

Research article

PERCEPTIONS OF MMOPANE COMMUNITY ON EDIBLE INDIGENOUS HERBS

A CASE STUDY OF MMOPANE VILLAGE KWENENG DISTRICT (BOTSWANA)

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ABSTRACT

Edible indigenous herbs are usually used by many communities in Africa. Harvesting of those has not been controlled especially in rural areas. Some of the indigenous edible herbs have disappeared for example *Senecioabruptus*, *Pteroniaglauca*, *Cucumelicinerea* (Setshogo, 2005). The purpose of this study was to establish perceptions of Mmopane Community on edible indigenous herbs. The study serves to gather information on whether Mmopane community appreciates the economic value and usefulness of indigenous edible herbs. The study also established whether there was variation in the populations or extinction of edible indigenous herbs over the past decade. The sample population comprised eighty residents from Mmopane village in Kweneng District, selected using simple random sampling procedure from the four wards.

The study employed a mixed methodology design. Cross sectional survey design was used. Quantitative design focused on testing of the hypotheses while qualitative design was used to analyse data from open-ended questions. A questionnaire was used to collect data. It was divided into three sections A, B & C. Section A was based on demographic information, Section B was made of statements on a 6 point likert scale and Section C comprised open ended questions. Cronbach reliability index of the questionnaire was found to be 0.804.

The findings are based on the data that were analysed statistically using (SPSS) IBM Version 20.0 to test the hypotheses. The means, standard deviations, correlations, independent t-test, One-way ANOVA were carried out on the data. All the seven hypotheses were converted to the null and tested at alpha level of 0.05. The findings revealed that gender significantly influences perceptions of Mmopane community on edible indigenous herbs. There was no significant relationship between the level of education and Mmopane community's perceptions on economic value of edible indigenous herbs. Twenty-six edible indigenous herbs were collected at Mmopane village and identified.

Keywords: Edible indigenous herbs, Perceptions, Community, Research hypothesis, GPS, Cronbach's alpha level, Kgalola

CHAPTER ONE BACKGROUND INFORMATION

1.0 Introduction

According to Van Wyk and Gericke (2000), a herb is a plant whose stem does not develop persistent woody tissues and generally dies back at the end of each growing season. Green vegetables are important as source of food in Southern Africa. They may be eaten fresh but are more often used as pot herbs. Leaves of various plants are traditionally cooked and eaten with porridge as relish. Green leaves add important nutrients to the diet. Analyses of the most popular sources of indigenous herbs have shown that they are rich in minerals (iron, calcium, magnesium), amino-acids especially thiamine, riboflavin and nicotinic acid, vitamin A and C. Some of the indigenous edible herbs are sun-dried and stored for use during winter season. A dried leaf of indigenous herbs is sold in the local market and generates income. Some herbs are considered to be as valuable as meat in terms of their flavour and popularity.

1.1 Statement of the problem

Edible indigenous herbs are usually used by many communities in Africa. Harvesting of those has not been controlled especially in rural areas. The population of some of the edible indigenous herbs have reduced in the last decade. Others have disappeared for example *Senecioabruptus* (collected in 1976 in northern side of Botswana), *Pteroniaglauca* (collected in 1955 in Ganzi), *Cucumelicinerea* (collected in 1988, actual place not specified), (Setshogo, 2005). All the three plants mentioned above have been documented in Pretoria and Zimbabwe Herbaria. There is no record of such plants in Botswana National Herbarium. Most communities are concerned about the rate at which edible indigenous herbs are excessively harvested by those who use them for medicinal purpose. This study is conducted to establish Mmopane community's perceptions on edible indigenous herbs and explore various approaches to address the problem at hand.

1.2 Purpose of the study

The purpose of this study is to establish perceptions of Mmopane Community on edible indigenous herbs

1.3 Specific Objectives

1. To identify edible indigenous herbs that occur at Mmopane village in Kweneng District (Botswana)
2. To determine whether there are edible indigenous herbs which are extinct at Mmopane Village?
3. To establish whether there is variation in the populations of some edible indigenous herbs in Mmopane village in the past decade.
4. To find out how Mmopane community perceives edible indigenous herbs in relation to their economic value, usefulness and sustainable harvesting.

1.4 Research questions

1. Which edible indigenous herbs occur in Mmopane Village?
2. Does Mmopane community practise sustainable harvesting of edible indigenous herbs?
4. Do indigenous edible herbs improve the economic value of Mmopane community?
5. Is there any variation in the populations of edible indigenous herbs in the past 10 years? If so what causes the variation?
6. How does Mmopane community conserve edible indigenous herbs?
7. What does Mmopane community use edible indigenous herbs for?

1.5 Research hypotheses of the study

1. Gender significantly influences perceptions of Mmopane community on edible indigenous herbs
2. Location significantly influences perceptions of Mmopane community on edible indigenous herbs.
3. Age significantly influences Mmopane community's perceptions on economic value of edible indigenous herbs.
4. Age significantly influences Mmopane community's perceptions on sustainable harvesting of edible indigenous herbs.
5. Age significantly influences Mmopane community's perceptions on use of edible indigenous herbs.
6. There is a significant relationship between gender and perceptions of Mmopane community on edible indigenous herbs.
7. Educational level has no significant relationship to perceptions of Mmopane community on economic value of edible indigenous herbs.

1.6 Significance of the study

The findings of this study provide valid information on how Mmopane community perceives edible herbs in terms of their economic value, sustainable harvesting, and use. Vital information on whether there has been variation in the populations or extinction of edible indigenous herbs in the last decade has been gathered. This will help policy makers, curriculum developers, stakeholders and Agriculture demonstrators to provide relevant environmental education to Botswana communities.

1.7 Limitations

Some of the participants were uncooperative in terms of keeping appointments for the interviews. The data collection exercise took a long time since questionnaires and consent letter were written in English while the interviews were conducted in Setswana. Shortage of transport at the Department of National Museum and Monument delayed data collection process.

1.7.1 Delimitation

The study covered only Mmopane village in the Kweneng District, therefore the finding of this study cannot be generalised to other communities in Kweneng District. Mmopane village was chosen because it is 30km away from where the researcher works, thus the village could be easily accessed. Shortage of transport at the Department of National Museum and Monuments was another factor which forced the researcher to cover only one village in Kweneng District.

1.8 Assumptions of the study

1. All participants were healthy at the time of the interview.
2. The information provided by participants is true
3. Statistical Package of Social Science (SPSS) is valid software for data analysis

LITERATURE REVIEW

2.0 Introduction

This section of the study focuses on review of literature associated with the perceptions of communities on edible indigenous herbs, their uses and nutritional value. How communities in general conserve or ensure sustainable harvesting of edible herbs in their area and the impact of those herbs on the livelihoods of people.

2.1 Analysis of nutritional value of edible indigenous herbs

Analyses of the nutritional value of various *Amaranthus* species performed by the Vegetable and Ornamental Research Institute at Roodeplaat north of Pretoria has shown that these plants are truly exceptional in terms of their food value. *Amaranthus* species are more valuable than all the other leaf vegetables. The protein content varies between 26 and 30 percent so that practically half the recommended daily allowance can be obtained

from a single 100 grams portion. The iron content may be as high as five times the recommended daily allowance; the calcium content is double and the vitamin A content not less than 20 times recommended daily allowance. The result indicated that a suitable cultivar/species must be chosen, depending on the specific product requirement (Van Wyk and Gericke, 2000).

A study was conducted in Ethiopia on ethnobotany, nutritional analysis and indigenous knowledge. It was found out that although there have been some attempts to conduct nutritional analyses of wild edible plants, available results were found to be insignificant when compared to the wild edible plant wealth of the country. Results also show that wild edible plants of Ethiopia are used as supplementary, seasonal or survival food sources in many cultural groups, and hence play a role in combating food insecurity. The presence of anthropogenic and environmental factors affecting the wild plant wealth of the country calls for immediate action so as to effectively document, produce a development plan and utilize the plants (Lulekal, Asfaw, Kelbessa and Damme, 2011).

According to (FAO, 1995; and Parvathi and Kumar, 2002) besides direct nutritional contributions, the diversity of edible herbs is a source of variety, spice and taste in local meals. They mentioned that in the past years, the official food security policies that were published worldwide have completely overlooked the importance of most foods represented by wild edible species which are normal harvested from impoverished and agriculturally unproductive lands. A general failure of the above mentioned food security policies was the limited appreciation of the livelihoods of this resource to the poor rural communities' wild edible herbs or wild leafy vegetables as a part of these resources that are mostly without formal markets.

The contribution of local plant foods to reducing health risks has always been recognised as part of the local knowledge which forms a great part of the complex cultural systems of the rural population. According to Ladio & Lozada (2004) the utilisation of wild plants continues to greatly benefit communities to date from processes mostly involving local experimentation through and local knowledge. Out of these indigenous and local knowledge came direct, dependence of numerous poor household on indigenous plant resources in rural areas of most countries an integral part of their livelihoods (Arnold & Ruiz Perez, 2001). This dependence is usually predominant in communities where there are easily accessible to them and are faced with limited economic options (Dovie et al., 2005).

In the study herbs and trees are collectively required to as woodland resources. Edible herbs in communities are valued for their medicinal contents and other several uses. Their role and value are hardly recognised in macroeconomic and conservation planning as they are overshadowed by the value of charismatic species. In rural areas the importance of herbs is diverse as referred to as lesser known in food security was demonstrated over a whole range of rural livelihood systems. In herbs there are essential sources of vitamin, minerals, carbohydrates and proteins for poor people (Agrahar-Marugkar and Pal, 2004; Singh & Garg, 2006).

2.2 Edible indigenous plants threatened by extinction

According to JingxianZhuo (2013) Wild food plants species are abundant and diverse in Shangri-la region of Yunnan Province, south west China. They provide food and nutrients to local people. However, both wild edible plants species and their associated indigenous knowledge are facing various threats. Thus, conservation and sustainable utilization of these plants in this area are of the utmost importance. Locally harvested wild edible plants provide cash income for indigenous people and are of great importance in ensuring global food security. Some also play a significant role in maintaining the productivity and stability of traditional agroecosystems. Shangri-la region of Yunnan Province inChina, is regarded as a biodiversity hotspot. People living there have accumulated traditional knowledge about plants. However, with economic development, wild indigenous plants are threatened and the associated traditional knowledge is in danger of being lost. Therefore, ethnobotanical surveys were conducted throughout this area to investigate and document the wild edible plants traditionally used by local Tibetan people.

In a study on Conceptualizing the human use of wild edible herbs for conservation in South Africa by (Delali, Dovie, Charlie, Shackleton and Witkowski, 2013) the majority of households consumed wild edible herbs, averaging 15.4 kg dried weight per household per year and valued at \$167 per household. The herbs were mostly harvested from uncultivated areas of farms, and rangelands. There was little correlation between household characteristics and the dependence on wild herbs for food. The absence of any correlation between cash income and the land-based livelihoods mitigates against the use of cash incomes alone to measure rural well-being and hence the poverty level of resource-poor households. As a result, the linkages between individual products and resources cannot be overlooked. The local people noted a decline in the availability of the species, although not much is known about attempts to cultivate them. The only reasons attributed to the decline were poor soils and drought.

RESEARCH METHODOLOGY

3.0 Introduction

This presents the description of how data was collected.It involves research design,population of the study,sampling procedures,sample size, validation and reliability of the instrument,data collection,data preparation and analysis procedure.

3.1 Research design

The study employed mixed methodology design.This is whereby quantitative and qualitative research designsare used. The cross sectional survey design was used. This involves collection of data at one point in time at a specified area. Quantitative design was focused on testing of the hypotheses.This is a statistical method of analysis which encourages objectivity,precision,standardisation and reliability of measurements. Qualitative design is conducted in natural settings,uses the evaluation as the primary instrument, emphasises rich

description of phenomena, employs multiple gathering methods and uses an inductive approach to data analysis. The two methods complement each other.

3.2 Population of the study

The population consisted of Mmopane residents from the four sampled wards. This involved youth, adults who were residents of Mmopane village and have knowledge on edible indigenous herbs.

3.3 Sampling procedures

Eleven Mmopane wards were identified as Lekwape, Kgosing, Morwane, Kwadibana, Ncaagae, Ratau, Maipei, Gasikwa, Borwane, Morope and Mmopane Block 1. Four wards were selected using simple random sampling. Each of the eleven wards was written in a piece of paper. Each piece was folded and put into a container. The papers were thoroughly mixed and each of the four wards picked at a time. Kwadibana, Gasikwa, Ncaagae and Kgosing were selected to constitute the sample. A total of 400 Mmopane residents who have knowledge about edible indigenous herbs were identified using the snowball method from the four selected wards. Snowball method is where a few individuals who know about the phenomenon under study are used to assist the researcher to identify others to constitute the sample. Simple random sampling was used to select 19 participants out of 95 Gasikwa ward, 20 participants out of 100 Kgosing, 20 participants out of 100 Ncaagae ward and 21 participants out of 105 Kwadibana ward to constitute a sample of 80 participants.

3.4 Sample Size

A total of 400 Mmopane residents who had knowledge about edible indigenous herbs were identified using the snowball method in four Mmopane wards which were selected through simple random sampling. Grinnell and Williams (1990); Levy and Lemeshow (1999) and Stydom and Devos (2000) state that twenty percent sample of the population is sufficient to control error. Therefore 20% of the total population was calculated to constitute the sample. A total of 80 participants from four Mmopane wards constituted the sample of the study.

3.5 Instrumentation

In the case of quantitative and qualitative inquiry, a questionnaire was used. The literature was reviewed. The questionnaire was developed basing on the literature reviewed. The questionnaire was divided into three sections A, B & C. Section A was based on demographic information, section B was made of statements on a 6 point likert scale: 1. Strongly Disagree (SD), 2. Disagree (D) 3. Slightly Disagree (SLD) 4. Slightly Agree (SLA) 5. Agree (A) 6. Strongly Agree (SA) Section C comprised open-ended questions and closed-ended questions. Combining open-ended and closed-ended questions gave participants the opportunity to provide the detailed information about the issues in question so as to improve the quality of data.

3.5.1 Validation of the instrument

To ensure validity of the instrument the questionnaire was given to experts in the Research and Evaluation Department at the University of Botswana to assess every item in the instrument and make suggestions for modifications. Experts in Botany Unit at Natural History Division were given the opportunity to assess the items and make comments. The modifications were based on comments made.

3.5.2 Reliability of the instrument

Reliability of the questionnaire was tested using Statistical Package of Social Science (SPSS) IBM Version 20.0. The Cronbach's reliability index was determined to find out if the instrument was desirable for collection of data. The cronbach's alpha level of .804 was obtained.

3.6 Data Collection

A letter was written to Mmopane village authorities to seek permission to conduct research in the village. Another letter was written to Ministry of Environment Wildlife and Tourism to request for research permit to conduct research on indigenous edible herbs.

Face to face survey questionnaire technique was used to administer the questionnaire. This is whereby the researcher interviews the participants using the questionnaire as a guide. This is an appropriate way of collecting data from adults who are visually or hearing impaired. Illiterate participants would have the opportunity to participate in the interview (Chilisa and Preece, 2005). After permission was granted the researcher visited Mmopane Community to inform them about the intention to study edible indigenous herbs in their area.

3.6.1 Data preparation

After data were collected, they were coded and manually entered into (SPSS). IBM Version 20.0 and operational definitions of demographic variables were outlined.

3.6.2 Data Analysis

Once the data preparation process was completed, raw data was analysed using (SPSS) IBM Version 20.0 to test the hypotheses of the study and answer the research questions set. The package was selected because it provides various data patterns and analysis programmes. It is convenient for analysing different types of data and presents them in the form of tables and other formats. All hypotheses were converted to the null prior to testing. An alpha level of 0.5 was used for significant test.

For all the hypotheses independent and dependent variables were identified and statistical parameters to use were stated.

3.7 Ethical consideration

Permission to conduct research was sought from the Ministry of Environment Wildlife and Tourism. The village authorities were consulted before research could be conducted in the Mmopane village. The participants were asked to sign a consent letter before answering the questionnaire.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

4.0 Introduction

The findings are based on the data that were analysed statistically using (SPSS) IBM Version 20.0 to test the hypotheses set for the study and responses from open-ended and closed-ended questions in the questionnaire. The means, standard deviations, correlations, independent t-test, One-way ANOVA were carried out on the data. The data from open-ended questions were qualitatively analysed. All the seven hypotheses were converted to the null and tested at alpha level of 0.05

4.1 Quantitative data analysis

4.1.1 Testing hypothesis 1

Gender does not significantly influence perceptions of Mmopane community on edible indigenous herbs.

When two means were compared, the observed t- value of -2.065 was obtained from an independent t-test analysis, degree of freedom 78 and significant level of 0.042 as reflected in (Table 1) below -2.065 in the absolute value was found to be greater than the critical value of 1.98. The null hypothesis was rejected and it was concluded that gender significantly influences perceptions of Mmopane community on edible indigenous herbs.

Table1

Independent t-test analysis of the influence of gender on perceptions of Mmopane community on edible indigenous plants

Gender	n	Mean	StdDev	t-value	df	P<
Male	27	68.37	12.37			
				-2.065	78	.042
Female	53	85.92	43.16			
Totals	80	154.29	54.53			

Significant at 0.05 level; critical t- value = 1.98

4.1.2 Testing hypothesis 2

Location does not significantly influence perceptions of Mmopane community on edible indigenous herbs.

The One- way ANOVA analysis resulted in F- value of 1.478 at degree of freedom 3 and 76 (Table 2) below. This was found to be less than the critical F value of 2.68 hence the null hypothesis was retained and it was concluded that location does not significantly influence perceptions of Mmopane community on edible indigenous herbs.

Table 2

One-way ANOVA analysis of the influence of location on perceptions of Mmopane community on edible indigenous herbs

Mmopane community's perceptions by wards	n	Mean	Std. Dev.
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Kwadibana	21	92.57	59.18		
Kgosing	20	77.20	24.57		
Ncaagae	20	80.25	29.59		
Gasikwa	19	68.79	11.42		
Totals	80	80.00	36.69		
Source of variance	Sum of squares	df	Mean squares	F	P<
Between groups	5864.749	3	1954.916	1.478*	.227
Within groups	100507.251	76	1322.464		
Totals	106372.000	79			

*Not significant $P > 0.05$, critical $F = 2.68$, df 3 and 76

4.1.3 Testing hypothesis 3

Age does not significantly influence Mmopane community's perceptions on economic value of edible indigenous herbs.

One-way ANOVA analysis resulted in F- value of 1.138 at degree of freedom 4 and 75 as shown in Table 3 below. This was found to be less than the critical F value of 2.45 and the null hypothesis was retained and it was concluded that age does not significantly influence Mmopane community's perceptions on economic value of edible indigenous herbs.

Table 3

One-way ANOVA analysis of the influence of age on economic value of edible indigenous herbs.

Mmopane community's perceptions by age.	n	Mean	Std. Dev.		
Less than 20yrs	5	23.00	5.79		
21- 30yrs	18	24.89	8.14		
31 - 40yrs	16	27.31	6.80		
41- 50yrs	13	21.92	6.78		
Above 50yrs	28	23.82	7.28		
Totals	80	24.40	7.27		
Source of variance	Sum of squares	df	Mean squares	F	P<
Between groups	238.955	4	59.739	1.138	.345
Within groups	3936.245	75	52.483		

Totals	4175.200	79
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*Not significant $P > 0.05$, critical $F = 2.45$, df 4 and 75

4.1.4 Testing hypothesis 4

Age does not significantly influence perceptions of Mmopane community on sustainable harvesting of edible indigenous herbs.

One-way ANOVA analysis resulted in F - value of .453 at degree of freedom 4 and 75 as shown in Table 4 below. This was found to be less than the critical F value of 2.45 and the null hypothesis was retained and it was concluded that age does not significantly influence Mmopane community's perceptions on sustainable harvesting of edible indigenous herbs.

Table 4

One-way ANOVA; analysis of the influence of different age groups of Mmopane community's perceptions on sustainable harvesting of edible indigenous herbs.

Mmopane community's perceptions by age.	n	Mean	Std. Dev.
Less than 20yrs	5	28.20	4.87
21- 30yrs	18	26.22	5.66
31 - 40yrs	16	34.06	27.50
41- 50yrs	13	30.69	29.10
Above 50yrs	28	26.64	17.80
Totals	80	28.79	19.95

Source of variance	Sum of squares	df	Mean squares	F	P<
Between groups	741.341	4	185.335	.453	.770
Within groups	30706.05	75	409.414		
Totals	31447.388	79			

*Not significant $P > 0.05$, critical $F = 2.45$, df 4 and 75

4.1.5 Testing hypothesis 5

Age does not significantly influence Mmopane community's perceptions on use of edible indigenous herbs.

One-way ANOVA analysis resulted in F - value of .950 at degree of freedom 4 and 75 as shown in (Table 5) below. This was found to be less than the critical F value of 2.45 and the null hypothesis was retained and it was concluded that age does not significantly influence perceptions of Mmopane community on use of edible indigenous herbs.

Table 5

One-way ANOVA analysis of the influence of different age groups of Mmopane community's perceptions on use of edible indigenous herbs.

Mmopane community's perceptions by age.	n	Mean	Std. Dev.
Less than 20yrs	5	21.80	4.60
21- 30yrs	18	27.00	22.42
31 - 40yrs	16	35.37	33.92
41- 50yrs	13	20.84	5.41
Above 50yrs	28	25.46	18.78
Totals	80	26.81	21.81

Source of variance	Sum of squares	df	Mean squares	F	P<
Between groups	1812.981	4	185.335	.950	.440
Within groups	35769.67	75	185.335		
Totals	37582.187	79			

*Not significant $P > 0.05$, critical $F = 2.45$, df 4 and 75

4.1.6 Testing hypothesis 6

There is no significant relationship between gender and perceptions of Mmopane community on edible indigenous herbs.

The correlation analysis resulted in r - value of .228 which was found to be higher than the critical r - value of .217, at significant level of 0.05 and 78 degree of freedom. Basing on the results on (Table 6) below, the null hypothesis was rejected. It was then concluded that there is a significant relationship between gender and the way Mmopane community perceive edible indigenous herbs.

Table 6

Pearson correlation of Mmopane community's perception on edible indigenous herbs in relation to gender (n=80)

Variables	Gender of participants	Perception of participants on edible indigenous herbs
Perception of participants on edible indigenous herbs	.228*	1.000
Gender of participants	1.000	.228*
P< (2 tailed)		.042

*Significant at 0.05 level; critical r –value = .217

4.1.7 Testing hypothesis 7

Educational level has no significant relationship to perceptions of Mmopane community on economic value of edible indigenous herbs.

The correlation in (Table7) analysis resulted in observed r- value -.083 which was found to be less than the critical value 0.217 at 0.05 significant level, degree of freedom 78 hence the null hypothesis was retained and it was concluded that educational level of Mmopane community has no significant relationship in their perceptions of edible indigenous herbs.

Table 7

Pearson correlation of Mmopane community’s perceptions on economic value of edible indigenous herbs in relation to educational level (n=80)

Variables	Educational level of participants	Perceptions of participants on edible indigenous herbs
Perception of participants on edible indigenous herbs	-.083	1.000
Educational level of participants	1.000	-.083
P< (2 tailed)		.465

Significant at 0.05 level; critical r –value = .217

The negative correlation value ratio indicates that the two variables are inversely related.

4.2 Findings from the qualitative data analysis

Mmopane community’s responses to the open-ended questions asked in the questionnaire were analysed. The themes were identified and captions were made under each theme. Twenty-six edible indigenous herbs in Mmopane village were identified. The summary of qualitative data analysis in percentages is presented in Table 8 and 9.

Table 8 below presents responses to questions that addressed variations in the populations of edible indigenous herbs in the past decade. Out of 80 sampled participants, 80% (78% males and 81% females) reported that there was reduction in the populations of edible indigenous herbs in Mmopane village. On the other hand 20% (22% males and 19% females) said they did not observe any variation. Out of the 64 participants who indicated that there was variation, 58% (76% males and 49% females) observed reduction in *Amaranthus thunbergii*, 22% (14% males and 26% females) observed reduction in *Coccinia sessilifolia*, and 20% (10% males and 26% females) observed reduction in *Cloeme ganandra*. Causes of variation were outlined as follows: majority of participants which was 50% (57% males and 46% females) indicated that variation was due to climate change, 17% (5% males 23% females) unknown factors, 17% (19% males and 16% females) human development, 11% (14% males and 9% females) destruction by wildlife and 5% (5% males and 5% females) uprooting for medical use.

4.2.1 Table 8 variation of edible indigenous plants in the past decade

Question	Responses	Males	Females	Total
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		N=27		N= 53		N=80	
		n	%	n	%	n	%
Have you observed any variations in the populations of edible indigenous herbs?	Yes	21	78	43	81	64	80
	No	6	22	10	19	16	20
		N=21		N=43		N=64	
		n	%	n	%	n	%
If the answer is yes for the question above, in which edible indigenous herbs is variation observed	<i>Amaranthusth urbegii</i>	16	76	21	49	37	58
	<i>Cocciniasessil ifolia</i>	3	14	11	26	14	22
	<i>Cloemeganan dra</i>	2	10	11	26	13	20
What are the causes of variation in the edible indigenous herbs?	Climate change	12	57	20	47	32	50
	Unknown factors	1	5	10	23	11	17
	Human development	4	19	7	16	11	17
	Destruction by wildlife	3	14	4	9	7	11
	Uprooting for medical use	1	5	2	5	3	5

Table 9 below presents responses to questions which were based on extinction of edible indigenous herbs. Out of 80 sampled participants, majority which was 63% (63% males and 62% females) pointed out that they have not observed any extinction of edible indigenous herbs in Mmopane village. 23% (26% males and 21% females) reported that there was extinction and 15% (11% males and 16% females) were not sure. Out of 18 participants who said that there was extinction; Majority which was 78% indicated that *Ceropegia* species were extinct, 17% (27% males and 9% females) *Antheriumwhytei* and 6% (0% males and 9% females) said kgalola belonging to Allileceaefamily was extinct. Regarding the causes of extinction 50% (43% males and 55% females) out of the 18 participants who reported that there was extinction indicated that it was due to climate change. 22% (29% males and 18% females) said extinction was due to excessive harvesting, 11% (14% males and 11% (14% males and 9% females) unknown factors (14% males 9% females) human development, 6% (0% males and 9% females) destruction by pests.

4.2.2 Table 9 Extinction of edible indigenous herbs

Question	Responses	Males		Females		Total	
		N=27		N= 53		N=80	
		n	%	n	%	n	%
Are there any indigenous edible herbs which	Yes	7	26	11	21	18	23

are extinct in Mmopane village?	No	17	62	33	62	50	63
	Not sure	3	11	9	16	12	15
		N=7		N=11		N=18	
		n	%	n	%	n	%
If your answer is yes for the question above, which edible indigenous herbs are extinct	<i>Ceropegia species.</i>	5	71	9	81	14	78
	<i>Anthericumwh ytei</i>	2	27	1	9	3	17
	<i>kgalola</i>	0	0	1	9	1	6
What are the causes of extinction in the edible indigenous herbs?	Climate change	3	43	6	55	9	50
	Excessive harvesting	2	29	2	18	4	22
	Human development	1	14	1	9	2	11
	Unknown factors	1	14	1	9	2	11
	Destruction by pests	0	0	1	9	1	6

4.3 Edible indigenous herbs identified at Mmopane, Village Kweneng District; Botswana

GPS: S24° 34' 35.5"

E 25° 52' 10.5"

Altitude: ± 3metres



Figure 1. Family: Alliaceae–Bulbinecapitata (kgomo-ya-buru) vegetable



Figure 2. Family: Convolvulaceae – *Impomeabolusiana* (Kgane) medicinal



Figure 3. Family: Cucubitaceae –*Kedrostiscrassirostrata* (Sekhandane) vegetable



Figure 4 . Family: Cucubitaceae –*Corallocarpustriangularis*(Rete-lakukama) vegetable



Figure 5. Family: Cucurbitaceae –*Coccinarella mannii* (Leropholane) vegetable



Figure 6. Family: Pedaliaceae –*Pterodiscus luridus* (Pelo-ya-khutsana) medicinal



Figure 7 . Family: Apocynaceae - *Pentarrhinuminspidum* (Leshwe) vegetable



Figure 8. Family: Convolvulaceae/Alliliceae-*Cynotis speciosa*(kgopo)medicinal



Figure 9.Family: Cucubitaceae –*Cucumis myriocarpus*, striped cucumber(Monyaku) vegetable



Figure 10. Family: Alliaceae -*Tulbaghia acutiloba*, Wild garlic (Thoma)vegetable/medicinal



Figure 11. Family: Euphobiaceae–*Jatrophazeyheri* (Seswagadi) medicinal



Figure 12 Family: Apocynaceae –*Fockeaangustifolia* (Leruswa) vegetable



Figure 13. Family: Aponogetonaceae–*Aponogeton junceus* (Makonkwe) vegetable



Figure 14. Family: Cucurbitaceae–*Coccinia sessilifolia* (Mogabala) vegetable



Figure 15. Family: Amaranthaceae –*Hermbstaediaodorata*(Thepeleshwane) vegetable



Figure 16. Family: Amaranthaceae –*Amaranthushunbergii* Pig weed(Thepe) vegetable



Figure 17. Family: Cucubitaceae –*Cucumshirsutus*, wild cucumber (Mokununu) vegetable



Figure 18. Family: Tiliaceae- *Corchorusolitorius*, jute mallow(delele) vegetable



Serial no.19 Family: Amaranthaceae - *Amaranthus hybridus*, Pig weed (Setlepetlepe) vegetable



Figure 20. Family: Capparaceae – *Cleome gynandra*, African cabbage (Rothwe) vegetable



Figure 21. Family: Capparaceae – *Cleome monophylla* (Malomaa-rothwe)vegetable



Figure 22. Family: Euphorbiaceae–*Jatrophaacrythropoda*(Thotamadi) medicinal



Figure 23. Family: Asteraceae –*Dicomacapensis* (Pelobothoko) medicinal



Figure 24. Family: Hyacinthaceae –*Drimiasanguinea*(Sekaname) medicinal



Figure 25. Family Asphodelaceae/Anthericaceae – *chlorophytumfasciculatum* (Bokwidi) medicinal



Figure 26. Family: Brassicaceae –*Erucastrum* sp.(Kutwane)vegetable

For identification of the edible indigenous herbs specimens above, the following references were used: Setshogo (2002), Setshogo (2005) Fabian and Germishuizen (1997), Van Wyk and Malan (1997), Alison and Hearth(2009) and National Herbarium plant specimens vouchers from 1975 to 2012.

NB.**Kgalolain** table 9 is a setswana name for a plant which Mmopane community indicated that it was extinct. The plant could not be found hence it could not be identified to give it either scientific or English name.

CHAPTER FIVE

DISCUSSION, CONCLUSION IMPLICATIONS AND RECOMMENDATIONS

5.0 DISCUSSION

The findings are based on the data that were analysed statistically using (SPSS) IBM Version 20.0 to test the hypotheses set for the study and responses from open-ended and closed-ended questions in the questionnaire. The means, standard deviations, correlations, independent t-test, One-way ANOVA were carried out on the data. Data from open-ended questions were qualitatively analysed. All the seven hypotheses were converted to the null and tested at alpha level of 0.05. The findings revealed that gender significantly influences perceptions of Mmopane Community on edible indigenous herbs. Location and age did not significantly influence the way Mmopane community perceive edible indigenous herbs. Age did not significantly influence perceptions of Mmopane community on economic value, use, sustainable harvesting of edible indigenous herbs. Level of education also did not influence Mmopane community's perception on sustainable harvesting of edible indigenous herbs.

Basing on the qualitative data summary descriptively analysed, the following results were obtained: Out of 80 sampled participants, 80% reported that there was variation in the populations of edible indigenous herbs in Mmopane village, this agrees with (Delali, Dovie, Charlie, Shackleton and Witkowski, 2013) who stated that the people noted a decline in the availability of the wild plants species, although not much is known about attempts to cultivate them. JingxianZhuo,Bo Lia and Long (2013) further highlighted that with economic development, wild indigenous plants are threatened and the associated traditional knowledge is in danger of being lost.

On the other hand 20% said they did not observe any variation. Out of the 64 participants who indicated that there was variation, 58% observed reduction in *Amaranthusthunbergii*, 22% observed reduction in *Cocciniasessilifolia*, 20% observed reduction in *Cloemeganandra*. Causes of variation were outlined as follows: majority of participants which was 50% indicated that variation was due to climate change, 17% unknown factors, 17% human development, 11% destruction by wildlife and 5% uprooting for medical use. Majority of participants pointed out that climate change was the main cause of variation in populations of edible indigenous herbs, this correlates very well with the study by (Delali, Dovie, Charlie, Shackleton and Witkowski, 2013) who found out that the only reasons attributed to the decline in wild edible plants were poor soils and drought.

Out of 80 sampled participants, majority which was 63% pointed out they have not observed any extinction of edible indigenous herbs in Mmopane village. 23% reported that there was extinction and 15% were not sure. Out of 18 participants who said that there was extinction; majority which was 78% indicated that *Ceropegia* species were extinct, 17% *Antheriumwhytei* and 6% saidkgalola was extinct. Regarding the causes of extinction 50% out of the 18 participants who reported that there was extinction indicated that it was due to climate change, 22% said excessive harvesting, 11% unknown factors, 9% human development, and 6% destruction by pests.

85% of the sampled population indicated that edible indigenous herbs are generally unprofitable hence they do not improve their economic value, this agrees with the study by (Delali, Dovie, Charlie, Shackleton and Witkowski, 2013) who found that the majority of households consumed wild edible herbs, averaging 15.4 kg dried weight per household per year and valued at \$167 per household. They further indicated that herbs were mostly harvested from uncultivated areas of farms, and rangelands. There was little correlation between household characteristics and the dependence on wild herbs for food. The absence of any correlation between cash income and the land-based livelihoods mitigates against the use of cash incomes alone to measure rural well-being and hence the poverty level of resource-poor households.

Twenty six indigenous edible herbs that occur in Mmopane village were collected, identified, mounted and filed in Botswana Nation Herbarium. This is supported by Lulekal, Asfaw, Kelbessa and Damme (2011) in their study on Wild edible plants in Ethiopia; a review on their potential to combat food insecurity. The finding show that wild edible plants of Ethiopia are used as supplementary, seasonal or survival food sources in many cultural groups, and hence play a role in combating food insecurity. The environmental factors affecting the wild plants wealth of the country calls for immediate action so as to effectively document, produce a development plan and utilize the plants.

Mmopane community uses indigenous herbs as relish, medicine and forage. 82% of the sampled population expressed that edible indigenous herbs are not sustainably harvested in Mmopane village and they are preserved by cooking and drying.

5.1 CONCLUSIONS

Basing on the results, the following conclusions were made:

1. Gender significantly influences perceptions of Mmopane Community on edible indigenous herbs.
2. Location and age did not significantly influence Mmopane community's perceptions on economic value, sustainable harvesting and use of edible indigenous herbs.
3. Level of education did not significantly influence perceptions of Mmopane community on sustainable harvesting of edible indigenous herbs.
4. Edible indigenous herbs do not improve economic value of Mmopane community
5. Mmopane community does not harvest edible indigenous plants sustainably.

6. Mmopane community has observed reduction in the populations of *Amaranthus thunbergii*, *Cocciniasessilifolia*, and *Cloemeganandra* in the past decade.
7. Climate change is the main cause of variation in populations and extinction of edible indigenous herbs in Mmopane village.
8. Mmopane community uses edible indigenous herbs as relish, medicine, forage and they preserve them by cooking and drying.
9. Minority of Mmopane community indicated that *Ceropegia* species, *Antherium whytei* and kgalola were extinct in Mmopane village.
10. The following are edible indigenous herbs that occur at Mmopane village: *Bulbine capitata*, *Impomea bolusiana*, *Kedrotis crassirostrata*, *Corollacarpustrangularis*, *Cocciniasessilifolia*, *pterodisus luridus*, *Pentarhinum inspidum*, *Cynotis speciosa*, *Cucumis microcarpas*, *Tulbaghia acutiloba*, *Fockea angustifolia*, *Jatropha zeyheri*, *Aponogeton junceus*, *Cocciniasessilifolia*, *Hermeshedtia odorata*, *Amaranthus thunbergii*, *Cucumis hirsutus*, *Corchorus solitorius*, *Amaranthus hybridus*, *Cloemeganandra*, *Cloememonophylla*, *Jatropha acrythopoda*, *Dicomacarpensis*, *Drimys sanguinea*, *Chlorophytum fasciculatum* and *Erucastrum* species.

5.2 IMPLICATIONS

1. If Mmopane community does not harvest edible indigenous herbs sustainably, the herbs will ultimately get extinct.
2. Plants are very vital in that they provide oxygen needed for human survival hence their extinction will have detrimental effects on human life.

5.3 RECOMMENDATIONS

1. Mmopane community should avoid any activity which leads to climate change since it was reported to be the main cause of reduction and extinction of some edible indigenous herbs.
2. Sustainable harvesting of edible indigenous herbs should be practised by Mmopane community so as to conserve them for the future generations.
3. The same study should be conducted in another village in Kweneng District to verify if results will be the same.
4. Another researcher should be conducted to make a follow up of plants which a few participants indicated that they were extinct in Mmopane village.

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