It is a source of proteins and vitamins, animal feed, and also a cash crop for farmers (Asare et al., 2013). Cowpea produced in sub-Saharan Africa represented 96% of the world production in 2012–2014 (Rawal & Navarro, 2019).

In Benin, cowpea-based dishes are part of traditional recipes. However, the potential changes in cowpea-based dish consumption over time, in terms of frequencies and of quantities consumed, are not documented in Benin. To our knowledge, no study compared cowpea consumption in rural and urban areas or among generations. Therefore, the aims of this study were to identify the motivations and the barriers to the consumption of cowpea-based dishes and to document changes in cowpea consumption patterns according to the location (rural vs. urban areas) and among generations. The data generated could bring insights into the factors influencing cowpea consumption and allow developing strategies to ensure a healthy and sustainable diet.

2 | MATERIAL AND METHODS

2.1 | Food Frequency Questionnaire

Adults aged from 19 to 65 years and living in Cotonou (urban area), Adjohoun and Allada (high and low cowpea production rural areas, respectively) were interviewed ($N = 1{,}217$). They were selected in each study area based on a two-stage sampling approach. In the first step, clusters (neighborhoods or villages) were randomly selected, and in the second step, an identical number of women and men in each cluster filled in the Food Frequency Questionnaire (FFQ). First, respondents had to list the legume species and the corresponding dishes they consumed in the last 7 days. Then, respondents quantified the consumption frequencies and quantity of nine cowpea dishes and listed the factors limiting their consumption. These nine cowpea dishes are among the best known among those identified by Madode et al. (2011): doughnuts (Ata, Ata-doco, and Ataclè), stews (Abobo, Vêyi, and Adowè), and mixed dishes (Atassi, Djongoli, and Abla).

Then, to evaluate the changes in the consumption of cowpea-based dishes over the generations (grandparents, parents, and young people), a complementary study to the FFQ was performed in the three study areas among 150 adults (19–65 years, 50 participants per area).

2.2 | Focus group discussions

Sixteen focus group discussions were carried out with participants (men or women; they did not take part in the FFQ-based survey) classified in two age groups (19–30 and 55–65 years) in Cotonou and in the two rural areas. The two age groups were chosen to capture potential differences in cowpea consumption between generations. In Cotonou, two focus groups per sex and per age class were held in two different neighborhoods. In each of the two rural areas, one focus group per sex and per age class was carried out.

Seven to 13 people joined each focus group for 1–2.5 h. The interview guidelines included questions about local food types usually consumed by the community (including legumes), knowledge of cowpeas and cowpea-derived dishes, changes in cowpea consumption over time and according to the place of residence (rural vs. urban), and reasons and barriers to cowpea consumption. During the focus group discussions, the moderator was allowed to ask new questions that might help respondents to better develop their ideas. Questions and answers were translated from the local languages ("Fon" in Cotonou and Allada and "Wémègbé" in Adjohoun) into French (vice-versa) and fully transcribed into text.

2.3 | Data collection

The **FFQ** was filled in on tablets using the SurveyCTO data collection platform.

During the **focus group discussions**, answers were directly recorded by a reporter on a notebook and using a voice recorder for full transcription. Prior to recording, the participants' consent was obtained.

2.4 | Ethical considerations

The study was approved by the National Ethics Committee for Health Research of Benin (Comité National d'Ethique pour la Recherche en Santé, CNERS) under the following clearance numbers N°29 of 28/07/2017 and N°14 of 10/04/2019 for the survey in the urban area and the rural areas, respectively. All participants signed a consent form, which was orally translated into the local dialect when needed. The respondents' anonymity was preserved as mentioned in the consent note.

2.5 | Statistical analysis

Quantitative data were analyzed with the Rstudio software (R version 4.0.5). All analyses were performed with the "Survey" package, by taking into account the sampling design. The results were expressed as a percentage of respondents. The chi-squared test was used to assess the effect of the living area on the legume consumption. Logistic regressions were used to assess associations between cowpea consumption and socioeconomic and demographic factors (level of education, sex, socioeconomic index, and age). The socioeconomic index was determined by performing multiple correspondence analysis followed by ascending hierarchical classification of variables related to household assets. The association between the occurrence of digestive discomfort and age, sex, and frequency of cowpea consumption was also tested, and results were expressed as odds ratios (ORs). For all analyses, statistical significance was set at $p < 0.05$.

Focus group data were analyzed using the content analysis method (Hsieh & Shannon, 2005). After reviewing the transcripts, focus group data were compared to determine similarities and dissimilarities through a thematic analysis. Keywords and the most recurring factors were identified per theme (Table 1). Data were classified by themes according to the study objectives using an Excel file to generate a narrative synthesis and an interpretative analysis.

TABLE 1 Focus group discussion topics and keywords generated from the discussions

Topic	Keywords
Food habits of the communities	Maize porridge; fermented/unfermented maize dough; rice, Abobo (cowpea stew); tubers and roots (boiled/fried sweet potatoes, yam and taro); cooked/added into water gari (roasted fermented cassava granular); tofu-like processed soybean; Atassi (mixed cowpea-rice); rice; sauces (cooked tomato/leaves); macaroni (pasta)
Knowledge about legumes	**Best known legumes**: Cowpea; Bambara groundnut; peanut; African locust bean; soybean; pigeon pea; common bean (local name "Akpakoun"); Kerstings groundnut
Knowledge about traditional cowpea-based dishes	Abobo; Atassi; Djongoli; Abla; Ata doco; Ata; Vêyi; Ataclè; Adjobokoun; Adowè; Kowé; Magni-Magni; Yôyôwè; Adalou; Don; Ayi blo; Adjagbé; Lèlè
Health and cowpea seeds	**Advantages**: Source of energy; provide vitamins; rich in nitrogen; improve blood; satiating; give intelligence; Eliminate dirties from the body; healthy food; give strength. **Disadvantages**: Difficult to digest when consumed in the evening; constipation; diarrhea; contain more sugars when first cooking water is not discarded; bloating; not good for blood pressure if not properly cooked; gas; not good for people with fever or with some diseases (hemorrhoids, hernia)
Perception of factors influencing cowpea consumption	Age (decreased consumption with age); sex (less consumed by women); cultural restrictions; digestive troubles; dietary preferences; long processing time; diseases (hemorrhoids, hernia); complete ignorance about recipes
Generational changes	Modification in cooking and eating patterns; decrease in frequency and quantity consumed; loss of some traditional dishes.

3 | RESULTS

3.1 | Legume consumption in southern Benin

3.1.1 | Level of consumption of legumes and their dishes (FFQ data)

Cowpea, soybean, peanuts, Bambara groundnut, Kersting's groundnut, and African locust bean were the most available legumes in the study areas, with differences in consumption levels between urban and rural areas ($p < 0.05$), except for peanuts (Table 2). Overall, cowpea was the most consumed legume among the available legumes (90%–95% of the respondents), and Kersting's groundnut the least frequently eaten. Soybean was more consumed in the two rural areas than in the urban area (75% vs. 45%), whereas the consumption of African locust bean, Bambara groundnut, and Kersting's groundnut was more important in the urban area. For instance, the percentage of Bambara groundnut

TABLE 2 Consumption of locally available legumes according to the living area (% respondents)

Legume	Urban ($N = 641$)	Rural ($N = 576$)	p value*
Cowpea (*Vigna Unguiculata*)	90	95	<0.001
Soy (*Glycine max*)	45	75	<0.001
Peanut (*Arachis hypogaea*)	63	68	NS
African locust bean (*Parkia biglobosa*)	59	36	<0.001
Bambara groundnut (*Vigna subterranea*)	27	15	<0.001
Kerstings groundnut (*Macrotyloma geocarpum*)	10	2	<0.001

*Chi-squared test for differences between urban (Cotonou) and rural (Adjohoun and Allada) areas.

consumers in the urban area was almost twice as high as in the rural areas.

Legumes were consumed in various forms (Figure 1). With the exception of soybean and African locust bean, the most common way of consuming legumes was by boiling them, alone or with cereals. In all surveyed areas, soybean was mainly consumed as tofu, Kersting's groundnut as a "cassoulet" (a mix of tomato sauce, vegetables—carrot and green beans—meat or sausage), Bambara groundnut as a stew, and African locust bean as a fermented seasoning (locally named Afitin and widely known in West Africa as Soumbala). Peanuts were mainly consumed as snacks and very few for the preparation of main courses (e.g., sauces). In the rural areas, the two main forms of consumption of peanuts were roasted peanuts and a spicy peanut snack known as Klui-klui. Conversely, in Cotonou, they were also consumed as boiled peanuts. The two main forms of cowpea consumption in rural and urban areas were the stew Abobo and the mixed dish Atassi (combination of cowpea and rice, cooked in water).

3.1.2 | Knowledge of cowpea-based dishes (focus group discussions)

When participants were asked about their knowledge of traditional cowpea-based dishes, the groups with the oldest people in both area types identified several ancient traditional dishes that are rarely or not currently consumed by the population (Table 1 and quoted statement—QS—N°1 in Table S1). Participants reported that some dishes are more frequently consumed than others (QS N°2–3 in Table S1). Variations in consumption of the different dishes in function of the area were also observed (QS N°4 in Table S1). Moreover, participants also highlighted changes in some traditional recipes over time (QS N°5 in Table S1).

3.1.3 | Place of consumption of cowpea dishes (FFQ data)

Most of the cowpea-based dishes were consumed at home or out of home as street food (Figure S1). In Cotonou, Ata, Ata-doco, Ataclè, Adowè, and Abla were mainly consumed as street food. Conversely, the dishes Abobo, Atassi, Vêyi, and Djongoli were mostly consumed at home. Similar trends were observed in the two rural areas. The proportion of consumers of the different dishes at a relative/friends' place was very low.

Comparison of the place of consumption of the three cowpea-based dish groups showed that doughnuts were mostly consumed as street food, whereas stews (except for Adowè) and mixed dishes (except for Abla) were eaten mainly at home.

3.2 | Factors affecting the consumption of legumes: The case of cowpeas

3.2.1 | Perceptions of cowpea consumption (FFQ data)

The respondents of the FFQ ($n = 641$ in the urban area and $n = 576$ in the rural areas) also gave their opinion about the inter-population (Cotonou vs. rural areas) and intra-population (own consumption vs. the one in the community) differences in cowpea consumption, and the factors limiting cowpea consumption (Table 3). Approximately 72%–87% of all respondents identified Cotonou as the biggest cowpea consumer area. Moreover, 50%–75% of all participants considered that their level of consumption was lower compared with that of other people in their area.

3.2.2 | Barriers to cowpea consumption (FFQ data and focus group discussions)

Several barriers to cowpea consumption were highlighted. For some people, cowpea consumption was influenced by dietary preferences or by the choice of consuming some cowpea-based dishes but not others. The reasons for non-consumption of cowpea-based dishes in the previous 7 days (except for Atassi and Abobo that were widely consumed) cited by cowpea consumers were mainly the preference for other dishes (also identified during the discussion groups) and the lack of availability of the dishes as street food (FFQ data, Table 4). Fewer respondents in both areas chose the length of cooking time, the high price of the dishes, and a digestive discomfort.

When questions about digestive discomfort were asked to cowpea consumers ($n = 626$ in Cotonou and $n = 565$ in rural areas), 40% and 62% of them, respectively, reported having experienced digestive problems after consumption of cowpea-based dishes

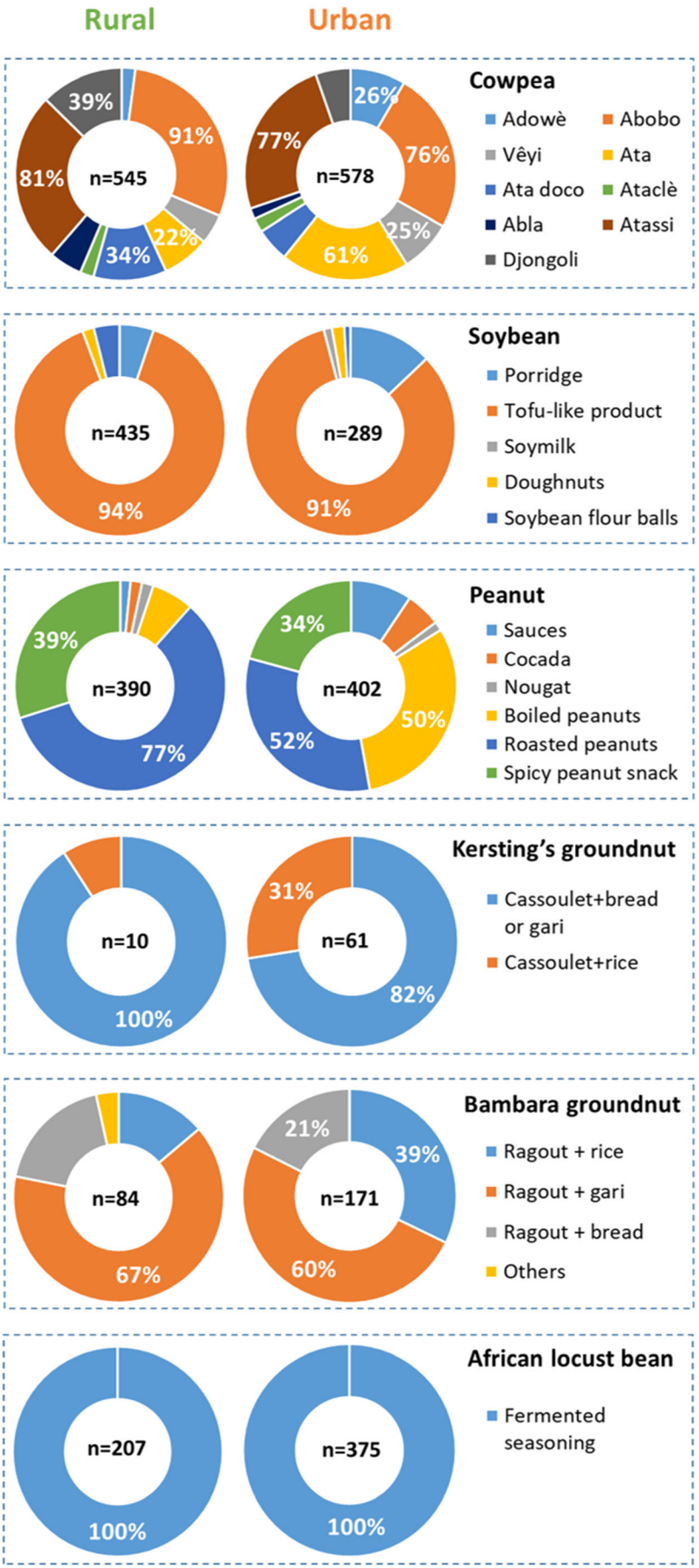

FIGURE 1 Main forms of consumption of legumes in the urban area (Cotonou, $n = 641$) and in the two rural areas (Allada and Adjohoun, $n = 576$) by the Food Frequency Questionnaire participants. Multiple choices were allowed. Percentages are indicated for dishes with more than 20% of consumers

TABLE 3 Participants perceived opinions on cowpea consumption (FFQ data)

		Percentages (%)	
		Urban ($n = 641$)	Rural ($n = 576$)
Level of consumption "Cotonou vs. rural areas" (inter-population level)	More than in our area	4	72
	Less than in our area	87	16
	Not different	9	2
	Do not know	-	10
Level of consumption "own consumption vs. the one of the community[b]" (intra-population level)	More than our area	14	22
	Less than our area	71	51
	Not different	15	9
	Do not know	-	19
Barriers to cowpea consumption[a]	Cooking constraints	20	28
	Perishability (seeds/foods)	25	9
	Expensive	0	24
	Digestive discomfort	56	87
	Like more other foods	18	3
	Others	2	5

[a]Multiple choices or answers were allowed.
[b]Inhabitants of the same area.

TABLE 4 Reasons of non-consumption of cowpea-based dishes in the last 7 days (FFQ data)

				Reasons of non-consumption									
Cowpea-based food group	Cowpea-based dish	Number of non-consumers for each dish[a]		Long cooking time or difficult to make		Expensive to make		Dislike or prefer other foods		Digestive discomfort		Lack of availability as street food	
		U	R	U	R	U	R	U	R	U	R	U	R
Stews	Abobo	185	69	5	1	2	0	81	24	30	8	11	1
	Vêyi	484	488	35	2	12	13	328	80	32	14	58	139
	Adowè	476	530	95	95	13	35	234	47	27	7	119	291
Cowpea-based doughnuts	Ata	276	443	20	12	3	14	125	53	18	13	45	230
	Ata-doco	534	377	21	2	1	13	331	80	35	14	188	72
	Ataclè	588	530	26	39	0	19	310	66	31	6	299	335
Mixed dishes	Atassi	182	125	16	4	4	19	60	32	9	9	17	3
	Abla	596	480	47	53	7	47	318	61	21	8	310	230
	Djongoli	531	352	84	30	24	18	276	129	60	45	136	17

Note. Data are shown as numbers of respondents. Multiple choices were allowed.
Abbreviations: R, rural areas; U, urban area.
[a]Total number of non-consumers of that dish in last 7 days before the FFQ among the population of cowpea consumers ($n = 626$ in urban area, $n = 565$ in rural areas).

(Figure S2). Abdominal pain and flatulence were the most cited problems in Cotonou, and flatulence and constipation in the rural areas. To further investigate this issue, the link between the occurrence of digestive problems and different factors (sex, age, and frequency of consumption of cowpea-based dishes) was studied. The occurrence of digestive problems was not different between sexes (Figure 2). Conversely, age had a significant influence in urban areas, because 45- to 65-year-old people reported fewer digestive problems than younger consumers. In addition, people who declared eating cowpea-based dishes less frequently reported more often digestive problems.

All participants highlighted other barriers to cowpea consumption. Respondents living in the urban area cited the seed and dish perishability and their preference for other foods, factors that were rarely mentioned by people in rural areas. Conversely, the high price of cowpea seeds and the cooking constraints were more often cited by people from the rural areas than by people living in the urban area (Table 3).

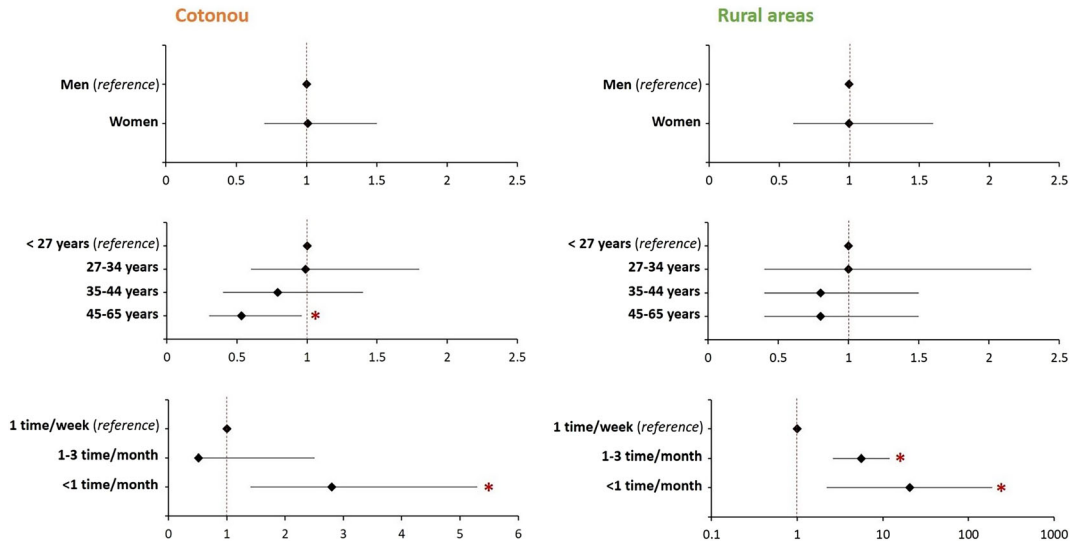

FIGURE 2 Risk of digestive problem occurrence after consumption of cowpea-based dishes: Effect of sex, age, and consumption frequency. Dashed vertical red lines represent the reference for each factor. *p value < 0.05

In the focus group discussions, elderly people stated that after cowpea consumption, they sometimes noticed complications of some diseases, such as hemorrhoids and hernia (QS N°6 in Table S1). Ignorance about some recipes was also highlighted, particularly by the youngest participants (QS N°7 in Table S1). Cowpea consumption was also influenced by the production period, mainly in rural areas (QS N°8 in Table S1).

3.2.3 | Motivations to cowpea consumption

Some participants of the focus groups perceived flatulence as a positive effect because it helps to discard dirty elements from the body (Table 1 and QS N°9 in Table S1). They also pointed out that cowpea-based dishes have good taste (QS N°10 in Table S1). Cowpea consumption was also associated with health effects, with a positive nutritional potential (QS N°11–12 in Table S1). Some participants indicated a difference between the brown and white varieties that are the most available varieties for consumption (QS N°13–14 in Table S1). The ability of cowpea seeds to satiate at a lower cost than some other foods (e.g., rice) was one of the benefits mentioned in the discussions (QS N°15–16 in Table S1).

3.2.4 | Influence of socioeconomic and demographic factors

Analysis of the FFQ data indicated that the consumption of cowpea-based dishes was not or minimally influenced by socioeconomic and demographic characteristics. In the rural localities (Table S2), Atassi consumption was significantly lower in the low cowpea production area (Allada) than in the high production area (Adjohoun). Adowè consumption was lower by people with a low socioeconomic index compared with other people. Ata was consumed more by respondents from the high socioeconomic index class than by the other two socioeconomic groups. Conversely, high socioeconomic index was significantly associated with lower consumption of Abobo and Atassi. The different cowpea dishes were similarly consumed by men and women. People with the highest education level consumed less Adowè and Vêyi and more Ata-doco, Ataclè, and Atassi than the other people.

In Cotonou (Table S3), only the consumption of Ata, Ata-doco, Abla, Abobo, and Djongoli was influenced by the socioeconomic and demographic factors. Ata, Ata-doco, and to a lesser extent Djongoli were consumed less by women. Abla consumption was significantly higher by 27- to 44-year-old respondents compared with <27-year-old participants. Respondents in the high socioeconomic index group consumed more Abobo than other people.

3.3 | Changes in cowpea consumption among generations

When the focus group participants were asked about differences in cowpea consumption compared with their grandparents and parents, and when they were younger, they declared that cowpea seeds were more consumed in the past (by their grandparents and great-grandparents) (QS N°17 in Table S1). Some respondents stated that their current consumption of some cowpea-based dishes had decreased relative to when they were younger (QS N°18 in Table S1).

The mechanization of some processing operations was also mentioned (QS N°19 in Table S1). Participants also stated that, to reduce the cooking time during cowpea seed preparation and to limit the use of combustible, some additives are now added. The use of some ingredients to make the dishes tastier was also highlighted (QS N°20 in Table S1). When asked about changes in consumption of cowpea-based dishes over time, for all types of dishes except Abobo stew and

Atassi mixed dishes, most respondents said that their consumption had decreased compared with the past or that they never consumed some of them (Figure S3).

4 | DISCUSSION

In this study, cowpea-based dish consumption patterns and the population's perceptions in urban and rural areas in the south of Benin were investigated using a FFQ and focus group discussions.

Our study showed that the percentage of participants who consumed locally available legumes was higher than 30% in both area types, except for Bambara groundnut and Kersting's groundnut (the least consumed legume). Indeed, participants stated that Kersting's groundnuts (local name Doyiwé) are consumed only during special events: "Doyiwé is cooked for festivities" (old woman, Adjohoun). Kersting's groundnuts are very expensive, and this could explain the low consumption frequency. High soybean consumption was observed mainly in rural areas, although soybean is not an indigenous legume in Africa. Triomphe et al. (2014) reported that soybean was introduced in Benin in the 1980s to improve infant nutrition by offering a protein-rich food. These authors also showed that soybean has become a major crop because it is used to produce *Amon-soja* (meaning soybean cheese or *tofu*), as an inexpensive substitute for cow cheese (locally named Wagashi), fish, and meat. In agreement, tofu was frequently consumed by the respondents in both urban and rural areas (Figure 1) because it is a cheap source of protein. The focus group participants from the rural areas pointed out that "we consume much soybean because it is our fish (old woman, Adjohoun); we use soybean cheese (tofu) as meat in the sauces (young man, Allada)." In a study based on structured interviews in Abomey-Calavi (southern Benin, 18 km away from Cotonou), Dossou et al. (2017) found that approximately 30%, 62%, and 8% of the surveyed households consumed soybean cheese 1–3 times per month, at least 4 times a month, and daily, respectively. They also reported that the most important motivation for soybean cheese consumption was the competitive purchasing price compared with other protein sources.

In our study, participants from the focus group discussions identified some legumes (e.g., common beans) that are no longer produced in Benin or are not available on the markets. Loko et al. (2018) found that the production of common beans in Benin has declined in recent years and that this crop diversity is threatened with extinction. Moreover, Odendo et al. (2011) reported that eastern, central, and southern Africa are the main growing regions of this pulse in Africa.

The beliefs concerning the positive health effects of cowpea seeds (e.g., "Cowpea raises the level of blood"; "Cowpea provides vitamins"; "It is also a good source of energy") are among the reasons for their high consumption. Similarly, Monge et al. (2019) showed that in the Mexican population, the bean health effects and nutritional composition partly explain their potential consumption. In our study, we observed that participants considered cowpea-based dishes as satiating foods. Indeed, like other pulses, cowpeas are a fiber-rich food, and dietary fibers enhance the sensation of satiety (Kristensen & Jensen, 2011).

The preference for other foods and the lack of availability of some cowpea dishes as street foods were identified as the main barriers to cowpea consumption. Indeed, the choice of other foods rather than cowpea-based dishes could be related to three main factors: the dish characteristics, the consumer, and the environment, as highlighted by several authors using food preference models (Khan & Hackler, 1981; Randall & Sanjur, 1981). The fact that respondents stressed the lack of availability as street food reflects the increased out-of-home cowpea dish consumption, also shown by the FFQ data (Figure S1). This could also be linked to the constraining processing methods that limit the possibility to cook these dishes easily at home or the lack of time to cook cowpea-based dishes due to the respondents' professional activity. Barriers to cowpea seed consumption, such as ignorance of some recipes and the long cooking time of the dishes, were also reported by Figueira et al. (2019), who studied the attitudes concerning legume consumption in Australia.

All respondents identified digestive discomfort as a factor that could limit cowpea consumption. This could be related to the presence of non-digestible oligosaccharides (e.g., alpha-galacto-oligosaccharides) in cowpea seeds that can cause flatulence and bloating. Their content in food can be reduced through processing, mainly soaking, fermentation, or germination (Coffigniez, 2018; Madode et al., 2013). Our study revealed that in both areas, people who complained about digestive discomfort consumed cowpeas less frequently. Moreover, in Cotonou, a lower tolerance to digestive discomfort was observed in younger people, compared with the 45- to 65-year-old group. This lower tolerance might contribute to a future decrease in cowpea consumption by younger generations if actions are not taken. Therefore, the promotion of adapted processing that allows reducing the alpha-galacto-oligosaccharide content may help to maintain cowpeas on the menu.

Lack of availability, long cooking time, ignorance of traditional recipes, and preferences for other foods are factors that can partly explain the influence of some socioeconomic and demographic factors on cowpea-based dish consumption. Moreover, the additional study to assess changes in cowpea-based dish consumption over time showed that some traditional cowpea dishes are progressively disappearing.

Cowpea-based dish consumption could be promoted or maintained by developing and distributing booklets with traditional recipes, particularly to the younger generations. Ready-to-use cowpea products (e.g., dehulled cowpea flour for doughnuts preparation) could also be developed to reduce processing constraints. Children's education programs on the importance of cowpea and other legumes (by emphasizing their benefits, for instance the health advantages and sensory quality) and learning recipes during cooking workshops also could contribute to preserving the knowledge of traditional recipes. To promote plant food consumption, Léa et al. (2005) reported that media advertising (magazines, newspapers, and TV cooking programs), food outlets (recipe cards), and cookbooks were the main sources of information used by the Australian population. Moreover, researchers could develop cookbooks that describe approaches to reduce the constraints linked to the preparation of dishes based on dried legumes.

Adoption of these recommendations could help to maintain the high level of cowpea consumption observed in our study and to limit

poor diets, chronic non-communicable diseases and obesity, associated with the nutritional transition in countries of the South.

5 | CONCLUSION

Positive perceptions on cowpea health effects were reported by participants in South Benin. Among the six legume species frequently consumed in the areas of study, cowpea was the most eaten in both rural and urban areas. The barriers to cowpea consumption were either general (digestive problems) or specific to some recipes (ignorance due to loss of know-how that caused a decrease in the consumption of cowpea-based dishes over time). To maintain/promote cowpea consumption, all the involved stakeholders should take action at all stages. One strategy is to promote cowpea-based foods by raising awareness of their nutritional benefits. Therefore, it is crucial to carry out a study to characterize the nutritional value of these dishes by focusing on compounds of nutritional interest in cowpeas, such as vitamins B (folate and thiamine), minerals, fiber and protein content, and to determine their contribution to the recommended daily intake.

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CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

DATA AVAILABILITY STATEMENT

Data used in this study are available from the corresponding author upon request.

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