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Assessment of non-timber forest products utilization in Kwabaktina forest reserve, Adamawa State, Nigeria

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ABSTRACT

This study assessed non-timber forest products utilization in Kwabaktina Forest Reserve, Hong Local Government Area of Adamawa State. Data were collected through semi-structured questionnaires, field observations, personal interviews, and focused group discussions. Descriptive and inferential statistics were used to analyze the data. The majority (54.6%) of the respondents were female, and most were youths (44.3%) between the ages of 18 to 40 years. A greater proportion (63.3%) were married individuals with a low level of education in the study area. The findings revealed that most of the respondents (72.25%) belonged to the household size category of 1-10 and were low-income earners. The findings also identified some available NTFPs in the study area, which include Borassus fruit, Borassus bark, honey, moringa seed, leaves, bush meat, caterpillars, crickets, and Borassus hypocotyls. Hypocotyls were the most preferred NTFPs utilized by the people. The results revealed that NTFPs were utilized to a very high extent due to the high economic value of the products. Gender played a significant role in the utilization of NTFPs, while age, educational status, and household size significantly determined the utilization of NTFPs in the study area. The results also showed no significant difference in the extent to which people utilized NTFPs. The study found that non-timber forest products (NTFPs) provided significant food, employment, income, and livelihood sources in the study areas. The study recommends prioritizing financial and technical support for alternative income-generating ventures, stakeholder involvement in forest resource planning, and economic evaluations of NTFP utilization to optimize their benefits.

Contribution/Originality: The study on NTFP utilization in Kwabaktina Forest Reserve, Nigeria, is original due to its geographical focus on a specific and relatively unstudied area, comprehensive assessment, mixed-methods approach, and contextualization within local livelihoods, providing new insights and policy implications for sustainable NTFP management and rural development.

1. INTRODUCTION

The development of local economies is a crucial aspect of sustainable development policy in developing societies, and Non-Timber Forest Products (NTFPs) play a vital role in sustaining local economies. By harnessing NTFPs, communities can generate income and stimulate local economic growth while enhancing natural resource

management, conserving ecosystems, preserving biodiversity, and ultimately contributing to a balanced and sustainable development trajectory [1].

Non-timber forest products (NTFPs) play a vital role in linking conservation with poverty alleviation by incentivizing sustainable forest management [2]. For rural communities, NTFPs have been a enduring source of benefits, providing essential resources for livelihoods [3]. NTFPs encompass a broad range of products harvested from forests, excluding timber, for household use, cultural purposes, or financial income [4]. Examples include edibles like fruits, seeds, and vegetables, as well as non-edibles like medicinal plants, resins, and fibers [5]. According to Jimoh and Adebisi [6] NTFPs contribute significantly to the livelihood sustainability of rural people worldwide, meeting their basic needs through subsistence, local trade, and external trade. NTFPs play a vital role in enhancing food security in rural areas by supplementing crops and serving as a source of income, food, shelter, fuel, fodder, medicine, and other essential resources [7, 8]. However, despite their importance, NTFPs have been neglected by policymakers, forest managers, and practitioners [9, 10]. This oversight has contributed to the alarming rate of deforestation and degradation, putting the livelihoods of forest-dependent communities at risk. Furthermore, national-level forestry programs often overlook the socioeconomic potential of NTFPs, which could greatly benefit underprivileged populations [11, 12]. The absence of institutional arrangements, targeted strategies, and clear guidelines for sustainable NTFP management, extraction, and marketing has hindered their development.

Additionally, the lack of incentives for local enterprise development has led to both over-exploitation and under-exploitation of resources. There is also a significant knowledge gap regarding the NTFP-related needs and consumption patterns of forest dwellers and other forest-dependent communities [13, 14]. The World Bank's poverty assessment report [15] aptly describes Nigeria as "a poverty state amid plenty," indicating that despite abundant resources, the country struggles with poverty due to poor exploration, underutilization, and mismanagement of these resources. Alarming poverty statistics in Nigeria underscore the need for effective solutions. The National Bureau of Statistics (NBS) [16] reported that 82.9 million Nigerians, representing 69% of the population, lived in relative poverty conditions. In this context, Non-Timber Forest Products (NTFPs) play a vital role in poverty reduction by providing rural communities with income, food, and medicine. However, there is a significant knowledge gap regarding the stock, abundance, utilization, and contribution of NTFPs to livelihoods and rural economies.

This study aims to address this gap by assessing the utilization of NTFPs in Adamawa State, providing essential insights into the sector's contribution to humanity and economic development.

2. METHODOLOGY

2.1. Study Area

The study was conducted in Hong Local Government Area, Adamawa State, Nigeria. Adamawa State is situated in the North-eastern part of the country, between latitudes 10° 21' and 13°30' North, and longitudes 13° 10' and 13° 40' East. The study area has a population of approximately 681,353 [17] with a projected population of 226,100 in 2016. The area experiences two distinct seasons: a wet season from May to November and a dry season from November to April. Annual rainfall ranges from 800 mm in the north to 1000 mm in the rest of the area, with temperatures reaching up to 40 °C in April and dropping to 18 °C between December and January [18]. Agricultural productivity in the area is hindered by low rainfall and frequent dry spells, resulting in reduced crop yields, water scarcity and reduced biomass for livestock [19]. The vegetation is characterized by Sudan Savannah in the north and Northern Guinea Savannah in the rest of the area [18]. Major crops grown include maize, sorghum, groundnut, cowpea, and rice [20].

2.2. Population and Sampling Procedure

The population of the study included NTFPs users in the selected communities in Hong LGA of Adamawa State. Purposive sampling and simple random techniques were to determine the study sample in the study area. The

adjoining communities around Kwabaktina forest reserve were purposively selected based on their history of NTFPs abundance and activities. The communities were Manjaa, Dazak, Mulili and Munga. Thus 30% sampling intensity was applied to select respondents and elicit information for the study Table 1.

Table 1. Sampling layout.

Community	Subpopulation	Sampled respondents
Manjaa	317	95
Dazak	310	93
Mulili	326	98
Munga	354	106

2.3. Data Collection Techniques

Data collection involved both primary and secondary sources. Primary data were gathered through semi-structured questionnaires, field observations, personal interviews, and focus group discussions. A questionnaire was administered in four communities (Manjaa, Dazak, Mulili, and Munga) that utilize the Kwabaktina forest reserve. To ensure gender balance, both men and women were included in the interviews. First-hand information on NTFP utilization was collected from local users in these communities.

2.4. Data Analysis

The data were analyzed using descriptive and inferential statistics. Descriptive statistics, including frequency distributions, percentages, tables, and means, were used to summarize the results. A Likert scale was employed to assess the extent of NTFPs utilization. Additionally, Spearman rank correlation analysis was conducted to examine the relationship between socio-economic variables and the extent of NTFPs utilization in the study area.

2.5. Analytical Tool for Data Analysis

2.5.1. Determination Of Extent of Utilization

A five-point Likert scale rating was used to measure the extent of NTFPs utilization in the study area. The weighted scale was derived based on the following values: Very High (VH) = 5, High (H) = 4, Moderate (M) = 3, Low (L) = 2, Very Low (LV) =1 [21].

The Mean Score (MS) of the respondents is expressed as $MS = \frac{\Sigma f}{n}$ (1)

Where :

f = Summation of the five point rating scale and,

n = Number of the points.

$$MS = \frac{1+2+3+4+5}{5}$$

$$MS = 3.0$$

The Likert Weighted Score (WS) is expressed as:

$$WS = \sum fx \quad (2)$$

The Likert Weighted Mean Score (WMS) is expressed as :

$$MS = \frac{\Sigma fx}{N} \quad (3)$$

Where :

f = Frequency of farmers.

x = Likert scale point.

N= Total Number of farmers.

Using the interval scale of 0.05:

The Upper Limit (UL) cut-off is MS+0.05 (3.0+0.05 = 3.05).

The Lower Limit (LL) cut-off is MS - 0.05 (3.0-0.05 = 2.95).

Based on these two extreme limits any variable with WMS below 2.95 (WMS<2.95) is considered Very Low extent of utilisation.

Variable with MWS between 2.95 and 3.05 Moderate extent of utilisation.

Variable MWS greater than 3.05 (MWS>3.05) Very high extent of utilisation.

2.6. Statement of Hypotheses

The following hypotheses were tested:

H_{o1}: There is no significant relationship between respondent's socio-economic variables and NTFPs utilization in the study area. (Spearman rank correlation).

H_{o2}: Male and female respondents do not differ significantly in utilization of NTFPs in the Study area. (Mann Whitney Test).

H_{o3}: Communities do not differ significantly in utilization of NTFPs in the study area (Kruskal-wallis Test).

H_{o4}: Communities do not differ significantly in NTFPs contribution to livelihood (Kruskal-wallis Test).

2.7. Test of Hypothèses

H_{o1}: Spearman correlation analysis was used to establish the relationship between socio-economic variables and extent of utilization of NTFPs in the study area. The spearman correlation is expressed as:

$$r = 1 - \frac{6\sum d^2}{n^2 - n} \qquad (4)$$

Where: r = Spearman rank correlation; d= difference between the two ranks of each observation; n= number of observations; 1 and 6= constant; Σ=summation sign.

Ho2: The Mann-Whitney U test (U) was used to test for the gender difference in NTFPs utilization in the study area. The Mann-Whitney U test (U) as used by Mustapha [22] is expressed as:

$$U = n_1 n_2 + \frac{n_2(n_2+1)}{2} - \sum_{i=n_{11}+1}^{n_2} R_i \qquad (5)$$

Where: U=Mann-Whitney U test; N1 = sample size one; N2= Sample size two; Ri = Rank of the sample size; Kruskal-Walis test was used to test if communities differ in their utilization of NTFPs and to test the NTFPs contribution livelihood. The equation is given as:

$$H = (N-1)\frac{\sum_{i=1}^{g} n_i(\bar{r}_i - \bar{r})^2}{\sum_{i=1}^{g}\sum_{j=1}^{n_i}(r_{ij} - \bar{r})^2} \qquad (6)$$

Where: ni= Number of observations in group i.

rij= The rank of observations from group i.

N = Total number of observations across all groups.

3. RESULTS

3.1. Socio-Economic Characteristics of the Respondents

The result socio-economic characteristics of the respondents in the study area are presented in Table 2a and 2b. The findings showed that majority 54.6% of the respondents were female while 45.4% were male. The highest proportion (44.3%) of respondents were between the ages of 18 to 40 years, followed by those between the ages of 41-50 (22.4%), while those who were 50 years and above were 33.2%. The highest proportion of respondents (63.3%) were married, 30.6% were single while 6.1% were divorced in the study area. A greater proportion of respondents (72.2%) had a household size of 1-10 members, followed by those with the household size of (11-20), while 5.6% of

the respondents had the largest (21-30) household size. Based on educational attainment, the highest proportion of the respondents (41.85%) attained secondary school level, followed by non-formal education with 26.85% while 22.7% had tertiary education, 8.7% of the respondents attained primary school education in the study area. Based on ethno-linguistic composition, 64.0% of the respondents in the study area were Kilba, followed by Margi 24.2%, Bahama (6.1%) while Higgi were 5.6% of the respondents. In terms of religion, Christianity accounted for 88% of the respondents while Islam was 12%. Based on occupation, 38% of the respondents indicated for farming, 30.4% trading, and 22.2% indicated that they were civil servants, 10% indicated for fishing while 1.3% were hunters and 1.7 % students. In terms of income Levels of the respondents, 44.6% earned ₦10,001 - 20,000 per month, 30.1% earned ₦20001-30000, 13% made ₦1000-10000, while 3.3% earned ₦40001-50000 per month. The distribution of the respondents based on experience showed that 45.7% had 1-10 years of experience, 21.4% had 21-30 years of experience, while the least proportion (69%) of the respondents had 51 years of experience and above. The years of residence, the results showed that the highest proportion (35.5%) of the respondents resided in the area for 11-20 years, 17.6% for 1-10 years while only 5.6% indicated for 51-60 years of residence in the study area.

3.2. Non-Timber Forest Products Utilized in the Study Area

The result in Table 3 showed the NTFPs utilized in order of preference in the study area. A greater proportion of the respondents (19.11%) utilized Borassus Hypocotyls, this is followed by Bush meat (15.29), Honey (12.87%), Borassus fruit (12.74%), *Moringa oleifera* (11.12%), Borassus bark (10.19%), Oleifera seed (8.41%), *Gryllus pennsylvanicus* (6.36%) and the Caterpillar (*Cirina forda*) Larvae had (3.82%), in that order.

3.3. Extent of Non-Timber Forest Products Utilization in the Study Area

The extent of utilization of NTFPs in the study area is presented in Table 4. The result showed that the extent in which NTFPs were generally utilized was high. The highly utilized NTFPs were bush meat, Borrassus fruit, Borassus hypocotyls, honey, Moringa leaf, *G. Pennsylvanicus*, and Borassus bark on aggregate scored 4.11, 4.08, 4.07, 4.06, 4.03, 4.02 and 4.02 respectively. Also, *Cirina forda* larvae (3.93) and Moringa (3.72) seeds were moderately utilized in the study area.

3.4. Gender Role in NTFPS Collection in the Study Area

The result in Table 5a and 5b revealed that 41.6% which is highest in the row showed that the gender FAMA adult carried out Borassus fruit collection activities in the study area. This was followed by MCMAFCFA (32.4%) indicating that all categories are involved in the collection of fruits. The other group that followed was MA (26%). Similarly, in terms of stem cutting, the result showed that, all the gender categories carried out stem cutting irrespective of gender groups; this is supported by 57.4% of the respondents sampled. The other groups that followed were FCFA (31.6%), MA (5.6%) and FAMA (5.4%).

Table 2a. Socio-economic characteristics of respondents in the study area.

Variables	Category	Frequency	Percentage (%)
Sex	Male	178	45.4
	Female	214	54.6
Age	18-20	12	3.1
	21-30	75	19.1
	31-40	87	22.2
	41-50	88	22.4
	51-60	85	21.7
	61-70	35	8.9
	71 Above	10	2.6
Marital status	Married	248	63.3
	Single	120	30.6

Variables	Category	Frequency	Percentage (%)
	Divorced	24	6.1
Household size	1-10	283	72.2
	11-20	87	22.2
	21-30	22	5.6
Education status	Non-formal	105	26.8
	Primary	34	8.7
	Secondary	164	41.8
	Tertiary	89	22.7
Ethno- linguistic group	Higgi	22	5.6
	Margi	95	24.2
	Kilba	251	64.0
	Bachama	24	6.1
Religion	Christianity	345	88.0
	Islam	47	12.0
Major occupation	Farming	149	38.0
	Civil service	87	22.2
	Trading	119	30.4
	Fishing	4	1.0
	Hunting	5	1.3
	Student	28	7.1

In the same vein, stem marketing of *Borassus aethiopum* involved all gender categories, represented by the highest proportion of 52%. The highest involvement of all gender groups in marketing shows the value attached to the product as a source of income. This is followed by other groups as FCFA (36.7%), FAMA (10.7%) and MA (0.5%). In terms of Hypocotyls harvesting, processing and marketing the result revealed that 54, 61.2 and 41.1% of these activities respectively are mainly handled by the FAFC gender category. These however indicated all gender groups are involved in these activities representing 21.9, 29.6 and 31.9% of MCMAFCFA category at these activities respectively. The result however showed that FAMA gender group is highly involved in the marketing of hypocotyls representing 20.7% of the respondents sampled. In terms of honey, processing and marketing the result revealed that the male adults (MA) were mostly involved. This is represented 37.2, 31.9 and 31.9% of these activities respectively. This is followed by the male gender group MCMA, 26.6, 21.2% respectively. The female involvement was very minimal. The result on seed collection, processing and selling of seeds as reported by the respondents, is mainly the responsibility of all categories (MCMAFCFA), 68.6, 79.1 and 48.7% respectively. This is followed by FAMA (15.6%) for seed collection, FAFC (10.7%) for seed processing and FAMA (23.5%) for seed selling. For seed collection and processing, the female gender plays a dominant role while the male gender is more involved in the selling of seeds.

Table 2b. Socio-economic characteristics of respondents in the study area (cont'd).

Variables	Category	Frequency	Percentage (%)
Income	₦1000-10000	51	13.0
	₦10001-20000	175	44.6
	₦20001-30000	118	30.1
	₦30001-40000	35	8.9
	₦40001-50000	13	3.3
Years of experience	1-10	179	45.7
	11-20	61	15.6
	21-30	84	21.4
	31-40	41	10.5
	51Above	27	6.9
Years of residence	1-10	69	17.6
	11-20	139	35.5
	21-30	101	25.8
	31-40	32	8.2
	41-50	29	7.4
	51-60	22	5.6

Table 3. Preferred NTFPs utilized in the study area.

NTFPs	Frequency	Percentage (%)
Borassus hypocotyls	150	19.11
Bush Meat	120	15.29
Borassus fruit	100	12,74
Honey	101	12.87
Moringa oleifera leaf	88	11.21
Borassus bark	80	10.19
Moringa oleifera seed	66	8.41
Cricket (Gryllus pennsylvanicus)	50	6.36
Caterpillar (Cirina forda) Larvae	30	3.82
Total	785	100

The result on M. Oleifera revealed that all the activities regarding leaf collection, leaf processing sells are mainly carried out by all the gender categories (MCMAFCFA) Table 5c. This is indicated by 74, 57.4 and 52.3% for collecting, processing and sells respectively. This is followed by FCFA (10.7%) for leaf collection, FCFA (32.1%) for leaf processing and FCFA (32.1%) for leaf marketing. The least involved category for leaf collection was FA (5.1%) leaf processing, MA (5.1%) and leaf selling FAMA (10.7%). Table 5d presents the results of gender roles in bushmeat utilization. The results show varying levels of involvement across different categories and activities: Bushmeat hunting is primarily done by MCMA/FCFA (52.3%) and MCMA (41.8%), with minimal involvement from FAMA (5.4%) and FCFA (0.5%). In bushmeat processing, FCFA (54.1%) and MCMA/FCFA (21.2%) are the main contributors, followed by FC (9.7%), FAMA (7.7%), FA (3%), and MCMA (3.3%). Bushmeat marketing shows a different pattern, with MCMA/FCFA (29.1%) having the highest involvement, followed by FAMA (7.4%), FC (1.8%), and FCFA (1.2%), while MCMA had the lowest (0.5%).

The results presented in Table 5e show that caterpillar (*Cirina forda*) harvesting is primarily done by females, who account for 44% of the FCFA category. However, all gender groups are involved in harvesting, with 31.4% of the sampled respondents participating. The FAMA category follows, with 21.2% involvement, while the MCMA category has the lowest involvement, at 1.5% of the respondents.

The processing of Larvae the MA represents the highest proportion, (37.2%), followed by MCMA (26.8%) FAMA (15.1%) while FC and FCFA (5.1%) represents the least proportion of sampled gender categories involved in the processing of Larvae. In marketing the *Cirina forda*, the highest proportion is done by MA (31.9%), followed by MCMA (21.2%), FAMA (20.9%) while the least is the FC group (5.1%). For *G. pennsylvanicus* harvesting, the result showed that the male group (MA) has the highest proportion of 31.9%, followed by MCMA (21.6%), FAMA (20.4%) while the least gender category participating in the harvesting is FC (5.1%) group. Overall, the male gender plays a major role in harvesting of *G. pennsylvanicus*. The processing and marketing are done by all the groups MCMAFCFA, this representing 69.9% for processing and 79.6% for marketing respectively.

Table 4. Extent of utilization of NTFPs in the study area.

NTFPs	Very High (VH)	High (H)	Moderate (M)	Low (L)	Very Low (VL)	Total No.	WS	WMS
Bush meat	177(885)	110(440)	85(255)	13(26)	7(7)	392	1613	4.11
Borassus fruit	170(850)	130(520)	60(180)	20(40)	12(12)	392	1602	4.08
Borassus hypocotyls	190(950)	100(400)	57(171)	30(60)	15(15)	392	1596	4.07
Honey	185(925)	95(380)	70(210)	37(74)	5(5)	392	1594	4.06
Moringa leaf	193(965)	87(348)	60(180)	35(70)	17(17)	392	1580	4.03
Borassus bark	165(825)	120(480)	70(210)	25(50)	12(12)	392	1577	4.02
G. pennsylvanicus	189(945)	89(356)	64(192)	35(70)	15(15)	392	1578	4.02
Cirina forda	180(900)	90(360)	60(180)	40(80)	22(22)	392	1542	3.93
Moringa seed	150(750)	85(340)	77(231)	60(120)	20(20)	392	1461	3.72

Note: *WS=Weighted scores.
*WMS=Weighted mean score.

3.5. Extent of Contribution of NTFPs in the Study Area

The result in Table 6 shows that, though with varying ranges of contribution of NTFPs, the extent of contribution to food was highest with a mean of 4.5, followed by income (4.0), occupation (3.9) while medicine had the least contribution. Respondents collect various NTFPs such as Bush meat, Borassus hypocotyls, Moringa leaf, and also Borassus hypocotyls as source of food which has the highest mean (4.5). According to the respondents, edible food found in the forest has superior nutritional quality when compared with domesticated varieties. Olawoye [23] opined that rural household spends income realized from NTFPs to buy food to maintain their families. This provides a significant supplement to the economic well-being of the general population in the study area. The respondents identified food as the most significant benefit they derived from Non-Timber Forest Products (NTFPs) in the study area. This is attributed to the value they place on food and the crucial role NTFPs play in meeting their nutritional needs. Notably, the respondents emphasized their reliance on NTFPs as a food source, even as they utilize these products for various other purposes. According to the respondents, income and food are crucial aspects of their lives. They reported that different Non-Timber Forest Products (NTFPs) generate varying levels of income. Specifically, bush meat, Borassus hypocotyls, and Borassus fruits were identified as having greater economic potential than other NTFPs. Furthermore, the majority of respondents revealed that selling NTFPs is a primary source of their cash income.

For medicinal purpose, mankind has depended on NTFPs for medicinal uses. For example, the respondents use Borassus hypocotyls, Moringa seed and also Moringa leaf as medicine. Occupation with, (3.9) also contribute in the lives of the respondents. According to the respondents, they have generated a lot from the use of NTFPs in the study area. The respondents reported that, all the NTFPs is being used for one purpose or the other, that is why they derived benefits using the NTFPs as occupation in the study area.

3.6. Test of Hypothesis

Ho1: There is no significant relationship between respondents socio-economic variables and NTFPs utilization in the study area (Spearman rank correlation).

Table 7 presents the results of the Spearman rank correlation test, examining the relationship between socio-economic variables and NTFPs utilization in the study area. The results show that age had a significant negative correlation ($r = -0.24$, $p = 0.00$) with NTFPs utilization. Household size had a significant positive correlation ($r = 0.11$, $p = 0.04$) with NTFPs utilization. Education status also had a significant positive correlation ($r = 0.02$, $p = 0.00$) with NTFPs utilization. In contrast, income had no significant correlation ($r = 0.01$, $p = 0.92$) with NTFPs utilization.

Table 5a. Gender role in NTFPs utilization in the study area.

NTFPs	Gender role	Frequency	Percentage (%)
Borassus fruit collection	MA	102	26
	FAMA	163	41.6
	MCMAFCFA	127	32.4
Borassus Stemcutting	MA	22	5.6
	FCFA	124	31.6
	FAMA	21	5.4
	MCMAFCFA	225	57.4
Borassus stem marketing	MA	2	0.5
	FCFA	144	36.7
	FAMA	42	10.7
	MCMAFCFA	204	52
Borassus stem construction	MA	2	0.5
	FCFA	164	41.8
	FAMA	21	5.4
	MCMAFCFA	205	52.3
Hypocotyls harvesting	FC	37	9.4

NTFPs	Gender role	Frequency	Percentage (%)
	FA	15	3.8
	MCMA	12	3.1
	FCFA	212	54.1
	FAMA	30	7.7
	MCMAFCFA	86	21.9
Hypocotyls processing	FC	7	1.8
	FCFA	240	61.2
	FAMA	29	7.4
	MCMAFCFA	116	29.6
Hypocotyls marketing	FA	7	1.8
	MCMA	6	1.5
	FCFA	173	44.1
	FAMA	81	20.7
	MCMAFCFA	125	31.9

Note: MA = Male Adult, FAMA = Female adult male adult, MCMAFCFA = Male child male adult female child female adult, FCFA = Female child female adult, FAMA = Female adult male adult, MC = Male child, FA = Female adult, FC = Female child.

Ho2: Male and female respondents do not differ significantly in utilization of NTFPs in the study area. (Mann Whitney Test).

Table 8 presents the results of the Mann-Whitney test, which examined gender differences in NTFPs utilization. The results revealed a significant gender difference (p = 0.00) in NTFPs utilization in the study area, indicating that gender plays a crucial role in shaping NTFPs utilization patterns.

Ho3: Communities do not differ significantly in utilization of NTFPs in the study area (Kruskal-wallis Test).

Table 9 showed the result of Kruskal-wallis test on the difference between communities and extent of NTFPs utilization in the study area. This finding revealed that communities and their extent of NTFPs utilization had no significant (p=0.72) differences with H-value (1.33).

Ho4: Communities do not differ significantly in NTFPs contribution to livelihood (Kruskal-wallis Test).

The result on Kruskal-wallis test on the difference between communities and NTFPs contribution to livelihood is presented in Table 10. This showed no significant difference (p=0.76) with H. value (1.17) between communities and NTFPs contribution to the livelihood of the people in the study area.

Table 5b. Gender role in NTFPs utilization in the study area (Cont'd).

NTFPs	Gender role	Frequency	Percentage (%)
Honey harvesting	MA	146	37.2
	FC	20	5.1
	MCMA	104	26.5
	FCFA	20	5.1
	FAMA	61	15.6
	MCMAFCFA	41	10.5
Honey processing	MA	125	31.9
	FC	20	5.1
	MCMA	83	21.2
	FCFA	20	5.1
	FAMA	82	20.9
	MCMAFCFA	62	15.8
Honey marketing	MA	125	31.9
	FC	20	5.1
	MCMA	83	21.2
	FCFA	20	5.1
	FAMA	82	20.9
	MCMAFCFA	62	15.8
M. Oleifera seed collection	FA	20	5.1
	FCFA	42	10.7
	FAMA	61	15.6

NTFPs	Gender role	Frequency	Percentage (%)
	MCMAFCFA	269	68.6
M. Oleifera seed processing	FA	20	5.1
	FCFA	42	10.7
	FAMA	20	5.1
	MCMAFCFA	310	79.1
M. Oleifera seed selling	MA	56	14.3
	FC	11	2.8
	FA	9	2.3
	MCMA	11	2.8
	FCFA	22	5.6
	FAMA	92	23.5
	MCMAFCFA	191	48.7

Table 5c. Gender role in NTFPs utilization in the study area (Cont'd).

NTFPs	Gender role	Frequency	Percentage (%)
M. Oleifera leaf collection	FA	20	5.1
	FCFA	42	10.7
	FAMA	40	10.2
	MCMAFCFA	290	74
M. Oleifera leaf processing	MA	20	5.1
	FCFA	126	32.1
	FAMA	21	5.4
	MCMAFCFA	225	57.4
M. Oleifera leaf selling	FCFA	145	37
	FAMA	42	10.7
	MCMAFCFA	205	52.3

Table 5d. Gender role in NTFPs utilization in the study area Cont'd.

NTFPs	Gender role	Frequency	Percentage (%)
Bush meat hunting	MCMA	164	41.8
	FCFA	2	0.5
	FAMA	21	5.4
	MCMAFCFA	205	52.3
Bush meat processing	FC	38	9.7
	FA	15	3.8
	MCMA	14	3.6
	FCFA	212	54.1
	FAMA	30	7.7
	MCMAFCFA	83	21.2
Bush meat marketing	FC	7	1.8
	MCMA	2	0.5
	FCFA	240	61.2
	FAMA	29	7.4
	MCMAFCFA	114	29.1

Table 5e. Gender role in NTFPs utilization in the study area (Cont'd).

NTFPs	Gender role	Frequency	Percentage (%)
Cirina forda harvesting	FA	7	1.8
	MCMA	6	1.5
	FCFA	173	44.1
	FAMA	83	21.2
	MCMAFCFA	123	31.4
Cirina forda processing	MA	146	37.2
	FC	20	5.1
	MCMA	105	26.8
	FCFA	20	5.1
	FAMA	59	15.1

NTFPs	Gender role	Frequency	Percentage (%)
	MCMAFCFA	42	10.7
Cirina forda marketing	MA	125	31.9
	FC	20	5.1
	MCMA	83	21.2
	FCFA	20	5.1
	FAMA	82	20.9
	MCMAFCFA	62	15.8
G. Pennsylvanicus harvesting	MA	125	31.9
	FC	20	5.1
	MCMA	83	21.2
	FCFA	20	5.1
	FAMA	80	20.4
	MCMAFCFA	64	16.3
G. Pennsylvanicus processing	FA	20	5.1
	FCFA	40	10.2
	FAMA	61	15.6
	MCMAFCFA	271	69.1
G. Pennsylvanicus marketing	FA	20	5.1
	FCFA	40	10.2
	FAMA	20	5.1
	MCMAFCFA	312	79.6

Table 6. Extent of contribution of NTFPs in the study area.

Extent	Very high	High	Moderate	Low	Very low	No. of response	WS	WMS
Income	125(625)	200(800)	11(33)	56(112)	-	392	1570	4.0
Food	270(1350)	94(376)	8(24)	20(40)	-	392	1790	4.5
Medicine	42(210)	123(492)	186(558)	21(42)	20(20)	392	1322	3.3
Occupation	143(715)	147(588)	62(186)	20(40)	20(20)	392	1549	3.9

Table 7. Relationship between socio-economic variables and utilization of NTFPs.

Test variable	r. value	P. value	Decision
Age vs NTFPs utilization	-0.24	0.00	Sig.
Household size vs utilization	0.11	0.04	Sig.
Educational status vs utilization	0.20	0.00	Sig.
Income	0.01	0.92	Not sig.

Note: Level of significant = 0.05.

Table 8. Mann-Whitney test of gender difference in NTFPs utilization.

Test variable	U. value	P. value
Gender vs. NTFPs utilization	15508.00	0.00

Note: Level of significant = 0.05.

Table 9. Kruskal- Wallis test of difference between communities and extent of NTFPs utilization.

Test variable	H. value	Df	P. value
Communities Vs NTFPs utilization	1.33	3	0.72

Note: Level of significant = 0.05.

Table 10. Kruskal-Wallis test on difference between communities and NTFPs contributions to livelihood.

Test variable	H. value	Df	P. value
Communities Vs NTFPs contribution to livelihood	1.17	3	0.76

Note: Level of significant = 0.05.

4. DISCUSSION

4.1. Socio-Economic Characteristics of the Respondents

The dominance of female over males in the utilization activities of NTFPs in the study area is underscored by Dishan, et al. [24]; Padvi [25] and Ayeni, et al. [26] that women are more adventurous, hardworking and active in the collection, gathering, processing and trading in NTFPs than men. A similar outcome was noted by Opaluwa, et al. [27] in a study involving some rural communities of North-central Nigeria. The high proportion of men's involvement in the utilization of NTFPs indicates that, men are equally engaged in utilization activities of NTFPs in the study area. According to studies by Edeh and Mbam [28] and Suleiman, et al. [29] men are the dominant extractors of NTFPs. These differences could be attributed to value systems, customs, tradition and beliefs in these regions. It is also a common fact that male-headed households and those with large family sizes are more involved in NTFPs collection. In the Nigerian setting men are the major providers and contributors for the needs and primary welfare of the family, hence the need for them to be involved in income generating activities more than the women. The study by Tee [30] reported that men dominated marketing system of *Borassus aethiopum* in Northern Eastern, Nigeria. The dominance of male respondents can be attributed to religious factors, as Muslim women in the area are often restricted to purdah and have limited opportunities for outdoor activities. This finding is consistent with Dau and Elisha [31] who reported that Christian women in Bauchi South Senatorial district, Bauchi State, were more involved in NTFPs collection and utilization compared to their Muslim counterparts.

The high proportion of respondents falling within active ages of 18 to 40 years indicates the capacity and ability of this age group in collection of NTFPs. Suleiman, et al. [29] posited that this could be due to the intensive labour associated with NTFPs' collection. Furthermore, they inferred that collection of NTFPS requires active individuals giving the illegal, time-consuming and tedious nature of extraction. The high proportion of respondent's attainment of secondary school education implies that they are educated and communicate in English. Acquiring relevant skills is crucial in all human endeavors. It is expected that individuals involved in NTFPs production, processing, and marketing possess the ability to adapt to technological advancements, negotiate prices effectively, and access and disseminate market information. Furthermore, they should be able to adapt to advances in marketing strategies [32]. The predominance of married respondents engaged in NTFPs utilization activities suggests a reliance on these activities as a stable means of livelihood to support their families. Married households typically have larger family sizes, which increases their demand for various resources. This finding is consistent with previous studies by Ibrahim, et al. [33] and Demie [34] which also highlighted the importance of NTFPs in supporting the livelihoods of married households. The large household sizes of the respondents suggest a reciprocal relationship between family size and NTFPs utilization activities. The primary occupation of the respondents indicates that their large family sizes both support and are supported by these activities. This finding is consistent with Suleiman, et al. [29] who observed that larger family sizes tend to engage in more extensive extraction of NTFPs, leveraging additional labor to support the collection process. The widespread acceptance and consumption of NTFPs across various ethno-linguistic tribes demonstrate their cultural and religious significance. In the study area, the dominance of Christianity over Islam contributes to the prominent role of women in NTFPs utilization activities, as there are fewer restrictions on their participation. Furthermore, the prevalence of farming in the area indicates that it is the primary occupation, and consequently, a vital source of livelihood. Therefore, economic policies and reforms aimed at improving the economic well-being of these communities should consider the importance of NTFPs. A total of nine Non-Timber Forest Products (NTFPs) were identified in the study area, including *Borassus aethiopum* hypocotyls, Borassus fruit, Borassus bark, Moringa leaf, Moringa seed, *Gnetum pennsylvanicus, Cirina forda*, bush meat, and honey. This array of NTFPs aligns with earlier findings by Tee [30]. The utilization of these products varied across time and location. As noted by Subedi [35] and Akinniyia, et al. [36] the local use and trade of NTFPs, although often underrecognized, constitute a vital component of the subsistence lifestyles and local economies of many communities. In developing countries, particularly in Africa and Asia, Non-Timber Forest Products (NTFPs) play a vital role in subsistence and

income generation [37]. These products provide essential goods, including medicines, food, oils, fibers, and building materials, as well as a source of financial income for numerous individuals and families, often living in poverty. The diverse ethnic groups residing in the study area have traditionally utilized NTFPs in various ways, and this practice continues to the present day. The widespread utilization of Non-Timber Forest Products (NTFPs) in the study area can be attributed to their significant economic value as a source of income for local communities surrounding the forest reserve. Moringa leaf, which exhibited the highest extent of utilization, likely owes its popularity to its rich mineral content and associated health benefits [38]. Moreover, the extensive use of NTFPs may also be linked to their potential to provide sustainable livelihoods, encompassing income generation, food security, and nutritional value [39, 40]. Notably, in Nigeria, rural households derive a substantial proportion of their income, up to 80%, from the sale of NTFPs [41, 42]. A significant relationship exists between the selected socioeconomic variables (age, education status, and household size) and the utilization of Non-Timber Forest Products (NTFPs) in the study area. This indicates that these variables positively influence the extent of NTFPs utilization. Specifically, the utilization of NTFPs increases with the number of people in active ages, higher education levels, and larger household sizes. However, the respondents' income levels do not significantly impact their utilization of NTFPs. Additionally, the findings reveal a significant relationship between gender and NTFPs utilization, with females utilizing these products more than males. These results align with Ogundele, et al. [43] who found that educational status, household size, monthly income, age, and sex determine the variation in forest utilization levels in Akwa Ibom State, Nigeria. The finding that females are primarily engaged in the utilization of Non-Timber Forest Products (NTFPs) contradicts the study by Edeh and Mbam [28] which reported that males utilize NTFPs more frequently due to their daily activities. However, the involvement of various gender groups in harvesting hypocotyls highlights the product's value as a source of food and income. The gathered fruits were sold for income generation and also planted to produce hypocotyls. While fruit harvesting was a shared responsibility across all categories, females were the least involved. The division of labor suggests that adults undertook more strenuous tasks, while children engaged in less demanding activities to enhance productivity and earn income. Honey harvesting, in particular, was primarily done by males, with minimal female involvement. This was attributed to the physically demanding nature of the task, with women being perceived as more fragile and less capable of handling stressful activities. The results indicate that all gender groups collectively participate in production, harvesting, processing, and marketing activities related to Non-Timber Forest Products (NTFPs). While there are no exclusive activities for specific genders, males tend to dominate harvesting, whereas females are more involved in fruit processing and marketing. This suggests a division of labor, with males focusing on harvesting and females on marketing. The finding that communities in the study area do not differ significantly in their utilization of NTFPs may be attributed to the relative scarcity of most NTFPs due to deforestation. However, the growing awareness of their importance and the addition of value have made NTFPs highly marketable [43]. This is consistent with Dau and Elisha [31] who reported that NTFPs play a vital role in the livelihoods of people and forest-dwelling communities in Bauchi South Senatorial district.

5. CONCLUSION

The utilization of Non-Timber Forest Products (NTFPs) in Kwabaktina forest reserve, Adamawa State, Nigeria, was found to be inclusive, with both genders and religions participating without any apparent religious barriers. Christians constituted the majority of NTFP users, with a few long-term residents also utilizing these products. The study revealed that the extent of NTFP utilization did not differ significantly among communities. Most respondents were within the active workforce, possessing the potential to utilize NTFPs positively. However, the majority of respondents belonged to the low-income class. The results showed that age, educational status, and household size had a significant impact on the extent of NTFP utilization. In contrast, income did not significantly influence the level of NTFP utilization. Overall, NTFPs play a vital role in the livelihoods of people across different communities.

6. RECOMMENDATIONS

To promote the sustainable development and utilization of NTFPs in the study area, the following recommendations are made:

1) Stakeholders should prioritize providing financial and technical support for alternative, long-term income-generating ventures, such as planting economic trees on marginal lands. This would encourage forest-edge communities to establish tree plantations, supporting local cottage industries and reducing dependence on existing forests for NTFP extraction and raw materials. This initiative would also help mitigate rural-urban migration driven by unemployment.

2) More awareness should be made about sustainable utilization of some NTFPs as food for their nutritional value and medicinal value especially when Organic food is advocated for among developing nations.

3) Key stakeholders such as the youths and major interest groups involved in the extraction and utilisation of NTFPs should be involved in the planning and implementation utilisation of forest resources. This will ensure effective conservation of NTFPs and relieve pressure on available forest resources.

4) There should be a site-specific evaluation of NTFPs collection and utilisation with an efficient data collection system to accurately establish the importance of NTFPS as a revenue component for the livelihood of the indigenous people.

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