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Women cassava processors' livelihood; implications for improved processing technology usage in Nigeria

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Abstract: The study compared the impact of the use of conventional and improved cassava processing technologies on the livelihood of women processors in north central Nigeria. This study adopts a quantitative method using a well-structured interview schedule for data collection from 410 respondents. Descriptive and inferential statistics such as an independent two-sample t-test was used to analyze the data. The majority of respondents were married and between the ages of 31 and 50. The mean years of education for improved technology users (ITU) were 8 years, while that of conventional technology users (CTU) was 10 years. Majority of both ITU (88.9%) and CTU (63.9%) had more than 10 years of processing experience. Majority of ITU (89.2%) and CTU (97.1%) were educated. A little above average (ITU - 53.7% and CTU - 50.2%) had medium household sizes and average annual income of ITU: N = 528,654 and CTU: N = 294,610. It was found that improved technology users had a very high livelihood status, while conventional technology users had a low livelihood status (ITU 75.25 and CTU 52.50) which indicated that the use of improved technology enhanced women's contribution to family welfare and improved their livelihood. The results of the independent two-sample t-test show that there is a significant difference between the livelihood of improved and

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conventional technology users ($t = -18.614$, $p = 0.000$). The government should therefore focus on the development of appropriate and cost-effective farm-level processing technologies and further encourage the promotion of improved investment heavily in subsidized cassava processing machinery to afford processors to acquire these machines at a reasonable cost.

Subjects: Sociology of the Family; Gender Studies - Soc Sci

Keywords: livelihood; Cassava processing; women processors; improved technologies; conventional technologies

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1. Introduction

Forty-five percent of the world's population, or about 3.1 billion people, reside in rural areas (FAO, 2011). Around 2.5 billion of them rely primarily on agriculture for their survival. Five hundred million peasant women, who do not own any land and only receive 5% of the agricultural resources, make up a percentage of this total. About half of the agricultural workforce is made up of women, who are change-makers and promoters of resilience (FAO, 2011). However, rural women face even larger barriers to accessing necessary productive resources and services, technology, market intelligence, and financial assets than their male counterparts (FAO, 2017).

Rural women are the key to holding families and rural communities together. In agriculture, food security and nutrition, land and natural resource management, and rural enterprises, rural women play a critical role. According to Xiong, Ukanwa, and Anderson (2018), rural Nigerian women are expected to provide for their families' livelihoods in addition to bearing and caring for their children. Many rural families depend on the food, clothing, and education that women give. According to Nagler and Naudé (2014), women often contribute more to family welfare than males do and play a significant role in covering home expenses. In certain circumstances, women made a greater financial contribution to their families' needs and spent less on themselves than did males.

In other instances, the mother's income rather than the father's was more closely tied to the children's dietary needs, medical expenses, and general household food expenditures, while males looked for profits (Mbah & Igbokwe, 2015). This is because, according to Oladeji et al. (2006), women typically prioritize the welfare of their families and only spend money on personal items if the requirements of the family have been addressed. In rural areas, the majority of women are in charge of the family's health, nutrition, and education (Oladeji et al., 2006).

The role of women is vital in the highly labour-intensive processing activities through which they provide for and improve household food security, as well as creating employment in the rural community (Elmasoud, 2001; Kabir et al., 2012). Through increased access to and control over their resources, women's participation in development activities is anticipated to have an impact on their lives in the personal, social, and economic spheres. Attempts to promote sustainable agriculture, rural development, and food security must not disregard or alienate women, who make up more than half of the rural population (Kabir et al., 2012).

In Nigeria, Cassava (Manihot esculenta Crantz) is a significant staple crop that employs over four million farmers and feeds over 100 million people (FAOSTAT 2016) because Nigeria is the world's largest producer of cassava and cassava processing is one of the vital agricultural businesses that provides household income and may serve as a catalyst for reducing poverty in Nigeria

(Ijigbade et al., 2014). Comparing cash crops to other staples, cassava provides most households with cash income (Ijigbade et al., 2014).

Nigerian cassava production, processing, and commercialization are dominated by women (Enete et al., 2002). In Nigeria, women perform the majority of the labour involved in growing and processing cassava (Forsythe et al., 2016). Cassava is therefore considered to be a "women's crop" in some ways (Ijigbade et al., 2014). Cassava is crucial to ensuring food security in the home, which is frequently the responsibility of women. Cassava is a low-risk and low-input crop that is especially important for women because they face more severe barriers to accessing agricultural inputs than males do (Kiriti & Tisdell, 2003).

Due to the crop's poor storageability and the necessity to decrease, if not completely eliminate, the poisonous chemical that renders it unfit for ingestion (cyanide), processing has been a crucial component of cassava utilization (Ehinmowo & Fatuase, 2016). People have developed methods for processing cassava into storable goods including tapioca, starch, fufu, Lafun (cassava flour), high-quality cassava flour (HQCF), and "gari" in areas where it is a major staple food. Utilizing technology to transform cassava tubers into various products necessitates the use of various tools and techniques (Fatuase et al., 2019). The combined small-scale processing represents Nigeria by far largest cassava food product production (Onyenwoke & Simonyan, 2014).

The value adding technologies in cassava processing has enormous potential to increase cassava consumption, diversifying its uses, and utilizing it to improve farm families' livelihoods by creating employment opportunities; micro-agro-enterprises, income generation, and strengthening rural households' economies (Okebiorun & Jatto, 2017).

Although Nigeria has remained the global leader in cassava production, the benefits are far from being optimized by cassava processors and the country in general. Outputs of processed products are very low, and product qualities are highly compromised. This is because cassava processing is mostly done by traditional methods, and the critical mass of processing machines and equipment required are in great lack (B. Achem, 2017).

It is unlikely that cassava processors and business owners will profit from new market prospects until Africa's inadequate manufacturing capacity for cassava processing equipment is increased (Food and Agricultural Organization FAO, 2012). A huge gap still exists as the majority of processors do not have good access to high-capacity equipment such as mechanical graters, motorized sieves, rotary and flash dryers, convenient and low-cost drying facilities, high-quality durable presses, and mechanical peelers. There is therefore a need for improved technologies in the processing of cassava in order to improve the livelihood and living condition of processors and reduce rural poverty as cassava processing has been one of the major income-generating activities of women in Kogi and Kwara states for several years.

The study focuses on the fact that women often make less money than males, but they tend to spend more of it on household food purchases and cater for other pressing household needs. Cassava processors are restrained in how much they can actually contribute to the family. The need to get more out of their cassava processing endeavours necessitates adoption of improved practices and cassava processing technologies, which will in turn result in a better livelihood and living condition.

There are many studies on cassava processing technologies used by processors (Abdoulaye & Sanders, 2002; Abdoulaye et al., 2014; Akinola et al., 2010; Alene et al., 2000; Awoyemi et al., 2020; Bamire et al., 2002; Oluoch-Kosura et al., 2001; Shiferaw & Holden, 1998; Zeller et al., 1998).

Literatures have shown that cassava processing enterprise is profitable and has capacity of improving the livelihood of cassava processors (Awoyemi et al., 2020). Against this background, this study seeks to assess the cassava processing technologies and livelihood of women processors in north central Nigeria.

2. Review of literature and theoretical framework

It is impossible to overstate how important cassava is as a crop for food security and economic growth. It can be said that cassava is a significant root crop in the tropics. For a population of over 500 million people, its starchy roots provide a good source of meal carbohydrates. It is well known that among staple crops, it produces the most carbs (ARC, 2011). The Food and Agricultural Organization of the United Nations (FAO) places cassava behind rice, maize, and wheat as the fourth-ranked most important food crop in developing nations. Over 70 million Nigerians depend heavily on cassava for their nutrition (FAO, 2003). Compared to other staple crops, the starchy roots of cassava produce more food energy per unit of land. Dry cassava roots have a higher concentration of carbohydrates than maize or any other cereal.

Cassava roots and products are in high demand and expanding swiftly. The subpopulation region's population is growing geometrically; nevertheless, the amount of food produced at the moment is hardly enough to meet their needs (Poverty, Oxford, and Human Development Initiative, 2017; and FAO, 2018). According to Moyo (2016), sub-Saharan Africa's (SSA) ability to produce food sustainably has continually been hampered by inadequate management of agricultural areas. According to Mgbenka et al. (2016); and Moyo (2016), the developing agro-allied businesses and industries that depend on cassava as a vital component, however, are raising worries that cassava products for Nigerian families could become much less accessible. Because of the need for food security as well as the growing demand for cassava as a food crop, cassava is becoming more important among the crops farmed in Nigeria (FAO, 2018).

In Nigeria, the traditional way of processing predominates, according to Nwokoro and Aletor (2007). Because traditional processing is labour intensive and economical, women predominately perform it, and it is viewed as unsuitable for women (Odebode, 2003). It is also physically demanding and linked to poor productivity. According to Food and Agricultural Organization (2008), Nigeria was the largest producer of cassava but the smallest exporter of root vegetables. This was ascribed to the fact that many people lacked understanding regarding how to prepare cassava for export (FAO, 2008).

According to the literature, availability of appropriate cassava processing machines and equipment has the tendency to make tremendous impact in increasing the output of processed cassava products as cassava processing especially in Kogi and Kwara states is characterized by traditional method of processing, which is inefficient, time-consuming, labourious, and compromised product quality (Okorji et al., 2003). Lack of improved technologies decreased the outcome of rural processors which limits the production capacity of cassava products. Adoption of improved technologies may have substantial economic effects, including enhancement of the most wearisome aspects of extraction, reduction of the time and labour input required at production, increase in total productivity, and in turn increase the quality of life, income, and food security of women cassava processors household.

The Unified Theory of Acceptance and Use of Technology (UTAUT). The importance of the unified theory of technology acceptance and usage (UTAUT), which the study uses, in the adoption of cassava processors cannot be overstated. This model of technology acceptance was created by Venkatesh, Morris, Davis, and Davis in "User acceptance of information technology towards a unified vision" (2003). This theory expresses users' both the initial intentions to use an information system and the actual utilization. According to the theory, there are four main constructs: (1) performance expectations; (2) effort expectations; (3) social influence; and (4) facilitating circumstances.

The first three are categorized as direct determinants of user behaviour, and the fourth is categorized in the same way. The four main dimensions' effects on usage intention and behaviour are said to be moderated by gender, age, experience among adopters' socioeconomic factors, and voluntariness of use. One of the most important concerns is: What are the user's attitudes about accepting technology? Many educational institutions, including universities, research institutes, and other tertiary institutions, have adopted and implemented this theory to address this issue. Regardless of the level of infrastructure and support services offered, it is important to consider whether teachers and trainers, in the case of cassava processing technologies, were prepared to integrate available technologies to modify the livelihood assets of cassava processors through the adoption of improved cassava processing technologies.

3. Methodology

3.1. Research design and population of the study

The study employed a cross-sectional survey design using a quantitative research method for data collection; this research was conducted in two major states in north central Nigeria: Kogi and Kwara states. Nigeria is made up of six geopolitical zones, one of which is north central. The region has a population of about 20 million people, around 11% of the total population of the country (National Bureau of Statistics, 2021). The region also houses major cities, including the federal capital of the country. However, the two states were selected for the study due to population size and cassava processing activities that are prevalent in the states. Kogi state, for instance, is one of the largest producers of cassava in Nigeria (International Institute of Tropical Agriculture, 2005). Kwara state has also been identified as one of the major cassava producing states in the country. The choice of this study in these two cities is also premised on the fact that these two states were beneficiaries of cassava processing interventions, such as cassava multiplication programme and Root and Tuber Expansion Programme (RTEP). This study focuses on female cassava processors in the two states that are beneficiaries and non-beneficiaries of cassava processing interventions.

3.2. Sampling procedure and sample size

The Sample Frame of the study includes all members of female cassava processors groups. This is made up of over 1000 female processors in the study area. The survey participants were chosen to use a multi-stage sampling method, a variant of the probability sampling method, to identify and select the study participants as presented on table 1. The first stage involved the purposive selection of Kogi and Kwara. The second stage also involved the purposive selection of two Agricultural Development Programme (ADP) zones from each state. Due to the concentration of cassava processors in these two ADP zones, only two of the four ADP zones in the two states were purposively chosen for the initial stage: Zone A (Aiyetoro-Gbede) and B (Anyingba) in Kogi state, and Zone C (Igbaja) and D (Malete) in Kwara state. This is because these zones were the areas selected by the Root and Tuber Expansion Programme which have been seats of intervention programmes over the years. Also, these areas were selected because of the high rate of cassava processing activities in the area.

A list of cassava processors who have adopted and are using improved technologies based on cassava processing interventions over the years was obtained from the State Agricultural Development Programme (ADP) headquarters in each state. The third stage involved a random selection of 35% of the members of all the registered improved technology and unimproved technology users' groups in the two states from the list provided. This is to allow for comparison between improved and conventional technology users and to ascertain the possible impact of the use of these technologies. This gives a total sample size of 410 that was used for the study.

This study adopts a quantitative method for data collection. Therefore, the research instrument used was a structured interview schedule to elicit information on their socio-demographic characteristics and the implication of cassava processing technology usage on their livelihood. The data were analysed using frequency distribution tables, cross tabulation, and t-test. All the ethical guidelines of anonymity, voluntariness, and malfeasance were strictly adhered to in this study as

Table 1. Gives the detail of the procedure used for the proportionate allocation of the respondents for the study

State	Zone	Groups	Processing Membership	Proportionate Sample size (Improved)	Control group (Conventional)
Kogi	A (Aiyetoro-Gbede)	8	115	40	40
	B (Anyigba)	10	155	54	54
	Total	**18**	**270**	**94**	**94**
Kwara	C (Igbaja)	12	195	68	68
	D (Malete)	10	123	43	43
	Total	**22**	**318**	**111**	**111**
	Total			**205**	**205**

Source: Own computation, 2022.

Table 2. Distribution of respondents by socio-economic characteristics

Socio-economic Characteristics	Improved		Conventional	
	F	%	F	%
Age				
<30	5	2.4	39	19.0
31–40	63	30.7	70	34.1
41–50	102	49.8	56	27.3
51–60	33	16.1	40	19.5
>60	2	1.0	0	0
Mean	44.45		41.26	
Marital Status				
Single	0	0	6	2.9
Married	163	79.5	162	79.0
Single Parent	9	4.4	14	6.8
Widowed	33	16.1	17	8.3
Divorced	0	0	6	2.9
Educational Level				
No Formal Education	22	10.7	6	2.9
Primary	90	43.9	61	29.8
Secondary	62	30.2	91	44.4
Tertiary	31	15.1	47	22.9
Mean	8		10.33	
Household Size				
≤3	12	5.8	13	6.3
4–6	110	53.7	103	50.2
≥6	83	40.5	89	43.4
Mean	6		6	
Processing Experience				
≤5	0	0	9	4.4
6–10	23	11.1	65	31.7
11–15	85	41.5	60	29.3
16–20	69	33.7	49	23.9
>20	28	13.7	22	10.7
Mean	17		14	
Average Annual income from Cassava Processing				
<100,000	0	0	12	5.9
100,000–300,000	19	9.3	125	61.0
300,001–500,000	79	38.5	59	28.8
500,001–700,000	89	43.4	9	4.4
700,001–900,000	17	8.3	0	0
900,001–1,100,000	1	0.5	0	0
Mean	N528,654		N294,610	
S.D	N139,485		N260,000	

Source: Field Survey, 2022.

respondents were duly informed of the purpose of the study and had the opportunity to either be part of the study or otherwise.

4. Results and discussion

Table 2 reveals that the majority of the respondents were between 31 and 50 years of age. In the case of improved technology users, the age of selected female cassava processors ranges from 28 to 70 years, having an average age of 44 and a standard deviation of 7 years, respectively. Majority of the respondents (80.5%) were in the age range of 31–50 years, 17.1% of the respondents are above 50 years of age, and only 2.4% of the respondents are below 30 years of age.

In the case of conventional technology users, the age of selected female cassava processor ranges from 22 to 60 years with a mean age of 41 and a standard deviation of 10, respectively. Majority of the respondents (61.4%) were in the age range of 31–50 years, 19.5% of the respondents are above 50 years of age, and 19% of the respondents are below 30 years of age.

This suggests that the bulk of respondents was in their prime earning years. The results reveal that most of the female cassava processors in the study area are young, active, and agile. Most of the activities in cassava processing are labour intensive, which may help to explain why the bulk of the group was of middle age. During this time, women typically have greater needs for welfare, and their expanding children's needs may also necessitate more need for funding.

The outcome is congruent with Onyemauwa's findings (2019), Asadu et al. (2014), as well as Olajide and Oyebode (2015), where they stated that majority of the cassava processors are in their middle and economically active age of life and therefore have the ability to carry out their processing activity effectively and improve their livelihood as well as that of their household.

The results from Table 2 also reveal that most of the women who responded to the poll were married and had husbands as household members. In the case of improved technology users, the majority of the respondents (79.5%) were married, while 16.1% are widowed and 4.4% are single parents. In the case of conventional technology users, majority of the respondents (79%) were married, 2.9% were single, 6.8% were single parents, 8.3% were widowed, and 2.9% were divorced.

According to the study, all the respondents were female and had families, which suggests financial responsibility. These women tried to improve their current socioeconomic situation by starting a cassava processing business. The amount of involvement in one or more income-generating activities ultimately rises in households where women are the primary breadwinner due to the constant pressure on their meagre resources to maintain the household (Ansoglenang, 2006).

The results of this study are in conformity with Matanmi et al. (2017) as well as B. A. Achem et al. (2013) assertion that married processors with families and financial obligations handle the majority of cassava processing activity.

Results in Table 2 also present the educational level of female cassava processors. Rural women's education levels ranged from no education to 20 years of formal education. Five categories were utilized to characterize education based on education scores: no formal education (0), primary (1–6), secondary (7–12), and tertiary (>12). The mean year of education for users of improved technology is 8 years, while that of users of conventional technology is 10 years.

In the case of users of improved technology, 10.7% of the interviewees had no formal education, followed by primary education (43.9%), secondary education (30.2%), and tertiary education (15.1%). Majority of the respondents (89.2%) had one level of education or the other. Similarly, in the case of users of conventional technology, the result shows that 2.9% of the respondents had no formal education, 29.8% had primary education, 44.4% had secondary education, and 22.9% had post-secondary/tertiary education. This implies that majority of the respondents (97.1%) were educated, while only 2.9% had no formal education. The respondents therefore have a chance to understand the accruing benefits relating to their occupation as a means of livelihood and this would assist their information seeking behaviour and adoption of improved practices in cassava processing. This result disagrees with the findings of Matanmi et al. (2017) where they stated that the majority of cassava processors lack formal education.

Table 2 displays the distribution of rural women processors by the size of their families. The rural female cassava processors had somewhere between 2 and 12 members. The female cassava processors were split into three main categories based on the size of their families: small (up to three), medium (four to six), and large (six or more).

For users of improved technology, the household size of selected female cassava processors ranges from 3 to 12 persons, averaging six people, with a two-person standard deviation.

4.1. 53.7% of rural women had medium-sized families, 5.8% had small families, and the remaining 40.7% had large families

In the case of non-improved technology users, the household size of the chosen female cassava processors spans from 2 to 12 people, with an average and standard deviation of 6 and 2 people, respectively. The majority of rural women (50.2%) had a medium-sized family, followed by 6.3% who had a tiny family and 43.4% who had a large family.

The results of this study therefore imply that, since a large proportion of the respondents had between medium and large household sizes, they may have the opportunity to use members of their households as a source of labour, thereby reducing labour costs and increasing working capacity.

The respondents' relatively large family sizes may also act as a form of insurance against a labour supply shortage. In the agricultural sector, family labour provision is greatly influenced by household size.

This is in line with Sule et al. (2015) who stated that a large proportion of farmers have large household sizes. The study is also in line with Olusegun, Obi-Egbedi, and Adeniran (2015) and Asadu et al. (2014) who claimed that the average number of people in a farming household for cassava producers was around 7.

Years of processing experience entail the total number of years a person had spent on the occupation. Years of cassava processing experience are therefore a total number of the years the cassava processors had spent in processing cassava into *garri* (cassava flakes) and other products. The higher the farming experience, the more the knowledge and technological ideas of adopting new technologies and all things being equal, the higher would be his output and income.

Results presented in Table 2 show that the majority of the respondents were experienced cassava processors having processing experience ranging from more than 5 years. The minimum years of processing experience were 3 years and the maximum years were 40 years. Users of improved technologies had average years of processing experience of 17 years with standard deviation of 6 years. 11.1% of the respondents have 6–10 years processing experience, 41.5% have 11–15 years processing experience, 33.7% had 16–20 years of processing experience, and 13.7% of the respondents have more than 20 years processing experience. This implies that the majority of the respondents who used improved technologies (88.9%) had more than 10 years of processing experience, while just 11.1% have processing experience of between 6 and 10 years.

In the case of users of conventional technology, the mean years of experience are 14 years with a standard deviation of 7 years. 31.7% of the respondents had 6–10 years of processing experience, 29.3% of the respondents had 11–15 years of processing experience, 23.9% had 16–20 years of processing experience, 10.7% had greater than 20 years of processing experience, while 4.4% have less than or equal to 5 years of processing experience.

The results of this survey imply that both users of improved and conventional technologies were experienced processors with average years of processing experience of 14 or more. This is in agreement with the findings of Onyemauwa (2019) who reported that majority of cassava processors had 11–20 years of cassava processing experience.

Ahmed (2009); Ahmed et al. (2007) and Al-Amin (2008) were of the opinion that only until the rural poor earn better money from their economic activity will their living standards improve. Table 2 reveals that improved technology users' annual income from cassava processing ranges from N200,000 to N940,000 with a mean and standard deviation of N528,654 and N139,484, respectively. A little above average of improved technology users (52.2%) had average annual income of between N500,000 and N1,100,000 from cassava processing, 38.5% had average annual income of between 300,001 and 500,000, and 9.3% had average annual income of between N100,000 and N300,000 from cassava processing. However, in the case of conventional technology users, annual income from cassava processing ranges between N80,000 and N700,000 with a mean and standard deviation of N294,610 and N121,618. Majority (61%) claim to make between N100,000 and N300,000 annually, 28.8% earned between N300,001 and N500,000 annually, 4.4% claimed generating average annual income of between N500,001 and N700,000, while 5.9% earned less than N100,000 annually.

The finding implies that users of improved technology users earned more with a mean of N528,654 when compared to that of Conventional technology N294,610. The results are consistent with those of Koloche et al. (2016) who reported that beneficiaries of improved technologies had net returns in their processing business, all things being equal to others who did not benefit from improved packages.

Table 3. Distribution of respondents by number of eating occasions within a 24-hour period

S/n	Eating Occasion	Improved		Conventional	
		Yes	No	Yes	No
1.	Any food before a morning meal	68 (33.2%)	137 (66.8%)	10 (4.9%)	195 (95.1%)
2.	A morning meal	205 (100%)	0	202 (98.5%)	3 (1.5%)
3.	Any food between morning and Afternoon meals	73 (35.6%)	132 (64.4%)	57 (27.8%)	148 (72.2%)
4.	An afternoon meal	205 (100%)	0	200 (97.6%)	5 (2.4%)
5.	Any food between afternoon and evening meals	76 (37.1%)	129 (62.9%)	12 (5.8%)	193 (94.1%)
6.	An evening meal	205 (100%)	0	202 (98.5%)	3 (1.5%)
7.	Any food after the evening meal	39 (19%)	166 (81%)	6 (2.9%)	199 (97.1%)

Source: Field Survey, 2022

4.2. The implication of the use of cassava processing technologies on the livelihood of processors
The effect of the use of cassava processing technology on livelihood of women cassava processors is presented in this section. This was measured based on three indications of food availability and consumption situation.

4.2.1. Food availability and consumption situation
People consume food as a necessity for survival in order to preserve their health and regain their vitality. This section is intended to talk about eating habits of respondents. It discussed food frequency, the food items consumed by cassava processors and their households over a 24-hour period, as well as the availability of food throughout the year. As used by Hies (2005) and as a pre-test result, 13 food items were chosen as consumed by rural women who processed cassava. The percentage of rural women who consumed each food item during the 24 hours before the data collection period was collected and presented in the results below.

4.2.2. Number of eating occasion of cassava processors
Table 3 presents the results of a number of eating occasions of respondents. In the case of beneficiaries of improved technology, majority of the respondents (66.8%) do not eat any meal before a morning meal, while only 33.2% eat food before a morning meal. All respondents (100%) ate a morning meal, 35.6% of the respondents ate a meal between the morning and the afternoon meal. This is especially common among families with younger children and children of school age who take school lunches and snacks to school. 64.4% of the respondents do not eat any meal between a morning and an afternoon meal. All respondents (100%) ate an afternoon meal. 37.1% of the respondents ate a meal between an afternoon and an evening meal, while majority of the respondents (62.9%) did not eat any meal between an afternoon and an evening meal. All the respondents (100%) ate an evening meal. The majority of the respondents (81%) did not eat any meal after an evening meal, while only 19% of the respondents ate a meal after an evening meal. This result implies that majority of the respondents ate three meals per day and some in fact ate between meals, which indicates a good number of eating occasions that possibly was made possibly by the use of improved technology.

In the case of conventional technology users, 95.1% of the respondents do not eat any meal before a morning meal, only 4.9% of conventional technology users ate a meal before a morning meal. 98.5% of the respondents ate a morning meal, 1.5% did not eat a morning. 27.8% of the respondents ate a meal between a morning and an afternoon meal, while 72.2% did not eat a meal between a morning and an afternoon meal. 97.6% of the respondents ate an afternoon meal, while only 2.4% did not eat an afternoon meal. 5.8% of the respondents ate a meal between an afternoon and an evening meal, while majority of the respondents (94.1%) did not eat any meal between and afternoon and evening meal. Majority of the respondents (98.5%) ate an evening meal, while only 1.5% did not eat an evening meal. Majority of the respondents 97.1% did not eat any meal after evening meal, while only 2.9% of the respondents ate a meal after an evening meal. This result implies that majority of Conventional technology users also ate 3 meals a day and a number of respondents even ate between meals. This implies that improved technology users ate three meals more frequently when compared to users of conventional technology and this could possibly be linked to the use of improved technology.

4.2.3. Distribution of respondents by daily pattern of food items consumed
Following Hies's (2005) report and the pre-test results, 13 food items were chosen. The percentage of cassava processors who consumed each of the itemized food items during the 24 hours before the data collection period was recorded and is shown in Table 4.

In the case of beneficiaries of improved technology, 99.5% of the respondents consume cereals as staple food. 93.7% also consume root and tubers within the last 24 hours to this study. Majority of the respondents (86.8%) also consumed legumes. It is remarkable that only 45.4% and 32.2% of

Table 4. Distribution of respondents by daily pattern of food items consumed

S/n	Food Items Consumed	Improved		Conventional	
		Yes	No	Yes	No
1.	Cereals (Rice, Maize, wheat)	204 (99.5%)	1 (0.5%)	196 (95.6%)	9 (4.4%)
2.	Root and tubers (Yam, Sweet Potatoes)	192 (93.7%)	13 (6.3%)	24 (11.7%)	181 (88.3%)
3.	Legumes (Beans, peas)	178 (86.8%)	27 (13.2%)	159 (77.6%)	46 (22.4%)
4.	Milk/Milk Products	93 (45.4%)	112 (54.6%)	33 (16.1%)	172 (83.9%)
5.	Eggs	66 (32.2%)	139 (67.8%)	24 (11.7%)	181 (88.3%)
6.	Fish (Fresh fish, Dry fish)	158 (77.1%)	47 (22.9%)	61 (29.8%)	144 (70.2%)
7.	Meat (Poultry, Beef)	104 (50.7%)	101 (49.3%)	122 (59.5%)	83 (40.5%)
8.	Oil and Fat	186 (90.7%)	19 (9.3%)	175 (85.4%)	30 (14.8%)
9.	Green Leafy Vegetable	182 (88.8%)	23 (11.2%)	113 (55.1%)	92 (44.9%)
10.	Other Vegetable (Carrot, Tomatoes)	158 (77.1%)	47 (22.9%)	61 (29.8%)	144 (70.2%)
11.	Fruits(Mango, Banana)	161 (78.5%)	44 (21.5%)	58(29.3%)	147 (71.7%)
12.	Sugar/Honey	144 (70.2%)	61 (29.8%)	113(55.1%)	92 (44.9%)
13.	Beverages(Tea, Coffea, Chocolate drink)	105 (51.2%)	100(48.8%)	91(44.4%)	114 (55.6%)
14.	Others (Spices, Soda)	67 (32.7%)	138 (67.3%)	61(29.8%)	144 (70.2%)

Source: Field Survey, 2022.

the respondents consumed milk and egg, respectively. However, majority of the respondents 77.1%, and 50.7% consumed fish and meat, respectively, this covers as source of protein in the diet. 90.7% of the respondents reported that they consumed oil and fat. Women who worked as cassava processors in the study region ate a lot of vegetables (88.8% and 77.1%). A large proportion of the respondents (78.5%) ate fruits. Majority of the respondents (70.2%, 51.2%) also consumed sugar and beverages. Also, only a small proportion (32.7%) of the respondents consumed spices, soda, and other food additives. This result implies that women cassava processors who use improved technology eat healthy, the pattern of food consumption demonstrates without a doubt that improved technology users had a balanced diet, which could be attributed to the use of improved processing machines in the study area.

In the case of conventional technology users, 95.6% of the respondents ate cereal as staple, while only 11.7% ate root and tubers. Majority of the respondents (77.6%) also ate legumes. Only 16.1%, 11.7%, and 29.8% of the respondents consumed milk and milk products, eggs, and fish, respectively.

However, majority of the respondents 59.5% consumed meat, and this serves as a source of protein in the diet. 85.4% of the respondents reported they consumed fat and oils. A considerable number of Conventional technology users (55.1%) reported they consumed green leafy vegetables, while only 29.8% consumed other forms of vegetables. A considerable number of respondents

Table 5. Distribution of respondents by food availability (conventional technology users)

Month	Food Availability							
	Adequate		Inadequate		Shortage			
	F	%	F	%	F	%	Mean	Rank
January	123	60	50	24.4	32	15.6	2.44	6
February	126	61.5	43	21	36	17.6	2.43	7
March	80	39	71	34.6	54	26.3	2.14	9
April	21	10.2	141	68.8	43	21	1.90	11
May	24	11.7	136	66.3	45	22	1.89	12
June	60	29.3	113	55.1	32	15.6	2.13	10
July	84	41	97	47.3	24	11.7	2.29	8
August	134	65.4	60	29.3	11	5.4	2.60	5
September	182	88.8	20	9.8	3	1.5	2.87	1
October	176	85.9	25	12.2	4	2	2.84	2
November	160	78	39	19	6	2.9	2.75	3
December	135	65.9	59	28.8	11	5.4	2.61	4

Source: Field Survey, 2022.

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Table 6. Distribution of Respondents by Food Availability (Conventional technology Users)

Month	Food Availability							
	Adequate		Inadequate		Shortage			
	F	%	F	%	F	%	Mean	Rank
January	34	16.6	127	62.0	44	21.5	1.95	11
February	51	24.9	112	54.6	42	20.5	2.04	8
March	54	26.3	46	22.4	105	51.2	1.04	12
April	115	56.1	53	25.9	37	18	2.18	7
May	89	43.4	93	45.4	23	11.2	2.32	6
June	121	59.0	81	39.5	3	1.5	2.58	5
July	163	79.5	42	20.5	0	0	2.80	3
August	181	88.3	19	9.3	5	2.4	2.86	1
September	176	85.9	21	10.2	8	3.9	2.82	2
October	155	75.6	45	22	5	2.4	2.73	4
November	56	27.3	94	45.9	55	26.8	2.00	9
December	29	14.1	107	52.2	69	33.7	2.00	9

Source: Field Survey, 2022.

(55.1% and 44.4%) consumed sugar and beverages. Also, only a small proportion (29.8%) of the respondents consumed spices, soda, and other food additives.

This result implies that improved technology users' dietary diversification was good, and they consumed a well-balanced meal when compared to users of Conventional technology. In the case of conventional technology users, there was a general lack of nutritional diversity, and the diet is heavily reliant on carbohydrates with insufficient amounts of protein and minerals. Users of outdated technologies have dangerously unbalanced diets due to insufficient intake of fat, oil, fish, fruits, and vegetables. This implies that improved technology has really impacted the dietary intake and consumption situation of beneficiaries of improved technology and had afforded them a better livelihood.

4.2.4. Distribution of respondents by food availability

Tables 5,6 presents the results of food availability in cassava processors. In the case of Improved technology users, Table 5 reveals that there was adequate food from January to February, as indicated by the majority of the respondents with proportions 60% and 61.5%, respectively. Also, there was adequate food from August to December as shown by the respondents in the proportion of 65.4%, 88.8%, 85.9%, 78%, and 65.9%, respectively. However, using mean score and ranking order, the food availability was highest from September to December ($\bar{x} = 2.87$, 2.84, 2.75, and 2.61) and considered adequate for a majority of respondents. Findings from Table 5 shows that there was low food availability between the months of April ($\bar{x} = 1.90$) and May ($\bar{x} = 1.89$) and were considered periods of food inadequacy. The results indicated that there was low food availability only for April and May as indicated by the majority (68.8%, 66.3%) of the respondents. This therefore implies that in a whole year, for 10 months, there was availability of food for the respondents indicating that improved technology has positively affected the food security of its users. A two-month food shortage might be a lean period for respondents in the study area. The findings further imply that the manifestation of improved technological impacts has enhanced their livelihood capabilities in the study area. This results is in congruent with that of Koloche et al. (2016) who reported that intervention programmes enhanced livelihood of beneficiaries of these programmes.

In the case of conventional technology users, Table 6 shows that there was inadequate food from January to February as indicated by the majority (62.0% and 54.6%), the result also revealed that there was shortage of food in March as indicated by a large proportion of the respondents (51.2%). The result also revealed that there was adequate food from April to November and indicated by the majority (56.1%, 85.8%, 59.0%, 79.5%, 88.3%, 85.9%, 75.6%, and 73.2%). December was also recorded as a period of food inadequacy by about half of the respondents (52.2%). However, using mean score and ranking order, the food availability was highest from July to October ($\bar{x} = 2.80$, 2.86, 2.82, and 2.73) and considered adequate for the majority of the respondents. Findings from Table 6 also showed that there was low food availability between the months of January($\bar{x} = 1.95$) and March (= 1.04) and were considered periods of food inadequacy. This therefore implies that in a whole year, for 8 months, there was availability of food for the respondents, and there was shortage of food for 4 months.

Table 7. Distribution of respondents by the cumulative percentage scores

	IMPROVED	CONVENTIONAL
Livelihood Indicators	**Cumulative Percentage Score (CPS)**	**Cumulative Percentage Score (CPS)**
Food Availability and Consumption Situation	75.25	52.50

Source: Field Survey, 2022

This implies that beneficiaries of improved technology are more food secured when compared to their non-beneficiary counterparts. This result agrees with that of Ekwe et al. (2017) whose involvement in cassava processing improved processors' food provision status.

4.2.5. Distribution of respondents by the cumulative percentage scores

The state of indicator of livelihood based on cumulative percentage scores in the study area has been shown in Table 7. Cassava processors are divided into five groups based on their overall livelihood status score: very low (43–48), low (49–54), medium (55–60), high (61–66), and very high (67–73). The cumulative livelihood status of Improved technology users was computed to be **75.25** which indicated a very high livelihood status, while the cumulative livelihood status of conventional technology users was computed to be **52.50** which indicated a low livelihood status.

This implies that improved technology users had a very high livelihood status and are better when compared to xonventional technology users. It can therefore be said that the livelihood status of beneficiaries of improved technology has improved as a result of the use of improved technology.

This is in agreement with the findings of Adeleye et al. (2020) that the processing technology improved the livelihood of cassava processors. This means that using cassava processing techniques boosted their production, which in turn increased their farm income and, as a result, the livelihood of processors. Also, this result is in congruent with that of Yidana et al. (2013) that cassava processing is profitable and contributes significantly to the standard of living of women cassava processors in terms of income generation and family food security.

4.2.6. Result of independent two-sample t-test between improved and Conventional technology users

The result of independent sample t-test in Table 8 shows that the livelihood of improved technology users and conventional technology users was significantly different ($t = -18.614$, $p = 0.000$). Since $p < 0.005$, then there is a statistically significant difference between the livelihood status of improved and conventional technology users. Hence, the null hypothesis is rejected, and the alternative hypothesis is accepted.

This result indicates that improved technology users exhibit a better livelihood outcome than conventional technology users. Therefore, it could be said that the use of improved technologies has really impacted the livelihood of its beneficiaries in the study area. This result is in line with Oladipo (2012) who found significant differences in the productivity of NACB small-holder credit facility beneficiaries and non-beneficiaries in Osun state, Nigeria.

4.2.7. Regression analysis on the relationship between selected socio-economic characteristics and livelihood of women processors

The results in Table 9 reveal that the relationship between female cassava processors socio-economic characteristics and their livelihood with an R^2 value of 0.850. This implies that the variables accounted for 85% of the observed variations in determining the livelihood of female cassava processors in the study area. Table 9 reveals that there were positive and significant relationships between cassava processors' level of education ($\beta = 0.190$, $P = 0.000$), years of experience in cassava processing ($\beta = 0.106$, $P = 0.000$) and income from cassava processing ($\beta = 0.260$, $P = 0.000$) and a negative and significant relationship between age ($\beta = -0.034$, $P = 0.011$) and the food availability and consumption situation of respondents of this study. This result implies that these factors were factors influencing cassava processor livelihood in the study area. The coefficient of age was significant at 5% and relates negatively with the livelihood of cassava processors. The negative and significant relationships between the age of the processors and their livelihood implies that as cassava processors grow older, the contribution of cassava processing to the processors' livelihood reduces, this could be because cassava processing is a strenuous job. The positive and significant relationships between educational level, years of experience in cassava

Table 8. Result of independent two-sample t-test between improved and conventional technology users

Independent Sample Test

		Levene's test for equality of variances			t-test for equality of means		
		F	**Sig.**	**t**	**Df**	**Sig. (2-tailed)**	**Mean difference**
Livelihood	Equal variances assumed	.898	.344	−18.614	408	.000	−10.16101
	Equal variances not assumed			−18.614	399.334	.000	−10.16101

Source: Field Survey, 2022.

processing and income of cassava processors, and their livelihood are all at 1% significant level. This result implies that these independent variables play a significant role in women cassava processors' livelihood. This implies that the more educated female cassava processors are the better their livelihood could be as they could be more attuned to information seeking and receptive to adoption of improved cassava processing technologies. Also, the more experienced a cassava processor is, the better they become at cassava processing which could in turn better their livelihood. Third, the more the income, the more financial capacity cassava processors will have not only to allocate to family welfare but also for expansion of the cassava processing business.

5. Discussion of findings

Adeleye et al. (2020) assessed cassava processing techniques on the Livelihood of Agro-Forestry Farmers in Edo state, Nigeria. According to the study, 0.8% improved their output with less than 50 kg, 33.6% increased between 50 kg and 100 kg, and 46.4% increased between 100 kg and 200 kg. This means that if improved technologies were applied in the processing of cassava, they could boost production. In this study also, all farmers, without exception, stated that the processing technology improved their livelihood. This means that using cassava processing techniques boosted their production, which in turn increased their farm income and, as a result, the livelihood of processors.

Ekwe et al. (2017) conducted research on "small-scale processors' involvement in cassava postharvest and families' food provision in Imo state, Nigeria." The distribution of respondents based on the status of household food provision gained from cassava post-harvest technologies, rated on a 5-point Likert-type scale, shows that respondents recorded a moderate level (3.31) of household food provision from their involvement in cassava post-harvest activities. Again, the results suggest that respondents have yet to leverage the benefits of the various cassava post-harvest activities available, which may be the cause of the area's persistent hunger. Further findings in the study show a relationship between respondents' cassava postharvest livelihood activities and household food provision status, with probit analysis revealing a significant positive relationship between household food provision status and cassava postharvest activities, such as processing/marketing fufu (2.967) and processing/marketing flour (2.413). This means that as respondents' households were more active in the processing and sale of cassava fufu and flour, their food provision status improved.

The findings of this study show that users of improved technologies exhibited better livelihood when compared to their unimproved technology user counterparts, this implies that; the use of improved

Table 9. Results of regression analysis showing the relationship between respondents' socio-economic characteristics and their livelihood

Variables	Beta	t-value	P-value
Constant	8.570	16.320	0.000***
Age	−0.034	−2.570	0.011**
Education	0.190	8.700	0.000***
Household size	0.051	−1.420	0.158^{NS}
Experience	0.106	8.550	0.000***
Income	0.260	4.303	0.000***
R^2	0.850		
R^{-2}	0.840		
F	81.27***		

Source: Field Survey, 2022

Note: ***Significant at 1%, **Significant at 5%, *Significant at 10%, NS Not Significant technology has significant effect on their food availability and consumption situation in the area of number of eating occasions, daily pattern of food item consumed, and spatial distribution of food availability throughout the year. This finding resonates with Yidana et al. (2013) who positioned that cassava processing is profitable and contributes significantly to the standard of living of women cassava processors in terms of income generation and family food security.

Ngong, Lengha, and Tankou in 2020 conducted research on "Impact of technology on improving cassava yield and value". Based on the findings of this study, the study concludes that a significant increase in yield was recorded with the use of improved technologies by many farmers, which in turn increased their income and better their livelihood.

In their study on "Profitability and Value Addition in Cassava Processing in Buton District of Southeast Sulawesi Province, Indonesia", Saediman, Amini, Basiru and Nafiu (2015) reported that cassava processing is profitable and a significant value adding process and hence has high potential for the attainment of food security and income and employment generation. They pointed out that the level of profitability and value added is higher for processors using mechanized greater than those using manual one because the former can reduce processing costs, process higher volume of raw materials, and produce more output with greater efficiency. As cassava forms a major part of the household diet and livelihood strategy of most households in the selected villages, interventions targeted at improving the cassava processing sector especially through the introduction and use of improved cassava processing technologies are likely to have a large impact on the villagers.

In their study on "Adding value through the mechanization of postharvest cassava processing, and its impact on household poverty in north-eastern Zambia", Abass et al. (2017) reported that households who are users of mechanized post-harvest processing technologies experience lower levels of poverty compared to processors who do not use mechanized processing technologies. The authors discussed further that this is because the use of mechanized technologies enabled processing of larger amount of fresh cassava roots leading to productivity and income improvements.

The study concludes that the introduction of mechanized technologies for processing cassava has improved employment levels and income earning opportunities within rural areas in which the production and processing of cassava takes place. This has, in turn, resulted in improved livelihoods and led to a reduction in poverty levels in such areas.

6. Conclusion and recommendations

Based on the major findings of this study, it could be concluded that majority of the female cassava processors were married, in their middle, between the active age range of 31–50 years and had large family sizes. Both improved and conventional technology users were educated and had long years of experience in cassava processing. However, it could also be concluded based on the findings of the study that improved technology users earned more income than conventional technology users from cassava processing activities.

Secondly, improved technology users ate three meals more frequently when compared to users of conventional technology. Also, improved technology users eat a well-balanced meal, while conventional technology users' meal lack nutritional diversity and are dangerously unbalanced. Beneficiaries of improved technologies were more food secured when compared to their non-beneficiary counterparts. The use of improved technology had a considerable influence on the livelihood status of users of these technologies, most especially in the areas of food availability and consumption. There was also a significant difference between the livelihood of improved technology users compared to their conventional technology user counterpart. The use of improved technology enhanced productivity in terms of income and livelihood conditions of female cassava processors in the study area.

The study therefore recommended that Government should focus on the development of appropriate and cost-effective farm-level processing technologies; this will significantly contribute to the amelioration of the livelihoods of all cassava processors. Government and other players in the agricultural sector and cassava processing subsector should invest heavily in subsidized cassava processing machinery to promote processing option diversity in the downstream industry. In addition to raising the standard of living for rural processors, the provision of essential infrastructures like electricity, water, accessible roads, and filling stations will also encourage cassava processors to purchase diesel and electricity-powered equipment. Cassava processors through extension agents in the Agricultural Development programmes should be encouraged to form groups to enable them put their resources together to acquire processing machine that can be used and maintained by group members.

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