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Traditional contraceptive practices: survey of medicinal plants used to control birth in four states in Nigeria

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Abstract

Although modern contraceptive practices are actively advocated, many individuals continue to rely on traditional medicines for contraception due to their perceived safety. The open-ended questionnaire used in this study sought to gain insights into contraceptive practices from traditional providers' perspectives. Herb sellers and herbal practitioners from four yoruba-speaking states in Nigeria—Kwara, Lagos, Oyo, and Osun—were interviewed. Data from questionnaires were analyzed via descriptive and inferential statistics. Quantitative analysis was done using the informant consensus factor (ICF) and relative frequency of citation (RFC) indices. A total of 31 species were recorded across the study areas. Kwara had the highest diversity, with 20 plant species, followed by Lagos (16), Oyo (10) and Osun (4). The ICF value recorded across the study areas was 0.7, with the most frequently cited species for female and male contraception varying by location. *Carica papaya had RFC values of 0.58 in Oyo and 0.44 in Osun, while Mucuna pruriens* recorded 0.30 in Lagos and *Jatropha gossypiifolia* had 0.27 in Kwara. The plant species were mostly prepared in combination forms, with seeds and leaves being the most used parts. These were administered as herbal contraceptive decoctions, powders, or worn as contraceptive rings or waist beads. A statistically significant difference existed between the plant form, the education level of participants, and having patients seeking contraception. In conclusion, this survey underscores the diverse range of medicinal plant species used for contraception. Further research is essential to validate their efficacy and understand the mechanisms of herbal contraceptives.

Keywords *Carica papaya* L., *Mucuna pruriens* (L.) DC, *Jatropha gossypiifolia* L., Herbal contraceptive ring

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Introduction

Contraception refers to the prevention of conception, i.e., the prevention of pregnancy. While modern contraceptive methods such as oral pills, intrauterine devices, and hormonal injections have been effective in preventing pregnancy, they often have unwanted side effects that discourage their continued use, particularly among women [37]. These side effects include hormonal imbalances, an increased risk of cancer, cardiovascular diseases, and various other health complications. Presently, the current contraceptive options available for men are not optimal [1]. Vasectomy accounts for 4.5% of all male contraceptive procedures performed worldwide, raising concerns about its irreversibility [15, 21]. The failure rate of condoms is unacceptably high and accounts for 5.7% of usage globally, whereas the withdrawal method is unreliable and always problematic, with 6.8% usage worldwide [40]. Therefore, there is an increasingly urgent need for safe and reliable methods of male contraception globally [26, 57].

In recent years, interest in exploring traditional methods of contraception, particularly those involving the use of indigenous medicinal plants, has increased. In many communities, especially within Sub-Saharan Africa, traditional practices have long played a central role in contraceptive [8, 35]. These practices often rely on medicinal plants with known contraceptive properties. These plants are considered culturally acceptable alternatives to modern contraceptives and are often preferred because of their perceived lower risk of side effects [7, 14]. The use of indigenous medicinal plants for contraception, however, is not without challenges. One of the primary concerns is the lack of scientific validation of the safety and efficacy of these plants. Although traditional medicine practitioners (TMPs) have extensive knowledge of medicinal herbs, much of the knowledge remains anecdotal, with limited understanding of the mechanisms of action of the active compounds responsible for their contraceptive effects [16, 19, 34]. There is a risk of toxicity, as the active ingredients in these plants may have harmful effects that are not well understood or documented [13, 14]. Despite these challenges, the potential benefits of indigenous contraceptive methods make them promising areas for research. The perceived safety of herbal products utilized in indigenous contraceptive methods is a driver that fuels indigenous contraceptive uptake. This study documents and analyzes a survey on the use of medicinal plants and traditional practices for male and female contraception in four yoruba-speaking states in Nigeria.

Methods

Ethical considerations

The proposal for this study was approved by the University of Lagos Research Ethics Committee with ethics approval number UNILAGREC/23/08/006. Informed consent was also sought from all participants after the study was duly explained to them.

Study area

The survey was purposively conducted in four (4) yoruba-speaking states, namely, Lagos, Oyo, Osun (Southwest) and Kwara (North Central) in Nigeria. Southwest Nigeria lies between longitudes 2°31'and 6°00'E and latitudes 6°21'and 8°37'N. It is bordered by the Atlantic Ocean in the south; Kwara and Kogi states in the North; Edo and Delta states in the east and the Republic of Benin in the west [6]. The region includes six states: Ekiti, Oyo, Lagos, Ogun, Ondo, and Osun, which together form part of Yoruba land alongside Kwara and parts of Kogi State. Using cluster sampling, this study selected local government areas (LGAs) from four states in Nigeria:- Lagos (6°35'N, 4°35'E): Agege, Ajeremi-Ifelodun, Alimosho, Apapa, Ifako-Ijaye, Ikorodu, Kosofe, Mushin, Odofin, Osodi-Isolo, and Somolu; Oyo (7°35'N, 3°86'E): Ibadan southeast and Ibadan North East; Osun (7°56'N, 4°52'E): Ife East, Irewole, Atakumosa West, Ilesha west; and Kwara (8°32'N, 4°35'E): Ilorin west (Fig. 1). Herb sellers in the Bode and Oje (Ibadan) markets and the Olorunsogo (Modakeke), Iloro, Ita-akogun (Ife) Obada (Ikire) markets and the Oja-oba, Oja-kuntu, Idi-ape, and Kodi markets (Ilorin) were interviewed in Oyo, Osun and Kwara States, respectively. Herb sellers and herbal practitioners in the study areas were interviewed.

Ethnobotanical survey and data collection

The survey was conducted from 22 March 2024 to 27 April 2024 among herb sellers and herbal practitioners in 11 LG areas in Lagos, 4 LG areas in Osun, 2 LG areas in Oyo, and 1 LG in Kwara states following informed consent by the participants. Herb sellers in selected markets where herbal materials are being sold and herbal practitioners from different local government areas of the four states were selected via purposive and clustering sampling to ensure the representation of diverse practices within Yoruba land. The sample size was calculated via Cochran's sample size formula in Eq. 1:

$$n0 = \frac{z^2 * p * q}{e^2} \quad (1)$$

where z is the statistic corresponding to the 95% confidence level = 1.96; p is the prevalence (8.3%); q is 1−p;

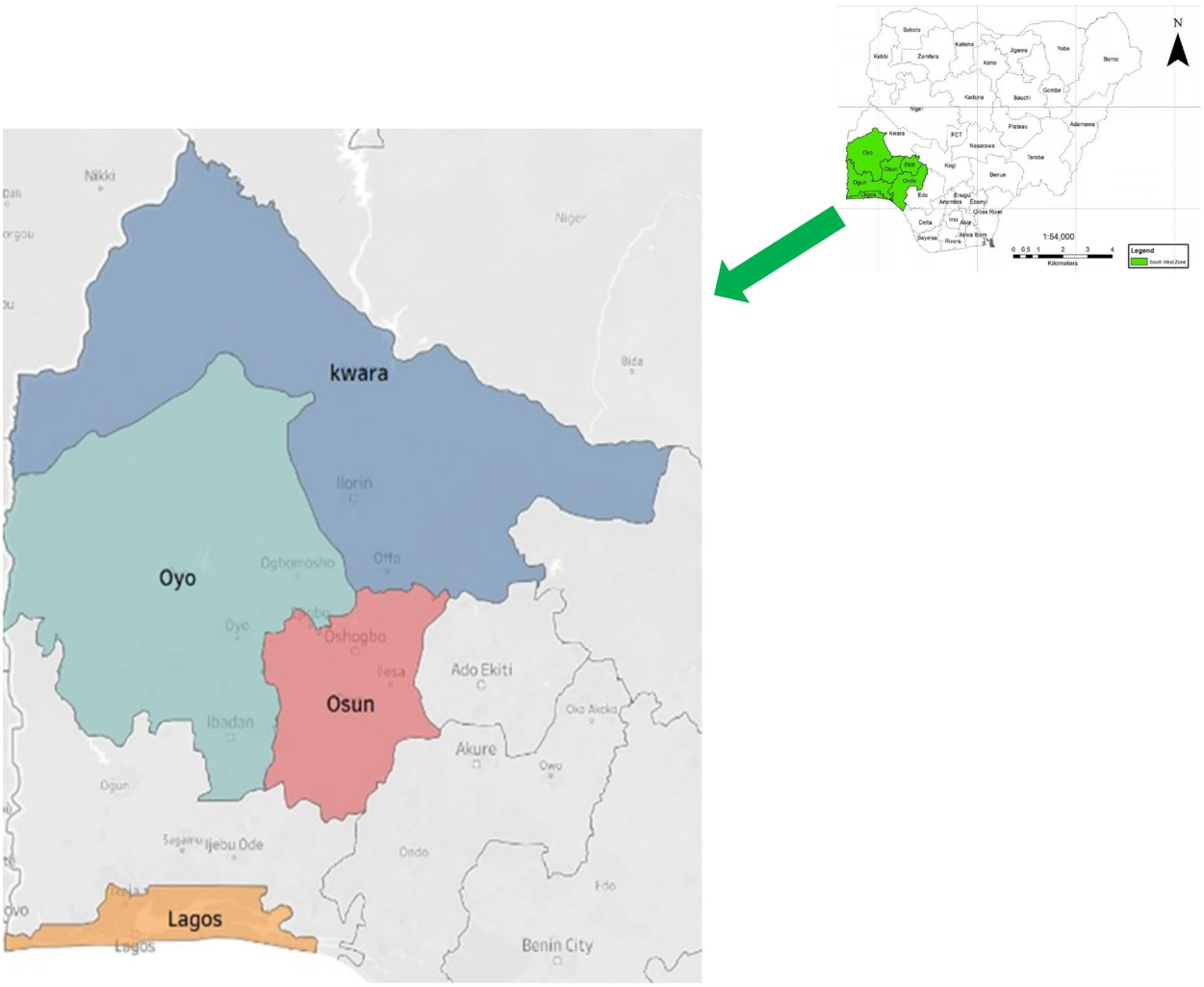

Fig. 1 Map of Nigeria showing the study area in selected states in Southwest Nigeria

and e is the margin of error or precision. Using a prevalence (8.3%) of the traditional contraceptive method as determined from previous studies [36], a 95% confidence interval (z = 1.96) and a prevalence estimate within a 5% error margin (e), a minimum of 117 samples were calculated and deemed appropriate for this study. This survey utilized 120 semi-structured questionnaires to collect data through face–to-face interviews and open-ended conversations in Yoruba with herbal sellers and practitioners. The study documented consultations for contraception among females and males, including the medicinal plants given to contraceptive seekers for usage, methods of preparation and modes/forms of administration. The traditional contraceptive use of the mentioned indigenous plants was initially investigated through a literature search [3, 20, 41]. This was followed by validation of plant specific names, families and authorities using the World Flora online database (https://www.worldflora lonline.org). A total of one hundred and nine (109) questionnaires were recovered from the 120 questionnaires administered. Sociodemographic data (age, sex, marital status, level of education, and location of practice) and ethno-botanical data (local plant names, parts of plants used, source of plant, mode of usage including methods of preparation, dosage form and route of administration of herbal contraceptives given to contraceptive seekers by traditional contraceptive providers) were gathered during the survey.

Data analysis

The data collected were entered into Microsoft Excel and exported to SPSS version 26 software for cleaning and analysis. A copy of the survey has been uploaded as a supplementary file. The qualitative data elicited from the

open-ended responses in the semi-structured questionnaire used in the study were analyzed via thematic analysis. The analysis was conducted manually via printed transcripts and handwritten notes to organize codes and themes. Quantitative indices such as informant consensus factor (ICF) and relative frequency of citation (RFC) were used in the analysis of the ethnobotanical data.

$$\mathrm{ICF} = \frac{Nur - Nt}{Nur - 1} \quad (2)$$

where *Nur* is the total number of participants/informants and *Nt* is the number of plant species prescribed as contraceptives.

RFC signifies the relative importance of each plant species in a study area, and this is determined by dividing the number of participants/informants citing a particular plant species (FC) by total number of respondents in the study area (*N*) [55].

$$\mathrm{RFC} = \frac{FC}{N} \quad (3)$$

Descriptive statistics such as frequency distributions and percentages were obtained for all the variables across the four states studied. A chi-square test of association was used to establish the associations between the plant form and sociodemographic variables such as participant status, level of education, route of administration, care givers having seekers of contraceptives and reported side effects of contraceptive plants. All p values were two-tailed, and $p < 0.05$ was considered statistically significant.

Results

Sociodemographic data

A total of 109 participants participated in the survey, with 41from Kwara, 40 from Lagos, 16 from Osun, and 12 from Oyo. Herb sellers (85.4%; 93.8%) aged 51–70 years (48.8%; 43.8%) were the major participants in Kwara and Osun states, whereas herbal practitioners (87.5%; 50.0%;) aged 31–50 years (50.5%; 83.3%) were the major participants in Lagos and Oyo states, respectively (Table 1). The participants in all the states were mostly married females with varying levels of education at the informal, primary, secondary and tertiary levels (Table 1). In the Kwara survey, 95.1% of the participants were married, 92.7% were females, and 26.8 to 36.6% had secondary or tertiary education. For the Lagos survey, 87.5% of the participants were married, 90.0% were females, and 40.0 to 47.5% had a level of education at the secondary and tertiary levels. A total of 91.7% of the participants in the Oyo survey were married, 58.3% were females, and 16.7 to 50.0% had secondary or tertiary education. Most of the participants in Osun state were married (87.5%) and female (68.8%), with an informal level of education (56.3%). Overall, most of the participants were females (84.4%) who were married (90.8%) herb sellers (48.6%) in the 31 to 50 years (50.5%) age range (Fig. 2). The educational background of the participants ranged from 14.7 to 37.6% at the informal, primary, secondary and tertiary levels (Fig. 3). A total of 94 out of the 109 participants mentioned having patients on traditional contraceptive demand, whereas 15 participants did not have patients on traditional contraceptive requests but had knowledge of traditional contraceptive practices (Fig. 4). Most of the participants (84) mentioned attending to only female traditional contraceptive seekers, and most (90) were not willing to disclose the number range of patients who demanded traditional contraceptive options (Fig. 4).

Ethnobotanical data

Twenty (20) indigenous plant names were mentioned by respondents interviewed in the Kwara state study area (Table 2). A literature search on the contraceptive uses of the indigenous plants identified 20 plant species distributed across thirteen (13) families (Table 2). The ICF value for the use of medicinal plants for contraception in Kwara study area was 0.5. The RFC of the reported plant species ranged from 2 to 27% with *Jatropha gossypiifolia* L. (0.27), *Mucuna pruriens* (L.) DC. (0.24) and *Ricinus communis* L. (0.17) recording the highest RFC values.

In Lagos State, sixteen (16) indigenous names of plants with their corresponding botanical names belonging to twelve (12) plant families were mentioned by the respondents (Table 3). The ICF value for the use of medicinal plants in contraception within Lagos study area was 0.6. The RFC of the reported plant species varied between 2.5% to 30% with the highest values recorded for *M. pruriens* (0.30) and *Carica papaya* L. (0.18).

Table 4 shows a total of nine (9) plant species belonging to 9 different families mentioned by the respondents in Oyo study area. Informant Consensus Factor (ICF) value for the use of medicinal plants in contraception in Oyo study area was 0.3. The RFC of the reported plant species varied between 8 to 58% with the highest values recorded for *C. papaya* (0.58) and *M. pruriens* (0.50).

In Osun state, four (4) plant species belonging to different families were mentioned. Among them, *C. papaya* (0.44) was the most frequently cited medicinal plant for male and female contraception, while *M. pruriens* (0.38) was the most frequently cited for female contraception according to herb sellers and herbal practitioners (Table 5). The ICF value for the use of medicinal plants in contraception within in Osun study area was 0.8.

Table 1 Socio-demographic data of the participants from the selected states

Category	Kwara (*N*)	Lagos (*N*)	Oyo (*N*)	Osun (*N*)	Total (*N*)	Percent (%)
Participants'Status:						
Herbs seller	35 (85.4)	-	4 (33.3)	15 (93.8)	54	48.6
Herbal practitioners	6 (14.6)	35 (87.5)	6 (50.0)	1 (6.3)	48	43.1
Botanists/pharmacognocists	-	3 (7.5)	2 (16.7)	-	5	4.5
Others (Unclassified)	-	2 (5.0)	-	-	2	2
Total number (*N*)	41	40	12	16	109	
Sex/gender						
Male	3 (7.3)	4 (10.0)	5 (41.7)	5 (31.3)	17	15.6
Female	38 (92.7)	36 (90.0)	7 (58.3)	11 (68.8)	92	84.4
Age range (years)						
10–30	-	1 (2.5)	-	1 (6.3)	2	1.8
31–50	18 (43.9)	20 (50.5)	10 (83.3)	5 (31.3)	53	50.5
51–70	20 (48.8)	17 (42.5)	2 (16.7)	7 (43.8)	46	40.4
71 and above	3 (7.3)	2 (2.0)	-	3 (18.8)	8	7.3
Marital status						
Married	39 (95.1)	35 (87.5)	11 (91.7)	14 (87.5)	99	90.8
Single	1 (2.4)	1 (2.5)	1 (8.3)	-	3	2.8
Widow/widower	1(2.4)	3 (7.5)	-	2 (12.5)	6	5.5
Separated/divorced	-	1 (2.5)	-	-	1	0.9
Education level						
Primary	10 (24.4)	3 (7.5)	2 (16.7)	1 (6.3)	16	37.6
Secondary	15 (36.6)	19 (47.5)	2 (16.7)	5 (31.3)	41	30.3
Tertiary	11 (26.8)	16 (40.0)	6 (50.0)	1 (6.3)	34	25.7
Informal	5 (12.2)	2 (5.0)	2 (16.7)	9 (56.3)	18	14.7
Location within the state	4	12	6	3	25	ND

N Number of participants

% Percentage

Across all the survey areas, *M. pruriens* (Eso werepe) and *C. papaya* (Ibepe) are the most prominently cited medicinal plants, with *M. pruriens* having the highest relative frequency of citation of 31%**.** *Carica papaya* follows closely, with RFC value of 21% (Fig. 5). *J. gossypiifolia* (Lapalapa) and *R. communis* (Eso laa) are also frequently cited, with RCF values of 14% and 10% respectively. Other plants, such as *Boerhavia diffusa* L. (Etiponla) and *Aframomum melegueta* K. Schum (Ata-ire), appeared less frequently, with RCF values occurrence rates of 6% and 4% respectively (Fig. 5).

Thirty-one (31) plant species belonging to twenty (20) plant families such as Amaryllidaceae, Bignoniaceae, Cariacaceae, Euphorbiaceae, Fabaceae, Lamiaceae, Malvaceae, Nyctaginaceae, Putranjivaceae, Sapotaceae, Zingiberaceae were mentioned across the four study areas (Fig. 6). The most predominant plant families were Fabaceae (37 occurences), Euphorbiaceae (28 occurrences), and Cariacaceae (23 occurences). Table 6 shows that most plant products were prepared as powders or decoctions and given to contraceptive seekers in the form of herbal contraceptive rings or waist/wrist beads (66.1%). The predominant routes of administration were through alternative methods such as wearing rings or waist beads, especially among male traditional contraceptive seekers (79.8%), whereas most female herbal contraceptives were administered via the oral route (48.6%). Most of the plants used were trees with the highest proportion recorded in Osun and Oyo study areas (48.6%). These plants were primarily sourced from farms or markets (46.8%). Table 7 shows some recipes that are prescribed to contraceptive seekers for contraception. According to the participants, recipes contain one to three different plants prepared in the form of a decoction by boiling with water or as powder by grinding dried plant samples, which are taken with water or pap food.

Associations between plant form and sociodemographic variables

A chi-square test of associations was conducted to determine the associations between the contraceptive plant form and sociodemographic variables such as participant

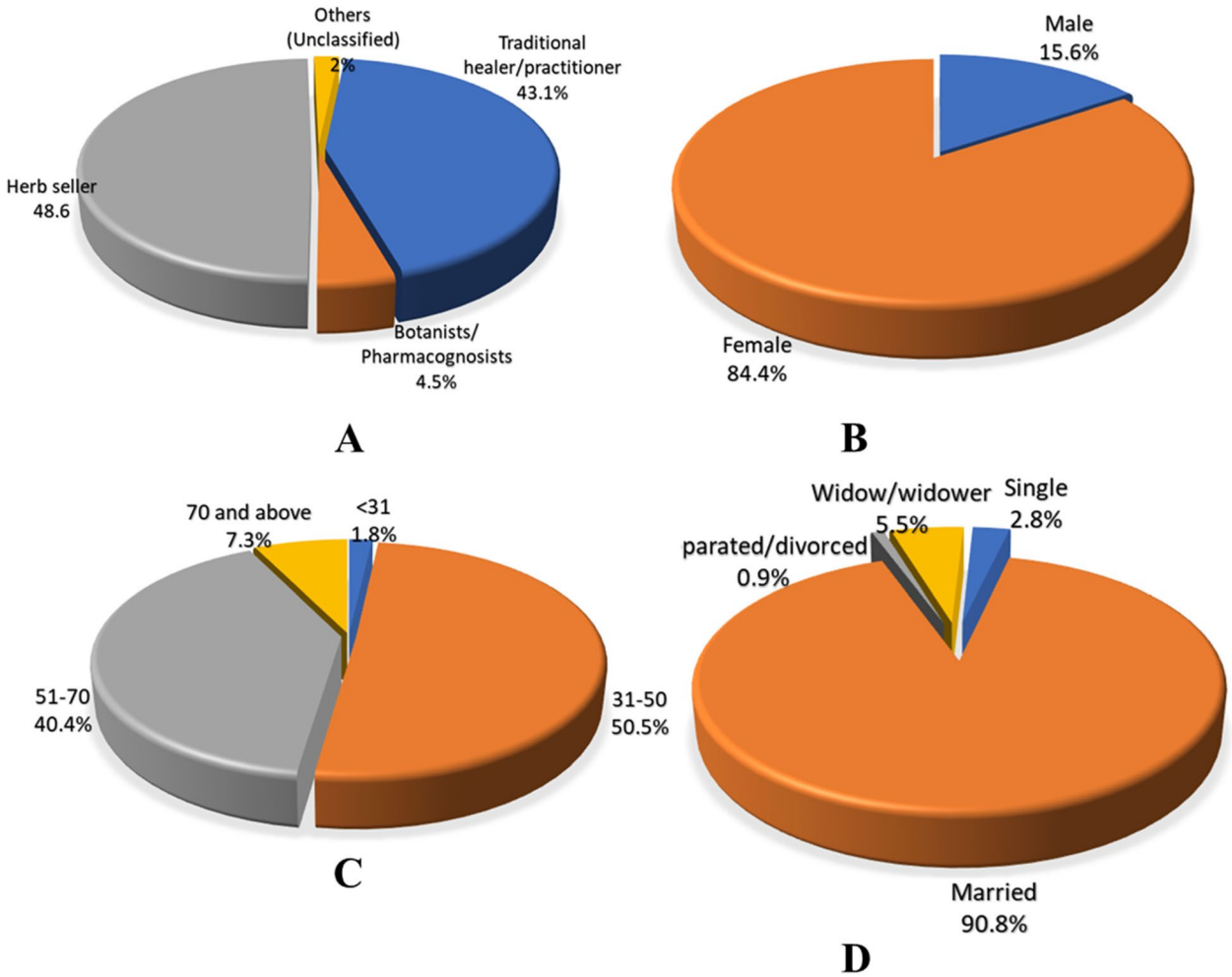

Fig. 2 Distribution of **A**: Status **B**: Sex **C**: Age and **D**: Marital status of the respondents from all studied areas

status, level of education, route of contraceptive administration for both male and female contraceptive seekers, number of participants with patients on contraceptives and reported side effects of the plants (Table 8). The results revealed a statistically significant association between plant form and level of education [$\chi^2 = 5.642$, df = 1, $p = < 0.018$] and between plant form and having patients on contraceptives [$\chi^2 = 11.862$, df = 1, $p = 0.001$]. However, there was no statistically significant difference between the plant form and participant status [$\chi^2 = 0.36$, df = 1, $p = 0.549$], route of administration (male), [$\chi^2 = 1.48$, df = 1, $p = 0.224$], route of administration (female), [$\chi^2 = 1.204$, df = 1, $p = 0.273$] or side effects of the plant [$\chi^2 = 0.285$, df = 1, $p = 0.593$].

Discussion

Women of childbearing age in the developing world, especially in most countries in Africa, struggle to space their children and prevent unwanted pregnancies. Modern contraceptives are perceived to have side effects such as hormonal imbalance, increased risk of cancer, thromboembolism, weight gain, heavy menstrual bleeding, and genital infections [9, 18]. The use of plants for contraceptive purposes is an age-old practice that is deeply embedded in the cultural and medicinal heritage of several communities across Nigeria. However, with the increasing influence of modern medicine and the potential decline in the transmission of this knowledge to younger generations, there is a pressing need to preserve this information [56].

Sociodemographic data

The participants in this study were predominantly married female herb sellers who were 31–50 years of age, in contrast to the number of male participants. This finding indicates that women, particularly those in middle to older age groups, are the primary custodians of traditional contraceptive knowledge. Female herb sellers,

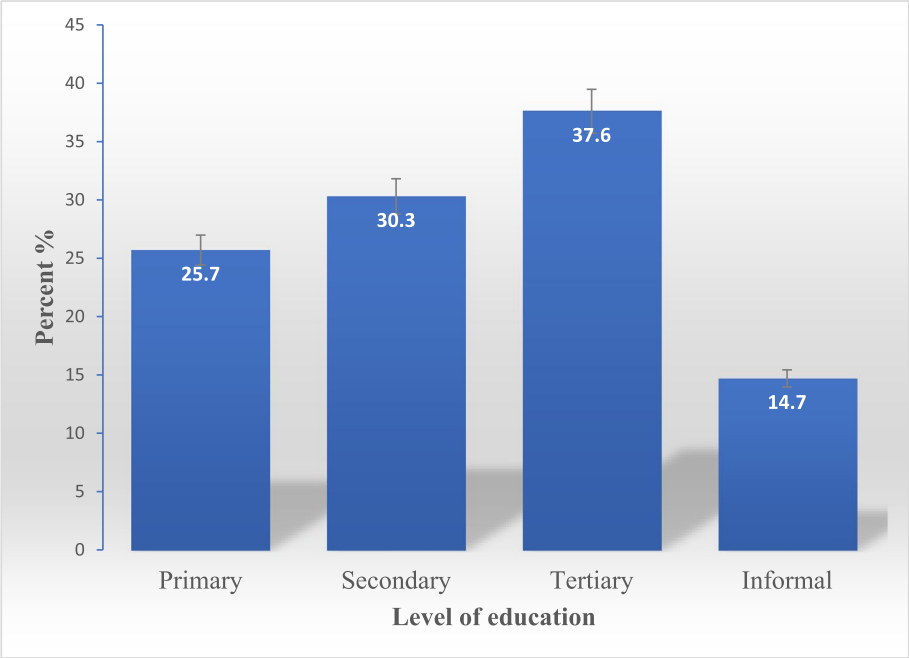

Fig. 3 Educational status of the respondents across the selected states

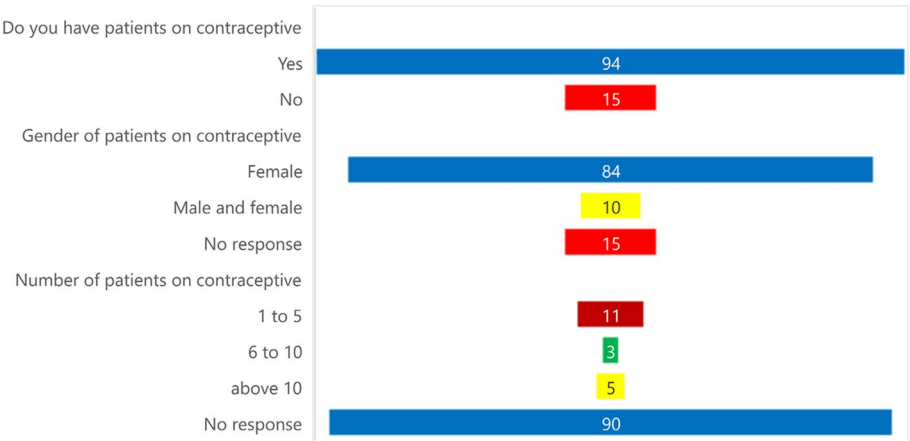

Fig. 4 Patients on traditional contraceptive demand

who frequently interact with other women, are likely to be well informed about contraceptive herbs, both for personal and professional use [45]. Additionally, in many societies, particularly in rural areas, women play a crucial role in local health practices. This disparity can be understood through sociocultural roles, knowledge dynamics, and economic factors specific to gendered practices in the realm of reproductive health [4].

The educational background varied across the four states, with a significant proportion having secondary and tertiary education. The varied educational backgrounds of the participants highlight the mix of traditional and formal knowledge systems in the practice of ethnobotany. Their literacy and education also enable them to understand the basics of contraceptive use and efficacy, aligning their knowledge with community needs in a practical manner [42].

These sociodemographics indicate that traditional contraceptive knowledge is held by experienced, educated, and married individuals. This analysis is crucial for understanding the dynamics of knowledge preservation and the role of different groups in maintaining traditional

Table 2 Medicinal plants used for male and female contraception in kwara State, Nigeria

S/N	Local name (Yoruba)	Botanical name	Family name	Plant part used	*N* (%) Occurrence
1.	Agbalumo	*Chrysopnyllum albidum* G. Don	Sapotaceae	Seed	1(2.04)
2.	Aluki	*Asparagus africana* var. africanus	Asparagaceae	Leaf	1(2.04)
3.	Ataare	*Aframomum melegueta* K. Schum	Zingiberaceae	Seed	3(6.12)
4.	Aworoso	*Croton penduliflorus* Hutch	Euphorbiaceae	Seed	1(2.04)
5.	Ayan	*Pericopsis laxiflora* (Benth. ex Baker) Meeuwen	Fabaceae	Seed	1(2.04)
6.	Bomubomu	*Calotropis procera* (Aiton) Dryand	Apocynaceae	Leaf	1(2.04)
7.	Efinrin-wewe	*Ocimum gratissimum* L	Lamiaceae	Leaf	1(2.04)
8.	Egusi Aije	*Melothria sphaerocarpa* (Cogn.) H. Schaef. & S.S. Renner	Cucurbitaceae	Seed	1(2.04)
9.	Emile	*Euphorbia hirta* L	Euphorbiaceae	Leaf	1(2.04)
10.	Eso laa	*Ricinus communis* L	Euphorbiaceae	Seed	7(14.29)
11.	Eso werepe	*Mucuna pruriens* (L.) DC	Fabaceae	Seed	10(20.41)
12.	Eti-ponla	*Boerhavia diffusa* L	Nyctaginaceae	Leaf	2(4.08)
13.	Ewuro-jije	*Vernonia amygdalina* Delile	Asteraceae	Leaf	1(2.04)
14.	Ibepe	*Carica papaya* L	Caricaceae	Bark and seed	2(4.08)
15.	Imi-Esu	*Ageratum conyzoides* L	Asteraceae	Leaf	1(2.04)
16.	Irugba	*Parkia biglobosa* (Jacq.) R.Br. ex G.Don	Fabaceae	Bark	1(2.04)
17.	Lapalapa	*Jatropha gossypiifolia* L	Euphorbiaceae	Seed	11(22.45)
18.	Mumu	*Drypetes parvifolia* (Müll.Arg.) Pax & K. Hoffm	Putranjivaceae	Seed	1(2.04)
19.	Oganwo	*Khaya ivorensis* A.Chev	Meliaceae	Leaf	1(2.04)
20.	Tangiri	*Lagenaria breviflora* (Benth.) Roberty	Cucurbitaceae	Seed	1(2.04)

Table 3 Medicinal plants used for male and female contraception in Lagos State, Nigeria

S/N	Local name	Botanical name	Family name	Part use	*N* (%) Occurrence
1.	Alubosa	*Allium cepa* L	Amaryllidaceae	Fruit	1(2.27)
2.	Ata-ile	*Zingiber officinale* Roscoe	Zingiberaceae	Rhizome	2(4.55)
3.	Atare	*Aframomum melegueta* K.Schum	Zingiberaceae	Seed	1(2.27)
4.	Eso laa	*Ricinus communis* L	Euphorbiaceae	Seed	4(9.09)
5.	Eso werepe	*Mucuna pruriens* (L.) DC	Fabaceae	Seed	12(27.27)
6.	Eti-ponla	*Boerhavia diffusa* L	Nyctaginaceae	Leaf	4(9.09)
7.	Ewe Oruru	*Markhamia tomentosa* (Benth.) K. Schum	Bignoniaceae	Leaf/Powder	1(2.27)
8.	Ibepe	*Carica papaya* L	Caricaceae	Seed and Bark	7(15.91)
9.	Imiesu	*Ageratum conyzoides* L	Asteraceae	Leaf	1(2.27)
10.	Ita (Emure-ekiti)	*Celtis mildbraedii* Engl	Cannabaceae	Seed	1(2.27)
11.	Kóko	*Colocasia esculenta* L. (Schott)	Araceae	Leaf	2(4.55)
12.	Lapalapa	*Jatropha gossypiifolia* L	Euphorbiaceae	Seed	3(6.82)
13.	Obi-edun	*Cola nitida* (Vent.) Schott & Endl	Malvaceae	Seed	2(4.55)
14.	Oju ologbo	*Abrus precatorius* L	Fabaceae	Seed	1(2.27)
15.	Òpẹ̀ igbó	*Lasimorpha senegalensis* Schott	Araceae	Rhizome	1(2.27)
16.	Orogbo	*Garcinia kola* Heckel	Clusiaceae	Fruit	1(2.27)

contraceptive practices. There have also been reports of a positive association between respondent age and plant knowledge acquisition [51].

Ethnobotanical data

Informant Consensus Factor (ICF) describes informants' consensus on the medicinal plant consumption and evaluates variability in mode of utilization for contraception [22, 53]. The ICF values calculated for Kwara, Lagos, Oyo, and Osun study areas were 0.5, 0.6, 0.3 and 0.8 respectively, with an overall ICF value of 0.7 across the four areas. A similar informant consensus factor (0.6) was reported in an ethnobotanical study on medicinal plants species used for contraception and reproductive

Table 4 Medicinal plants used for male and female contraception in Oyo State, Nigeria

S/N	Local name	Botanical Name	Family name	Part use/form	*N* (%) Occurence
1.	Ajó (Òwò)	*Sphenocentrum jollyanum* Pierre	Menispermaceae	Bark	1(4.76)
2.	Atare	*Aframomum melegueta* K. Schum	Zingiberaceae	Seed	1(4.76)
3.	Egusi-aije	*Melothria sphaerocarpa* (Cogn.) H. Schaef. & S.S. Renner	Cucurbitaceae	Seed	1(4.76)
4.	Eso werepe	*Mucuna pruriens* (L.) DC	Fabaceae	Seed	6(28.57)
5.	Eti-ponla	*Boerhavia diffusa* L	Nyctaginaceae	Leaf	1(4.76)
6.	Ewe akeeri	*Triumfetta cordifolia* A. Rich	Malvaceae	Leaf	1(4.76)
7.	Ibepe	*Carica papaya* L	Caricaceae	Bark and Seed	7(33.33)
8.	Lapalapa	*Jatropha gossypiifolia* L	Euphorbiaceae	Seed	1(4.76)
9.	Orogbo	*Garcinia kola* Heckel	Clusiaceae	Fruit	1(4.76)

Table 5 Medicinal plants used for male and female contraception in Osun State, Nigeria

S/N	Local name	Botanical name	Family	Part Use/form	*N* (%) Occurence
1.	Atare	*Aframomum melegueta* K.Schum	Zingiberaceae	Seed	1(6.67)
2.	Eso werepe	*Mucuna pruriens* (L.) DC	Fabaceae	Seed	6(40.0)
3.	Ibepe	*Carica papaya* L	Caricaceae	Seed/bark	7(46.67)
4.	Taro	*Colocasia esculenta* L. (Schott)	Araceae	Leaf	1(6.67)

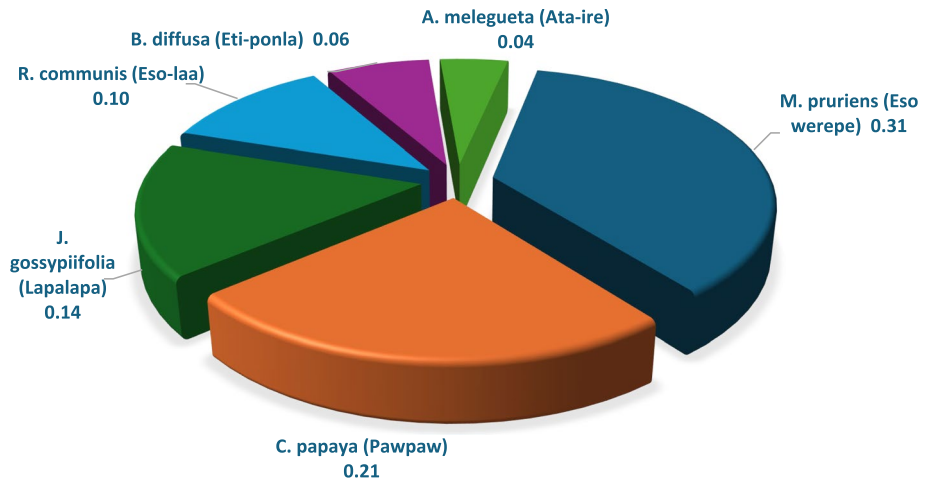

Fig. 5 Contraceptive plant species commonly mentioned in the four study areas with their RFC values

health care in four regions in Uganda [11, 33]. The results obtained from this study demonstrated that the herb sellers and herbal practitioners, who participated in the study tend to agree with each other in terms of the plant species used as contraceptives, which is an indication of quality control of administration of herbal remedies.

The RFC index authenticates the citation frequency of a medicinal plant used for treating various ailments. It also represents the relative importance of plant species and it is dependent on the number of informants that report their usage [53, 54]. In this study, RFC values ranged from 2 to 27% in Kwara, 2.5% to 30% in Lagos, 8% to 58% in Oyo, and 6% to 44% in Osun. Across the four study areas, the highest RFC was found for *Mucuna pruriens* (0.31), *Carica papaya* (0.21) and *Jatropha gossypiifolia* (0.14). This demonstrates that the vast majority of respondents in the study areas agreed that these species were the most often prescribed medicinal plants for contraception. *Mucuna pruriens* has been traditionally used for various medicinal purposes, including its

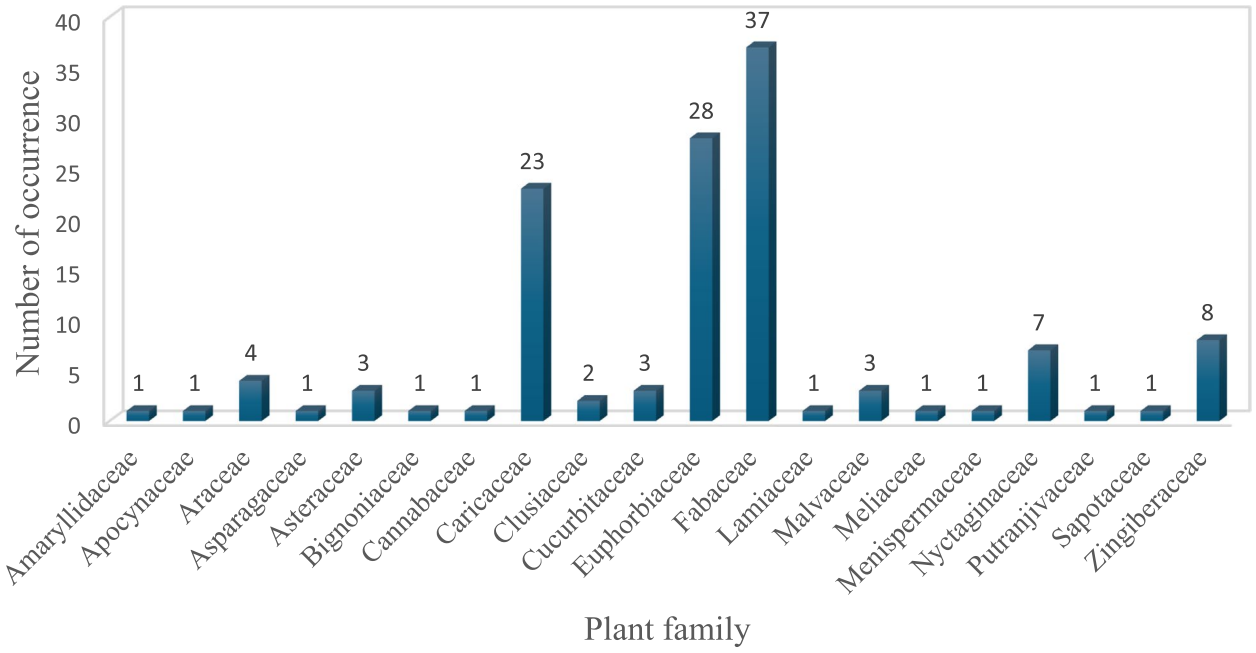

Fig. 6 Contraceptive plant families mentioned during survey

Table 6 Plant-based birth control: Forms, route of administration and natural habitats

Variable	Frequency (*N*)	Percent (%)
How do you prepare the plants given to patients		
Powdered or whole form	15	13.8
Liquid form (infusion, decoction)	14	12.8
Semi solid form (paste)	8	7.3
Other forms (herbal contraceptive ring and beads)	72	66.1
How do the patients take the product		
Male		
Orally	18	16.5
Incision/scarfication	3	2.8
Paste to be applied topically	1	0.9
Other routes (ring, waist beads)	87	79.8
Female		
Orally	53	48.6
Incision/scarification	4	3.7
Other routes (ring, waist beads)	52	47.7
What is the plant form		
Shrub	6	5.5
Trees (seed, leaf, bark, fruit, rhizome)	53	48.6
Climber	2	1.8
Other forms	48	44
Habitat of the plants used		
Forest	30	27.5
Savanna	3	2.8
Cultivated area	25	22.9
Others (farm, market)	51	46.8

Table 7 Local recipe for female and male contraception in selected states in southwest Nigeria

Recipes	Name of plant	Mode of preparation
Recipe 1	*Asparagus Africana* + *Pericopsis laxiflora*	Grind plant materials together and take with water or take with pap for contraception
Recipe 2	*Boerhavia diffusa* + Ring + *Aframomum melegueta* + *Parkia biglobosa*	Boil plant material together with ring; the ring is worn by female and male for contraception
Recipe 3	*Ageratum conyzoides*	Burn plant material with ring or waist bead and the ring or waist bead is worn by male and female for contraception
Recipe 4	*Euphorbia hirta*	Boil plant material with ring or waist bead. Leave the ring or waist bead soaked in the plant mixture for 3 days. the ring is worn by female and male for contraception
Recipe 5	*Carica papaya*	Boil the plant bark with ring and the ring is worn by female and male for contraception
Recipe 6	*Khaya ivorensis*	Grind plant material to powdered form and mix with ash for incision for male contraception
Recipe 7	*Ocimum gratissimum* + *Vernonia amygdalina*	Dry and grind plant material to powdered form and take with water for female and male for contraception
Recipe 8	*Melothria sphaerocarpa*	Dry and grind plant material to powdered form and take with water for female and male for contraception
Recipe 9	*Jatropha gossypiifolia*	Dry and grind 7 seeds to powdered form and take with water for female and male for contraception
Recipe 10	*Lagenaria breviflora*	Boil plant with ring or waistband for 7 days and the ring is worn by female and male for contraception
Recipe 11	*Calotropis procera*	Burn plant leaf and ring and salt and take with pap for female and male for contraception

Table 8 Association between plant form and sociodemographic variables ($n = 109$)

Variable	Plant Form		Total	Chi-square	df	*P*-value
	Liquid	Whole/seed/powder				
Respondents Status						
Traditional healer/herb seller	7(100.0)	97(95.1)	104(95.4)	0.36	1	0.549
Botanist/pharmacognosists	0(0.0)	5(4.9)	5(4.6)			
Level of Education						
Primary and below	5(71.4)	29(28.4)	34(31.2)	5.642	1	0.018*
Secondary and above	2(28.6)	73(71.6)				
Route of Administration (male)						
Orally	0(0.0)	18(17.6)	18(16.5)	1.48	1	0.224
Others (Ring/paste/incision)	7(100.0)	84(82.4)	91(83.5)			
Route of Administration (female)						
Orally	2(28.6)	51(50.0)	53(48.6)	1.204	1	0.273
Others (Ring/paste/incision)	5(71.4)	51(50.0)	56(51.4)			
Have patient on contraceptive						
Yes	3(42.9)	91(89.2)	94(86.2)	11.862	1	0.001*
No	4(57.1)	11(10.8)	15(13.8)			
Side effect of plant						
Yes	0(0.0)	4(3.9)	4(3.7)	0.285	1	0.593
No	7(100.0)	98(96.1)	105(96.3)			

* Statistically significant association

$p < 0.05$; df: degree of freedom

potential role as a herbal contraceptive. However, studies have reported that *M. pruriens* may enhance fertility instead of acting as a contraceptive [46]. *Mucuna pruriens* seeds have been reported to improve male sexual function as well as enhance uterine and ovarian functions in animal models [10, 47, 50]. Therefore, while traditional practices may have associated *M. pruriens* with contraceptive properties, current scientific evidence suggests

it may actually enhance fertility. In traditional medicine, different parts of *C. papaya* such as leaves, stem, roots and seeds are used in the management of various diseases. In search for male contraceptive agents, *C. papaya* seed extract has been widely studied for its antifertility properties [28–32]. The effects of *C. papaya* seeds on the male reproductive system have been well-documented, with concerns raised regarding the potential risks of seed ingestion during pregnancy. In female animals, the antifertility action of *C. papaya* seeds is primarily based on traditional knowledge, with conflicting reports regarding its precise mechanism in inducing infertility [25]. Different parts of *J. gossypiifolia* including its leaves, stems, roots, and seeds have been reported to exhibit several pharmacological activities, such as anti-inflammatory, analgesic, anti-microbial, anti-diabetic and contraceptive effects [23, 24, 44].

The most predominant plant families were Fabaceae, Euphorbiaceae, and Cariacaceae. The Fabaceae family was the most frequently cited, occurring 37 times. This high frequency of citation may be attributed to the wide variety of species within Fabaceae, also known as the legume family, which is known for its diverse secondary metabolites, including alkaloids, flavonoids, and glycosides. These compounds have been linked to antifertility effects, potentially explaining why Fabaceae species are favored in traditional contraceptive practices [2, 43]. The prominence of Fabaceae in such traditional uses has also been noted in studies across African regions, reinforcing its ethnobotanical importance [12].

In addition to Fabaceae, the Euphorbiaceae family ranked second with 28 occurences and the Caricaceae family ranked third with 23 occurrences in the survey. Euphorbiaceae is rich in diverse bioactive compounds, such as diterpenes and triterpenes, many of which have been researched for their pharmacological potential, including their antifungal and abortive properties [38, 39]. Plants in the Caricaceae family, particularly *Carica papaya*, are well documented in traditional medicine for their role in regulating fertility, with components such as papain believed to influence reproductive health [52]. The life forms of most of the plants cited as contraceptive medicinal plants in the four studied areas were trees, with the plant parts most commonly used being seeds, leaves, bark, fruits and rhizomes, which indicates a reliance on more substantial, possibly long-standing flora for contraceptive purposes. One prominent preparation method is herbal contraceptive powder, which is made by grinding the plant materials such as seeds or leaves into a fine powder. This powder is ingested with a medium such as pap food or water. This approach is likely to make the bioactive compounds more digestible and palatable, facilitating their intended contraceptive effects. Another method involves boiling the plant parts, after which the resulting decoction is consumed. Boiling may enhance the potency of the medicinal properties by extracting active constituents but may also render the remedy easier to ingest. In certain cases, plant materials are mixed with ash or boiled with other items, such as waist/wrist beads or rings, suggesting symbolic or ritualistic effects in addition to practical and pharmacological effects. The addition of ash may also serve as a preservative or additional binding agent, enhancing the effectiveness of the mixture [5].

Furthermore, some preparation techniques involve more prolonged processes, such as soaking plant materials alone or with rings or waist/wrist beads for several days. These extended soaking periods could serve to leach specific active compounds gradually, enhancing the potency or stability of the contraceptive. Methods involving boiling and/or drying, such as boiling rings with contraceptive herbs and allowing the rings to dry for three days, may carry cultural or symbolic significance, reflecting the belief that ritualistic handling can influence the efficacy of the contraceptive (Bablola et al. 2009). The use of contraceptive rings could have some consequences with periods and times of sexual intimacy, as emphasized by 5 out of the 41 participants in Kwara study area and 3 out of the 12 participants in Oyo study area. Further instructions/advice against the concurrent use of traditional and modern contraceptives were also given, which could stem from concerns over interactions that might reduce effectiveness or cause side effects. The oral route of administration (48.6%) was the most common route prescribed by respondents to female contraceptive seekers, aligning with the general preference for the ingestion of medicinal plants. This could indicate that the active compounds in these contraceptive plants are believed to work systemically. The use of incisions, though less common, suggests that some traditional practices might involve topical or localized applications, possibly in conjunction with spiritual or ritualistic practices [27]. Many of the participants (96.3%) reported no side effects from the use of these plants, which might have contributed to their continued use in traditional practices. The small percentage of reported side effects, particularly general body pain, could be due to individual sensitivities, dosage differences, or the preparation method [48]. Some of the excerpts quoted from the participants include "*Do not use traditional contraceptives together with modern contraceptives*". Another traditional contraceptive provider was quoted to have affirmed that "*the contraceptive ring will work as long as you wear it*" and, importantly, about the need for a firm belief in effectiveness: "*When you believe it will work without asking questions, it will work*". Based on these themes, quotes and excerpts, it can be inferred that traditional contraceptive providers generally

believe that their products and services, if prepared accurately and instructions are well followed, effectively assist women in planning their birth.

Associations between plant forms and sociodemographic variables

A chi-square test was used to identify significant relationships between the form of the plant (such as seeds, leaves) and various participant attributes or conditions of contraceptive usage. A statistically significant association ($p = 0.018$) between plant form and participants' level of education suggested that educational background may influence the choice of plant parts recommended as herbal contraceptives. A higher educational attainment may therefore influence preferences toward certain plant parts or preparation methods due to differences in perceived efficacy, safety, or cultural knowledge [2]. This finding aligns with studies indicating that education often impacts health behaviors, including contraceptive choices and methods [49].

Another statistically significant association ($p = 0.001$) between plant form and experience with herbal contraceptive patients suggests that individuals who have assisted others in contraceptive use may prefer to recommend specific plant parts due to their efficacy or perceived reliability. This association may indicate practitioner expertise, where experience influences the selection of plant forms most aligned with successful contraceptive outcomes [17].

In contrast, no statistically significant associations were found between plant part and participant status (p =0.549), route of administration for males ($p = 0.224$), route of administration for females ($p = 0.273$), or side effects of the plant ($p = 0.593$). The lack of association between plant part and participant status—such as whether the participant was a practitioner, user, or general informant—indicates that plant form preference may be more culturally or community-based rather than role-specific within the population surveyed. Similarly, the absence of a significant relationship with the route of administration for both males and females implies that plant form selection is likely independent of the intended mode of delivery (e.g., oral, topical), with variations perhaps rooted in local cultural practices rather than biological gender considerations.

Finally, the nonsignificant results concerning the plant form and side effects of the plants suggest that side effects may not be directly tied to the plant itself but rather to the individual plant species or preparation methods used. This finding underscores the potential complexity of ethnobotanical contraceptive side effects, where variables such as dosage, individual tolerance, and preparation may play more influential roles [13].

Conclusion

The results presented in this survey indicate a rich diversity of medicinal plant species used by indigenous people of the study area as contraceptive. Traditional contraceptive providers are patronized by people who still use traditional approaches to contraception despite the penetration of orthodox contraceptives, which indicates the significance of plant based traditional recipes. The high ICF value reflects a strong agreement among participants with regards to medicinal plants used for contraception. Although scientific evidence supports the contraceptive effects of some of the plants mentioned, additional research is needed to validate the traditional claims of those not yet studied. Specifically, *Mucuna pruriens*, with the highest relative frequency of citation (RFC) as a contraceptive plant, has also shown pharmacological activity as a fertility enhancer. Furthermore, our analysis of plant knowledge in relation to sociodemographic variables provides valuable insights into the factors that affect changes in the use and perception of contraceptive plants across different sociocultural contexts.

Supplementary Information

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Supplementary Material 1

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Authors' contributions

MBI designed the study and coordinated the project. MBI, ASO, BAL, OFO, JS and MOI participated in all field data collection. MBI, ASO, BAL, OFO, MOI and ASA wrote the manuscript. NAB and WAT analysed data and contributed to writing of manuscript. The manuscript was reviewed by MBI and MOI. All the authors read and approved the final manuscript.

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Data availability

All data generated and/or analyzed during this study are included in this published article.

Declarations

Ethics statement

The University of Lagos Research Ethics Committee approved the study with approval number UNILAGREC/23/08/006. Informed consent was obtained from the participants following explanation of the study, and the study was conducted in compliance with the Declaration of Helsinki

Conflicts of interest

The authors declare no conflicts of interest.

Competing interest

The authors declare no competing interests.

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