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INLAND FISHERIES CONSUMPTION PATTERN AND FACTORS AMONG RURAL HOUSEHOLDS OF MOPANI DISTRICT MUNICIPALITY, LIMPOPO PROVINCE, SOUTH AFRICA

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ABSTRACT

The consumption of fish is accepted by all ages and social groups. Moreover, fish is rich in both micro, and macro-nutrients and minerals which are suitable for human development. The objectives of the study was to profile the socio-economic characteristics of households in Mopani District Municipality, to describe rural households' consumption pattern of inland fisheries and, to analyse the factors that influence the consumption of inland fisheries by rural households in the study area. A total of 134 households were interviewed using structured questionnaire. Descriptive statistics, Household Dietary Diversity Score and Binary Logistic model were adopted to achieve these objectives. The results showed that Bass, Tilapia, Catfish and Carp are the most preferred inland fish species by rural households in the study area. However, Tilapia is the dominating fish species preferred by households for weekly consumption purposes. The regression results revealed that age and the gender of the household positively influence the consumption of inland fisheries while, access to inland fisheries' market has a negative relationship with consumption. To this end, the study concludes that the inclusion of inland fisheries as food by rural households and the availability of markets are necessary for the improvement of a healthy life.

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INTRODUCTION

Fish has been widely known as a very good and cheap source of protein for all income groups (Mohanty et al., 2019; Onumah et al., 2020). Moreover, fish is healthy and safe to be consumed as a whole due to its considerable high ratio of protein/fats compared to meat from goat, lamb, buffalo and chicken (Onumah et al., 2020). Fish is accepted by all as food regardless of age, gender, religion or region and, it is estimated to provide 60% of the protein needed by people (Onumah et al., 2020). Consequently, the consumption and utilisation of fish tend to differ from one consumer to another due to environmental conditions, geographical area, socioeconomic characteristics and adaptability of the fish to different climatic conditions (Can, 2015). Nevertheless, fish can either be farmed or harvested from marine or inland. Marine fisheries occur in the oceans while, inland fisheries are practised in natural public resources and are regarded as labour intensive (Funge-Smith and Bennett, 2019). Marine fisheries on the other hand are only available at the coast while inland fisheries occur within the inland territories of a country. Therefore, resources from inland fisheries are accessible to the rural poor because of the use of public dams/impoundments which creates an opportunity for the development of inland fisheries' activities, especially on a small-scale level to contribute significantly toward food security and rural livelihoods (Isaacs and Hara, 2015).

As maintained by Sara et al., (2017), the South African government has invested in the development of dams to store water for agricultural, industrial and domestic use. Although fishing exists within these dams, the households living and fishing around these dams are not given much attention by policymakers. This might be that inland fisheries are regarded as an informal activity (Britz et al., 2015). Besides these challenges, households are still involved in various fishing activities to generate food and income. It is recommended that fish be consumed by people at least twice a week to meet dietary requirements (Vilain and Baran, 2016). So far, fish contains macronutrients (such as protein, lipids, and ash), micronutrients (such as vitamin A, B12, D, E, and Folate), minerals such as iron, zinc, calcium, iodine, selenium, phosphorus and potassium which are essential for good human development (Bogard et al., 2015; Vilain and Baran, 2016; Mohanty et al., 2019). For instance, Vitamin D is important in assisting the body to absorb calcium which together, helps protect the body from developing diseases such as osteoporosis which thins and weakens bones (Tirakompong et al., 2019).

A recent study by Heilpern et al., (2021) established that substituting wild inland fisheries with aquaculture and chicken increases iron deficiencies and limits essential fatty acids. The study also emphasises that the production of chicken and aquaculture increases greenhouse gas emissions, agricultural land use and aggressively increases the growth of plants and algae within water bodies. Additionally, other animal protein and nutrient sources are expensive for the rural poor or not easily available (Belton and Thilsted 2014). Nevertheless, in many parts of the world, inland fisheries are the primary source of animal protein and important to ensure food and nutritional security at the local and regional levels, particularly among the rural poor (Youn et al., 2014). Therefore, inland fisheries are a good and affordable source of animal protein for all people, thus households are likely to consume more fish compared to other meat.

Similarly, Bogard et al., (2015) established that non-farmed fish contributes to the nutritional diet of children in Bangladesh and these fish species have more micronutrients compared to fish from aquaculture. Therefore, this exemplifies the importance of consuming inland fish for a better and healthier lifestyle. Globally, the fish per capita is estimated at 20kg with South African standing at 6.1kg (Food and Agriculture Organisations, 2018). Therefore, to increase consumption, households make use of the available inland water bodies such as rivers and dams which produce fish such as Catfish, Tilapia and Carp to acquire food (Tapela et al., 2015). Resources from these inland water bodies could contribute to reducing poverty and malnutrition within households. Moreover, the fish consumed is important for human development as fish species like Carp are rich in iron while small fish which can be eaten whole are rich in Vitamin A and Zinc (Vilain and Baran, 2016). Additionally, pregnant, lactating and nursing women are encouraged to eat more fish to avoid the risk of neurological development in children (Vilain and Baran, 2016). Likewise, fish also contains Polysaturated fatty acids (PUFA) including Docosahexaenoic acid (DHA) and Eicosapentaenoic acid (EPA) which are important for the good health of the human heart and reduce the risk for premature birth in pregnant women (Zhao et al., 2016).

In addition, inland fisheries play a significant role in achieving 2030 Sustainable Development Goals 1 and 2, that is, No Poverty and Zero Hunger respectively (Lynch et al., 2020). This, therefore, makes fish from the inlands a valuable source of nutrition for both rural and urban households. Although most poor households in South Africa rely on government-assisted social grants, still, these households are unable to afford a balanced diet and face food insecurity shocks (Govender et al., 2017). Hence, from a nutritional point of view, the consumption of inland fisheries has the potential to provide more micro and macro-nutrition for the rural poor (Bogard et al., 2015).

About 90% of fish from the inland waters are used for local and direct consumption (Funge-Smith, 2018). However, the consumption pattern or consumption frequency differs among individuals. For instance, in Sub-Saharan Africa, the demand for fish outweighs the supply (Tran et al., 2019). Despite these challenges, the socioeconomic characteristics of the consumer, proximity to the fishing area, and the type of fish preferred, determine the consumption pattern of fish by households (Uzundumlu et al., 2015). Therefore, based on this information, the study had the following objectives.

- To profile the socio-economic characteristics of households in Mopani District Municipality.
- To describe rural households' consumption pattern of inland fisheries in the study area.
- To analyse the factors that influence the consumption of inland fisheries by rural households in the study area.

MATERIAL AND METHODS

The study used primary data which was collected from 134 households in the Mopani District Municipality (MDM), of the Limpopo Province, South Africa. Purposive and simple random sampling techniques were adopted to identify the respondents. The Mopani District Municipality is in the north-eastern part of the Limpopo Province. Furthermore, the district has approximately 2001100 hectares of land which includes a portion of the Kruger National Park from the Olifants River to the Tshingwedi camps, Lepelle River and the Tshingwedzi River [Mopani District Municipality Integrated Development Plan (MDM IDP), 2018]. The district covers five local municipalities namely, Ba-Phalaborwa, Greater Tzaneen, Greater Letaba, Greater Giyani and Maruleng Local Municipalities.

The average maximum temperature in the district is 21°C in the mountain areas to 25°C in the dry Lowveld areas of the Kruger National Park. Frost rarely occurs in this district thus making it a good environment for fish production (MDM IDP, 2018). The municipality receives annual rainfall ranging from 400 to 900mm (Bodrick et al., 2014). Therefore, these climatic conditions deem the municipality suitable for inland fish production.

Different inland fish species have been identified in some of the water bodies in the district. These fish species include the Smallmouth Bass (*Micropterus dolomieu*), Sharptooth Catfish (*Clarias gariepinus*), Southern Dwarf Minnow (*Opsaridium peringueyi*), African Tigerfish (*Hydrocynus vittatus*), Tilapia (*Oreochromis mossambicus*) and Rainbow Trout (*Oncorhynchus mykiss*) among others (Tapela et al., 2015).

The study used questionnaires administered through face-to-face interviews to capture fisheries' consumption information of households in the MDM. Subsequently, descriptive statistics in the form of means and frequencies were used to profile the socio-economic information of households and to identify the types of fish consumed by households. Moreover, Household Dietary Diversity Score (HDDS) questionnaire was adopted to capture the consumption pattern of inland fisheries by rural households. The International Dietary Data Expansion Project (INDDEx), [2018] defines HDDS as the number of different food groups that are consumed by households over a given reference period.

The HDDS applies a reference period of usually the previous 24-hour recall which precisely consists of recalling, describing and quantifying the intake of food and beverages consumed either by the household in the previous 24 hours (Castell et al., 2015). However, a single 24-hour recall period does not provide the typical dietary intake but can yield a high response rate because of the ability to recall what has been consumed the previous night and is not time-consuming (Castell et al., 2015). Therefore, a 24-hour recall might not truly depict the pattern of fish consumed by households. Thus, for this study, households were asked based on a recall period of the past seven days. The main focus was for households to recall the different inland fish species that they consumed in the previous seven days.

A Binary Logistic Regression (BLR) model was adopted to analyse the factors that influence the consumption of inland fish by rural households in MDM. The general BLR model is given by:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 X_1 + \dots + \beta_n X_n + e_i$$

Where: P is the probability of households consuming inland fish, $1 - P_1$ is the probability of the household not consuming inland fish, \ln is the natural logarithm, β_0 is the intercept, β_1, \dots, β_n are the coefficients of the estimated parameters, X_1, \dots, X_n are the independent variables and e_i is the error term.

RESULTS AND DISCUSSION

Descriptive results for socio-economic characteristics of households in MDM

Table 1 presents the results for the socio-economic characteristics of households in the study area. The letter “N” represents the sample size. Min., Max. and Std. represents the minimum, maximum and standard deviation respectively. The total sample size for the participants in the study area is 134. The results show that in MDM, the maximum age is 82 years with a minimum of 19 years and a standard deviation of 14.71. The average age is 47 years which indicates that most of the respondents in MDM are still in their active stage.

Table 1. Descriptive results of continuous variables

Variable	N	Min.	Max.	Mean	Std. Dev.
Age of Household Head (Years)	134	19	82	47	14.71
Number of Household Members (Actual Number)	134	1	8	4	1.85
Total Household Income (Per Month)	134	450.00	32300.00	4038.28	5317.69
Distance to Market (Km)	134	.10	7.00	2.91	2.31

Source: Survey results

Furthermore, the descriptive results also show that most households have 4 household members. The maximum number of household members in MDM is 8 with a minimum of 1. In MDM, the average household income is R4038.28 per month with a minimum of R450 per month and, the maximum income is R32300.00 per month. The average income implies that most of the households live above the lower-bound poverty line of R810.00 per month (Statistics South Africa Release, 2019). However, the minimum income points that some of the households are living in poverty. Despite this, households travel a minimum distance of 0.10km to the market to purchase fish and other household items such as food, medicine etc. while the maximum is 7km. On average, households travel 2.91km to the market.

The standard deviation of the total household income insinuates that some of the households in this district municipality have variations in income received per month. For example, these households might be self-employed or receive social grants hence there might be fluctuations in the income received.

Consumption pattern of inland fish by households in MDM

The results presented in Table 2 show the consumption pattern of inland fisheries by rural households in MDM. As evident from the results, many of the households consume Bass followed by Tilapia, Catfish and Carp once a week. Eel and Tigerfish are consumed by 1 and 3 households once a week respectively. Similarly, Catfish, Tilapia, Bass, Trout, and Carp were consumed twice a week by 2, 10, 16, 2 and 1 households.

Table 2. Consumption pattern of inland fish by households in MDM

No. t/w	Catfish	Tilapia	Bass	Troat	Eel	Tigerfish	Carp
Once a week	10	19	22	0	1	3	10
2/week	2	10	16	2	0	0	1
3 /week	1	9	1	0	0	0	0
4 /week	0	8	0	0	0	0	5
5 / week	1	6	2	1	0	0	0
6 / week	0	0	0	0	0	0	0
Whole week	0	17	0	0	0	0	0

Source: Survey results

Different inland fish species such as Catfish, Tilapia and Bass were consumed by at least 1, 9 and 1 household three times a week respectively. On the other hand, 8 and 5 households consumed Tilapia and Carp four times a week. Only 1, 6, 2 and 1 of the households consumed Catfish, Tilapia, Bass, Trout five times a week respectively. A total of 17 rural households mentioned that they consumed Tilapia in the previous seven days. Of these fish species, Tilapia, Carp and Catfish are said to adapt well to different feeding habits, are acceptable by consumers, resistant to diseases and common in various water bodies (Davis et al., 2009).

As a result, inland fish is consumed at least once a week in MDM. However, consumption differs by species. On a report by Food and Agriculture Organisation (2020), generally, fish consumption renders humans with low risk of heart diseases and stroke. The consumption of fish is also essential for pregnant women due to its high omega-3 content, which is important in fetal development moreover; the nutritional content of fish is significant in the first 1000 days of a child's life (Bunthang et al., 2016). Therefore, most of the households in MDM include fish in their meals often.

Factors that influence the consumption of inland fish by rural households in MDM

This section gives the results of the Binary Logistic Regression (BLR) model on factors that influence the consumption of inland fisheries by rural households in MDM. The dependent variable is dichotomous such that it takes the value of 1 and 0 (consume inland fish and not consume inland fish respectively). The model fit results presented a -2Log likelihood of 25.319. The Cox and Snell R Square is 12.2% while the Nagelkerke R Square is 44.6%. As the adjusted Cox and Snell R square, the Nagelkerke R Square results imply that 44.6% of the variables are explained by the model. To validate that the model is fit, the model Chi-square is 17.376 with a probability of 0.043. Therefore, these results imply that there is a significant relationship between the independent variables and the dependent variable.

Table 3. Binary Logistic results on factors that influence the consumption of inland fish by rural households in MDM

Variable	B	S.E.	Wald	Sig.
Age of household head	.111*	.061	3.247	.072
Gender of household head	4.448**	2.058	4.671	.031
Number of household members	-.664	.480	1.910	.167
Distance to market	.347	.354	.961	.327
Access to inland fisheries' market	-.458*	.271	2.853	.091
Marital status	-.659	.642	1.055	.304
Access to credit	-1.400	2.210	.401	.526
Source of household head income	-.051	.158	.103	.748
Level of education	-.794	.795	.998	.318
Constant	-7.108	5.754	1.526	.217

Note: ** and * indicate significance levels at 5% and 10% respectively.

Source: Survey results

Age of household head

The paper found a positive and significant relationship between the age of the household head and whether they consume inland fish or not. This may imply that the likelihood of eating inland fish increases as the household head ages. This might be the result of factors such as experience, nutritional and dietary knowledge, the accessibility and, easy preparation of inland fish species that the household head has acquired. Therefore, the age of the household head coupled with these factors might influence the consumption of inland fisheries within the household. Similarly, Rahman et al., (2020) found a significant relationship between age groups and consumption of fish. Therefore, it can be argued that the age of the household head influences the consumption of inland fisheries which also represents the family life cycle.

Gender of household head

The BLR also show a positive and statistical significance of gender of the household heads at a 5% level. An earlier study by Burger (2002) investigated the gender differences in meal patterns. The findings of the study show that women are less likely to consume wild fish and game fish compared to men. This being the case, expecting mothers are encouraged to consume inland fish due to its high nutrients (Bunthang et al., 2016). In Cambodia, it was earlier discovered that men consumed more inland fish compared to women [Inland Fisheries Research and Development Institute (IFREDI), 2013]. However, a recent study by Thomas et al., (2021) shows that the majority of women who are engaged in inland fisheries consume fresh fish seven times a week. Therefore, the study contends that, the consumption of inland fish depends on the gender of the household head and whether the household is engaged in inland fisheries or not.

Access to inland fisheries' market

Access to the inland fisheries' market resulted in a negative but statistical significance. Based on these results, where inland fish is bought is likely to decrease its consumption. This might be attributed to the consumption decision of the household based on the availability, taste, price, convenience in preparation and safety concerns of inland fish (Uzundumlu et al., 2015). For instance, if households purchase fish from fishers, the consumption status of inland fisheries might decrease due to seasons and availability of the fish. In addition, Burger (2002) found that households consume wild-caught fish than fish bought at the store or restaurant due to the closeness of the local fish market. Therefore, the demand for inland fisheries signifies the development of different markets where households can purchase fish for continuous nutritional and health benefits.

CONCLUSIONS

The study revealed that the average age of households in MDM is 47. Additionally, rural households are likely to travel a distance of 2.91km to the market to purchase inland fisheries and other household items. When examining the consumption pattern of households, the study revealed that many of the households prefer Bass, Tilapia, Catfish and Carp as inland fisheries' species. However, Tilapia is the most consumed inland fish species by households throughout the week. Moreover, the study concludes that the consumption pattern of inland fisheries by households in MDM depends on the fish type. The findings of the study revealed that factors such as age and gender of the household head influence the consumption of inland fisheries by rural households in the study area. Congruently, where inland fish is bought has a negative influence on fish consumption. This suggests that the market where inland fisheries are bought influences the demand and buying power of rural households. Therefore, based on these findings, it is recommended that the inclusion and consumption of inland fisheries species in the diet of rural households be prioritized to maintain a healthy life. Moreover, the study calls on the development of inland fisheries' markets by the government, particularly in rural areas where households can have easy access. This will benefit households in terms of easily acquiring fish for consumption. In addition, the development of these markets will not only bring accessibility of inland fish for consumption but will also promote the value chain of inland fisheries in the study area.

COMPETING INTEREST

The authors declare that they have no competing interests.

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