CONTRIBUTION OF INDIGENOUS KNOWLEDGE PRACTICES TO HOUSEHOLD FOOD SECURITY: A CASE STUDY OF RURAL HOUSEHOLDS IN KWAZULU-NATAL

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ABSTRACT

The use of indigenous knowledge is a viable livelihood strategy for poor rural households. A binomial logistic regression model was used to demonstrate the effect of Indigenous knowledge practices (IKPs) on food security. Food availability at household level was used as a measure of food security using as a proxy the maize produced in 100 randomly selected households from five villages in KwaZulu-Natal. The IKPs were identified in pest management, fertility management, weeding, land preparation, seed and post-harvest storage. Households were able to secure food for an average of three to six months, and the significant effect of IKPs on food security was observed. Indigenous Knowledge feeds households in rural areas and focusing policy efforts on finding ways of enhancing and encouraging a perspective shift to that of approaching IKPs as a local source of resilience when it comes to food availability and access, could bring about one of the options for creating food-secure households in South Africa.

Keywords: Indigenous Knowledge Practices, food security, smallholder farmers.

INTRODUCTION

Household food insecurity is a topical issue in South Africa, which the government has set itself to address (Labadarios et al., 2009), and is contributed to by three main sources: insufficient food availability at national level, insufficient household food production or lack of economic power to purchase food, and inequitable intra-household access to food (Barrett, 2010). The second category is critical in South Africa due to poor agricultural production and increasing poverty levels. In 2011, more than two-thirds (68.8%) of rural dwellers in South Africa lived in poverty (Stats SA, 2014). KwaZulu-Natal (KZN) is amongst the provinces with a majority of poor households (Stats SA, 2014). A high proportion of the South African population comprises of rural dwellers (National Treasurer, 2011) who depend on smallholder agriculture as their main source of livelihood (Lopez, 2002). Some 92% of households, involved in smallholder agriculture in South Africa, farm for subsistence (Aliber and Hart, 2009).

The use of Indigenous Knowledge Practices (IKPs) in smallholder agriculture has been proposed for mitigating household food insecurity in South Africa (Agea et al., 2008, Thamaga-Chitja et al., 2004). Agea et al. (2008) defined Indigenous Knowledge as knowledge, including the social and natural well-being, continually influenced by local creativity, experimentation and by contact with external systems. Prices of staple foods, such as maize, which are mainly consumed by the low income population of South Africa living in rural areas,
have increased since 2008. Escalating food prices have meant that rural households in the poorer provinces of South Africa revert to greater reliance on their own production and divert their livelihood assets towards attainment of food security. In this regard, smallholder farmers use IKPs in their farming as a livelihood strategy. This article seeks to determine their effect on household food security.

**Indigenous Knowledge Practices in agriculture**

According to Ogle and Grivetti (1985) agriculture based on Indigenous Knowledge ensured the production of a variety of foods before the introduction of conventional agriculture. The discourse on use of Indigenous Knowledge agriculture emerged as an alternative to colonial policies, which emphasised economic maximisation in development strategies, where the latter led to scientific tools being promoted while IKPs were seen as backward and of low productivity. Dholakia and Dholakia (1992: 1) stated that modernising agriculture “consists largely of using improved seeds, modern farm machinery such as tractors, harvesters, threshers, and chemical inputs in an optimal combination with water”, while Haverkort (1995) identified agriculture based on Indigenous Knowledge as being low external input systems. According to Pretty *et al.* (1992), a low external input agriculture is one that has minimal association with modern farm inputs, access to marketing infrastructure, agro-processing facilities and credits sources. As such, Indigenous Knowledge becomes a tool that is structurally unfit for commercial food production systems. Proponents of agriculture based on Indigenous Knowledge such as Mervyn (2010) present it as an effective food production system that can lead to the reversal of environmental problems caused by conventional practices. Mervyn (2010) suggested that Indigenous Knowledge integration into soil sciences agendas will enhance strategies adopted for soil classification and agricultural development.

Soil fertility depletion has been identified as a fundamental reason for decreasing food production in Africa (Buresh *et al*., 1997). Smallholder farmers with small land sizes ensure that their land has enough nutrients by applying various indigenous knowledge and conventional knowledge practices (Salami *et al*., 2010). The IKPs in soil fertility management include the use of manure and composting (Lyimo *et al*., 2012). Mandumbu *et al.* (2011) identified various indigenous practices that people undertake during weeding. In recorded land preparation IKPs, animal traction is commonly used for tilling larger pieces of land and hand-hoes are mainly used in tilling small gardens (Sakala, 2000). Similar to weed management, land preparation by animal traction depends on household ownership of livestock, ability to hire traction services and availability of male labour.

Smallholders source pest management strategies from “built-in features in cropping systems, such as farm plot location, crop rotation, and intercropping, or on specific responsive actions to reduce pest attack, such as timing of weeding, use of plants with repellent or insecticide action, traps, scarecrows, smoke, and digging up grasshopper egg masses” (Abate *et al*., 2000: 642).
IKPs used for harvest processing and storage include maize-cribs, sacks, drums and tanks (Tefera and Abass, 2012; Thamaga-Chitja et al., 2004; Udoh et al., 2000). Maize-cribs have been found to be inefficient in terms of storage length, losses during storage and storage volume (Thamaga-Chitja et al., 2004). Preservation of seeds is an essential practice for the sustenance of traditional crops, which makes an important contribution to food production. The quality of stored seeds depends on strategies employed to prevent storage pests, insects, and unfavourable temperature (Talawar, 2005).

**METHODOLOGY**

Data were collected at household level from five rural villages of the Okhahlamba Local Municipality (OLM). A mixed method approach to data collection was used and involved the use of both qualitative and quantitative approaches. Two steps used during data collection were case studies and a sample survey. The first step involved 25 case studies of purposively selected households from the five villages. This stage collected details of the IKPs which households apply. The second step was a data collection survey of 100 households selected randomly to understand IKPs used by households for food production and ultimately food security. For analysis, descriptive statistics were used for analysing household characteristics. In addition, a binary logistic regression model was used for determining the effect of IKPs on household food security.

**Binomial logistic regression model**

The binary logistic regression model uses data from relevant independent variables to predict the probability of occurrence of an event (Hailu and Nigatu, 2007). In this article, the dependent variable was food security and is described below.

**Food security measurement (dependent variable)**

Food availability at household level was employed as a measure of food security. According to the World Bank (2008), households are primarily food secure when they achieve food availability through production of enough food for their requirements. Swaminathan and Bhavani (2013) suggested the use of the quantity of grains held at household level as a proxy when they account for a large share of food intake. Maize makes a large share of food intake for most rural households in South Africa (Twine et al., 2003). The National Agriculture Marketing Council (2014) classifies maize meal as the staple food in rural areas of South Africa. Therefore, the availability of maize is a significant determinant of household food security. Households that consumed their maize within seven to 12 months were regarded as food secure (assigned a value of 1 in the model). The rest of the households, who attained less than seven months of maize from their production, were considered food insecure (assigned a value of 0 in the model).
The Logit model is presented as:

\[ L_i = \beta_k X_i + \varepsilon_i \]

Where \( L_i = 1 \) if a household consumed its own maize for between 7 to 12 months in a year or 0 if otherwise (a household consumed its own maize for less than seven months in a year), \( \varepsilon \) is the error term, \( \beta \) is a vector of parameter estimates (coefficients) and \( X_i \) is a vector of independent variables at household level. The main independent variables included in the model were size of the land, household size, household income, use of indigenous inputs, conventional inputs and maize storage.

The size of the land that a household possesses should positively affect the amount of maize it can produce. Therefore, the duration of own maize consumption should be indirectly affected by the land size. Households with larger land sizes are expected to consume their own maize for a longer duration.

Household size is expected to have a negative effect on the duration of own maize consumption. The likelihood is that as more people in a household consume the maize it produced the fewer the months the maize will be available for consumption. Maharjan and Khatri-Chhetri (2006) looked at the relationship between socio-economic characteristics and food security status and found that food-secure households had small household sizes.

Household income affects the ability of a household to diversify its food consumption. Sen (1981) stated that income levels determine the ability of a household or an individual to access food. Thus, households with higher income may be able to purchase other cereal crops, thus reducing the consumption of their own maize. This prolongs the duration they consume the maize produced at household level. Therefore, the higher the income means maize should be available for a longer duration as their ability to diversify cereals and other foods is enhanced.

The use of indigenous inputs is generally seen as the reason for low production in smallholder farming. The critical stages in crop production, which can be adversely affected by use of indigenous inputs are pest management, fertility management, weed management, intercropping and seed sources. Therefore, IKPs are expected to negatively affect the amount of produce and duration of own maize consumption is expected to be shorter. By contrast, conventional inputs are generally viewed as more productive compared to the IKPs. The use of pesticides, herbicides, chemical fertilizers, and hybrid maize seed are related to high productivity. Thus, households using conventional practices are expected to be more likely to have maize available for a longer period compared to those using IKPs.

Maize storage can cause losses if measures such as temperature control, pest control, and protection from livestock or poultry are not taken into consideration (Udoh et al., 2000). Farmers store maize in metal tanks with conventional repellents, or in tanks without repellents. Others store their maize in maize-cribs with traditional repellents (plants or grass). Thamaga-Chitja et al. (2004) pointed out that the maize-cribs storage system is inefficient, as it is not protected from
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pests, harsh temperatures and livestock, compared to metal tanks and sacks. Udoh et al. (2000) found metal tanks and sacks are more susceptible to pests and diseases compared to a maize crib. The likelihood therefore is that storage in metal tanks without repellents will decrease the number of months of maize availability.

A test of a full model against a constant model was statistically significant, indicating that the independent variables reliably distinguished between the food secure households, i.e. have maize for 0 to 6 months, and the food insecure ones, i.e. have maize for seven or more months.

RESULTS AND DISCUSSION

This section presents the results on household characteristics, the analysis of the prevalence of IKPs and the results from the Logit regression model.

Household socio-economic status

Fifty-four percent (54%) of the households experienced food shortages. In addition to purchasing food, households incur other monthly expenditures, such as electricity charges, instalments towards accrued credit, school fees, and burial and community savings schemes. The majority of the households were female-headed while 54% had household heads older than 60 years. Some 57% of household heads had a primary education and only 14% had a secondary education. With regards to household income, 23% of the households had an income of less than ZAR 1,000\(^1\) and only 16% had more than ZAR 3,000 per month. The household sizes of sampled households ranged from one to 19 members, with an average of seven members. About 62% of the households had field sizes that ranged from 0.4 hectares to 1.5 hectares and garden sizes ranged from 8m\(^2\) to 705m\(^2\).

Household food production

In terms of agricultural production, 74% of the households were involved in field cropping, 76% planted garden vegetables, 65% owned livestock and 69% reared poultry. Some 45% of households were involved in the collection of wild foods. Maize was the main food crop planted in the fields, with ‘traditional’ maize being the predominant variety. Various crops were intercropped with maize. Tomato, spinach, cabbage, onion, carrot and beetroot were the main vegetables planted in gardens. Traditional crops such as yams, sweet sorghum, spring onion, sweet potato and pumpkin were planted by a small percentage of households.

Households kept cattle, goats, sheep and pigs as livestock. For poultry they kept chickens, turkeys and ducks. Table 1 shows livestock and poultry owned by the households.

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\(^1\) In 2014, US$1 was equivalent to ZAR 11.
Table 1: Livestock and poultry farming by smallholders in OLM.

<table>
<thead>
<tr>
<th>Livestock and Poultry categories</th>
<th>Frequency household (%)</th>
<th>Mean total number of livestock and poultry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of households keeping livestock</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Cattle</td>
<td>51</td>
<td>9</td>
</tr>
<tr>
<td>Goats</td>
<td>43</td>
<td>8</td>
</tr>
<tr>
<td>Sheep</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Pigs</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>35</td>
<td>–</td>
</tr>
<tr>
<td>Total number of households keeping poultry</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>Chickens</td>
<td>69</td>
<td>16</td>
</tr>
<tr>
<td>Ducks</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>Turkey</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>31</td>
<td>–</td>
</tr>
</tbody>
</table>

Cattle and goats were consumed approximately once a year. Chickens were consumed on a monthly basis and at least two chickens were consumed per household in a month. Some large birds and animals such as turkey, ducks, pigs and sheep were rarely consumed.

Use of IKPs in the OLM

Households used IKPs in farm activities such as pest management, fertility management, seed storage, land preparation and post-harvest processing. IKPs in pest management were applied for seed storage, planting and post-harvest processing. Concoctions to combat pests were prepared using combinations of resources like paraffin, salt, and vegetables and plants from gardens and surrounding areas. For weed management, households used cured manure prepared by heaping fresh manure outside the cattle pen. In addition, farmers burnt their kraal manure to eliminate the weed seeds. They also use hand-hoe weeding. For soil fertility management, households mainly used kraal manure mixed with chemical fertilizers, while other practices were the use of ashes and composts of different forms. Households used maize-cribs, bags, tanks and basins for post-harvest storage. Households stored seeds using pest concoctions, soot, drying and storage in bottles or plastic bags. For land preparation, animal traction and hand-hoes were used.

Some practices involved both indigenous and conventional knowledge, such as using mixtures of cattle manure and chemical fertilizers (61%). Households used conventional practices mainly in pest management and land preparation. About 80% of households stored their own seed, of which 76% stored maize seed. Only 30% of the households used hybrid maize. About 91% of households used a hand-hoe for weed management and herbicides were used by only 13% of households.
Consumption of crops produced using IKPs and conventional practices

Households in the OLM areas relied on food from crops such as maize (100%), beans (19%), pumpkin (39%), tomatoes (74%), spinach (76%), cabbage (75%), beetroot (47%), onion (52%) and carrots (54%) for an average of three to six months. Table 2 shows the number of months for which households consumed each crop.

Table 2: Monthly and daily consumption of the staple crops in the OLM.

<table>
<thead>
<tr>
<th>Crops</th>
<th>Percentage of households</th>
<th>Average number of months a crop was consumed</th>
<th>Average number of days per week a crop was consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>100</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Beans</td>
<td>19</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>39</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>74</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Spinach</td>
<td>76</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Cabbage</td>
<td>75</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Beetroot</td>
<td>47</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Onion</td>
<td>52</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Carrots</td>
<td>54</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Results of the Logit regression model

Table 3 presents the results of the Logit regression model, where the dependent variable is a binary variable depicting the number of months that households consume their own production.

Table 3: IKPs’ effect on household food availability.

<table>
<thead>
<tr>
<th>Predictors (independent variables)</th>
<th>B</th>
<th>S.E.</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional maize</td>
<td>-2.935</td>
<td>2.239</td>
<td>0.190</td>
</tr>
<tr>
<td>Hybrid maize</td>
<td>-1.670</td>
<td>1.920</td>
<td>0.384</td>
</tr>
<tr>
<td>Intercropping</td>
<td>-3.331</td>
<td>1.237</td>
<td>0.007***</td>
</tr>
<tr>
<td>Pesticides</td>
<td>1.358</td>
<td>1.086</td>
<td>0.211</td>
</tr>
<tr>
<td>Traditional pesticides</td>
<td>5.616</td>
<td>1.934</td>
<td>0.004***</td>
</tr>
<tr>
<td>Herbicides</td>
<td>-2.991</td>
<td>1.673</td>
<td>0.074*</td>
</tr>
<tr>
<td>Manure</td>
<td>-21.609</td>
<td>12285.360</td>
<td>0.999</td>
</tr>
<tr>
<td>Fertilizers</td>
<td>1.570</td>
<td>1.031</td>
<td>0.128</td>
</tr>
<tr>
<td>Household income</td>
<td>0.002</td>
<td>0.001</td>
<td>0.002***</td>
</tr>
<tr>
<td>Household size</td>
<td>-0.379</td>
<td>0.201</td>
<td>0.059*</td>
</tr>
<tr>
<td>Land size</td>
<td>1.308</td>
<td>0.615</td>
<td>0.033**</td>
</tr>
<tr>
<td>Maize storage-tanks or sack bags (repellents)</td>
<td>-1.981</td>
<td>1.432</td>
<td>0.167</td>
</tr>
<tr>
<td>Maize storage-tanks (no repellents)</td>
<td>-3.618</td>
<td>1.607</td>
<td>0.024**</td>
</tr>
<tr>
<td>Maize storage-crib (repellent plant)</td>
<td>-1.093</td>
<td>4.443</td>
<td>0.806</td>
</tr>
<tr>
<td>Constant</td>
<td>0.607</td>
<td>2.588</td>
<td>0.815</td>
</tr>
</tbody>
</table>

*significant at 10% level, **significant at 5% level, ***significant at 1% level, number of observations = 74, Log likelihood value = 42.042.
The regression results show that $X^2=51.211$ (p=0.01) and a Nigelkerke $R^2$ of 0.697 indicated a moderately strong relationship between prediction and grouping. Prediction success overall percentage was 86.5% (90% for 0 to 6 months and 79.2% for 7 to 12 months).

Seven variables emerged as having a statistically significant effect on the duration of maize availability for consumption during the year. The variables are intercropping (p=0.007), traditional pesticides (p=0.004), herbicides (p=0.074), household income (p=0.002), household size (p=0.059), land size (p=0.033) and maize storage in containers without repellents (p=0.024) (Table 3). Intercropping has a negative effect on the duration of maize availability. Even though intercropping has its strengths in weed control (Mandumbu et al., 2011) and pest control (Abate et al., 2000), the results show that a shift from monocropping to intercropping decreases the log odds of the duration of consumption of own maize. This relationship was expected because the smallholder households have small land sizes, which on average are 1.5 hectares, and may not be ideal for practising intercropping. According to Lahiff and Cousins (2005), because of small land sizes, smallholder farmers in South Africa prioritise the production of staple foods. Thus the results indicate that those who prioritised their land for monocropped maize production had more produce and thus increased the duration of maize consumption, holding other factors constant.

Land size had a positive effect on the duration of own-maize availability. This indicated that the odds ratio of a likelihood of increased duration of own-maize availability increases with land size. The own-maize availability increases as a household accesses more land.

Use of IKPs in pest management had a positive effect on the duration of own-maize availability. A shift from non-user to user of IKPs-based pesticides increases the log odds that the duration of own-maize availability will increase.

According to Singh and Satapathy (2003), the lack of harvest processing and storage results in a substantial loss of produce. As was predicted, the storage of maize without repellents had a negative effect on own-maize availability. Storage in metal tanks with repellents and maize-cribs had unexpected signs, but were not significant. All the storage practices had a negative effect on the duration of own-maize consumption. This finding agrees with that of Thamaga-Chitja et al. (2004) and Udoh et al. (2000) who noted that smallholders’ storage facilities cause food losses.

Household size and duration of consumption of own-maize had a negative relationship. Every unit increase in household size was associated with a decrease in the number of months a household consumed its own-maize produce. Household size had a significant negative effect on household own-maize availability.

Total household income had a positive effect on the duration of own maize consumption. An increase in income increased the log odds of own-maize being available for consumption. Financial access could also mean access to inputs.
required for productive farming, and therefore more maize for consumption. Food availability, i.e. the number of months a household has or consumes maize produced on the farm, relates more to the household’s ability to purchase other cereals to diversify food choices and prolong consumption of maize produced on the farm.

CONCLUSION

The article shows that IKPs have a significant role in enhancing household food security in rural communities. This is demonstrated by the number of months smallholders secure food, using inputs derived from Indigenous Knowledge. However, these IKPs were seldom practised on their own but in a modified form. Findings suggest that there is a need for the improvement of IKPs that had a negative effect on household food security. Some IKPs are threatened due to the need for households to prioritise staple food production and cannot be used effectively despite their evident benefits. Intercropping, a practice vital for crop diversification and weed management faces such a challenge.

The article extends the body of knowledge that advocates the significance of Indigenous Knowledge on attaining household food security for smallholder farming in general, and in South Africa, in particular. The research also enhanced arguments that Indigenous Knowledge and conventional knowledge must be viewed as complementary with potential to jointly enhance the food production system. Incorporating IKPs in food security strategies should be encouraged as they are physically, financially and socially accessible for food production, and therefore critical for use as a household food security strategy.
REFERENCES


