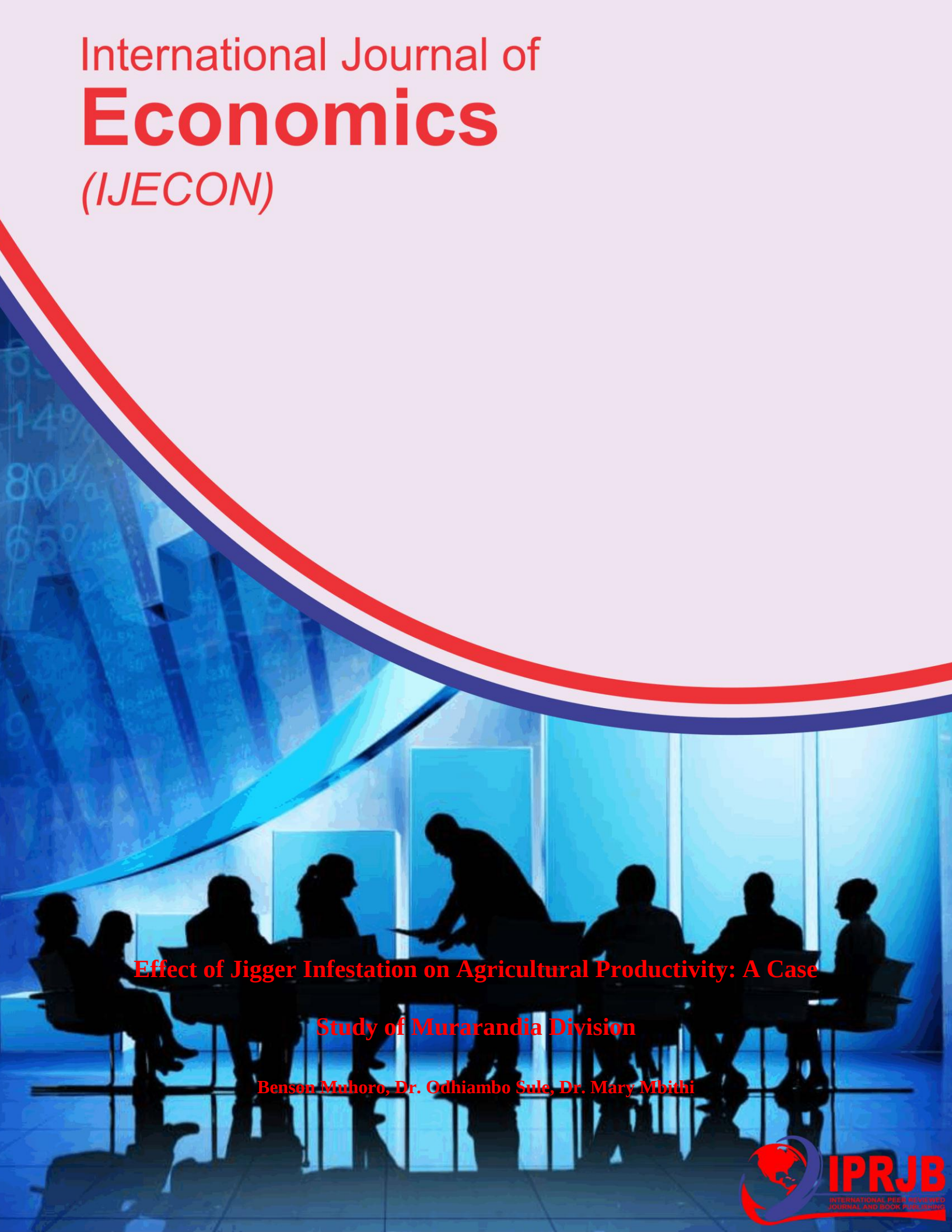
International Journal of
Economics
(IJECON)



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IPRJB
INTERNATIONAL PEER REVIEWED JOURNAL AND BOOK PUBLISHING

International Journal of Economics
ISSN xxxx-xxxx (Paper) ISSN xxxx-xxxx (Online)
Vol.1, Issue 1 No.1, pp 1-11, 2016

IPRJB
INTERNATIONAL PEER REVIEWED JOURNAL AND BOOK PUBLISHING
www.iprjb.org

Effect of Jigger Infestation on Agricultural Productivity: A Case Study of Murarandia Division

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Abstract

Purpose: The study investigated the effect of jigger infestation on agricultural productivity among the farmers of Murarandia, which is a Sub County in Murang'a. Specifically, extent and effect of jigger infestation on agricultural productivity was investigated. The study also sought to provide recommendations on jigger menace handling to government and humanitarian policy makers.

Methodology: The population of the study consisted of 28,943 households in Murarandia division Murang'a County according to the 2009 Kenya census report. The sample size was 384 households. This study used primary data which was analyzed using STATA. Inferential analysis was achieved using an ordinary least square regression model. T-test was also used to test whether there was a statistical difference in the mean production of infected and uninfected labour.

Results: The study findings revealed that 67.35% of farmers in Murarandia Division in Muranga County are infected with Jiggers. That figure is higher than the prevalence rate of 4.5% of Kenya. Findings also indicated that when uninfected labour is used, then one unit of capital produces 2.072 units of annual production whereas when jigger infested labour is employed, then one unit of capital produces 1.235 units of annual production. The study findings revealed that more output is realized when uninfected labour is used (2.093 versus 1.3171 units). Jigger infested labour produces 0.7759 units less than uninfected labour.

Unique contribution to theory, practice and policy: From the study findings, it is recommended Muranga County government should create awareness about effects of jigger infestation through media campaigns. The county government should also have deliberate policies to treat, free of charge, those infested with jiggers. The county government in a bid to reduce the infestation rate should deliver fumigants to residents of the area.

Keywords: jigger infestation, agricultural productivity

INTRODUCTION

Health is a key factor if productive results are to be realized from any activity. Health educators and health professionals worldwide agitate for total commitment to good health as a way of life. Health is the physical, mental and social wellness of a person. According to Kelly and Lewis (1987) an individual cannot be active and productive in his/her day to day activities if they are unhealthy. The new Constitution of Kenya plays a key role in matters concerning health. It focuses on how health standards can be improved, how inequalities in health can be addressed and how poverty can be alleviated (Kenya Health Policy, 2012-2030). The policy states that quality health is a right of every citizen of Kenya According to the policy; every Kenyan citizen has a right to the highest attainable health standard including sanitation and clean heath environment. Even though this is the case, majority of the residents of Murarandia are jigger infested.

The jigger flee is dominant among the population of sub-Saharan Africa, the Caribbean and South America with a potential to infection of more than 70 developing countries. The infection has an influence on labour as it leads to foot localization which makes the infected have difficulty in walking. The situation is said to be aggravated by existence of poverty among the infected communities (Heukelbach, Frank & Feildmeier, 2004). The demand for agricultural output is affected by health status. The quantity, demanded, quality of food provided and the different types of food supplied is affected by both malnutrition and disease patterns which affects the labour. According to Sur et al (1999) and (Antle et al, 1994), the nutrition status of an individual affects the health of the individual and hence the labour the individual can provide in terms of how long they can work.

According to Ahadi Trust (2011), the number of people infested with jiggers of which half are children is in excess of 2.6 million. The effects of the infestation range from dropping out of work, school or economic activity. In order to realize the Millennium Development Goals (MDG) and Vision 2030 and eradicate poverty and hunger, this problem of jigger infestation needs to be solved. Central province is the most affected with the menace of jiggers. According to Ahadi Trust reports (2012), Murang'a County had approximately 6,200 jigger infested school going children. Earlier reports had indicated that Murarandia Sub County had reported that more than twenty jigger victims were admitted at Maragwa District hospital.

Problem Statement

According to FAO (2006), 80 per cent of Kenyans depend on agriculture and is a contributor to the country's GDP in the tune of 25 per cent. In Murang'a, jigger infested people are not able to participate fully in social, political and economic activities. There is a high number of people who cannot attend to farm duties, children who cannot attend school and caregivers who cannot attend to their duties because of the infestation (Ahadi Kenya, 2011). Ahadi Kenya (2011) reports that in Murang'a County, there was a high rate of stigmatization among the jigger victims and this makes them shy away from seeking treatment because of fear of being recognized.

Studies on health have mainly focused on health conditions such as parasitic infections like Malaria and other conditions like HIV, Tuberculosis, cancer and malnutrition (Makena, 2013). These studies did not establish the effects of poor health on productivity in the agricultural sector. The health conditions looked at was not related to jiggers. Available studies suggest that jigger infestation has a negative impact on people's health (Collins, 2009) but the relationship

between jigger infestation and agricultural productivity has not been given much attention. Thus, there was need to conduct an empirical study to find out whether such a relationship existed. This study therefore analyzed the effects of jigger's infestation on agricultural productivity with a focus on Murarandia Division.

Objectives of the study

i) To establish the extent of jigger infestation in Murang'a county.

ii) To analyze the effect of jigger infestation on agricultural productivity within Murang'a county.

iii) To provide recommendations on jigger menace handling to government and humanitarian policy makers.

Theoretical literature

The Human Capital Theory: Health as a Human Capital

The human capital theory states that an increase in the knowledge of an individual and also their health leads to an increase in their market and non-market productivity. The time of labour available to them is determined by health while the knowledge they have affects their productivity (Grossman, 1972). According to the theory, human capital, just like any other type of capital, depreciates and hence investments should be made to it in order to restore it. The investment can come in form of nutrition, health care, education, training and exercises. Becker (1962) stated that proper model for managing the health benefits are provided for by the human capital theory. The essential idea is that human beings can be regarded, among other things, as a stock of capital. According to the theory, workers who are not functional impose costs through labour time lost through absenteeism. A worker's productivity levels can be improved through therapeutic and preventive health care services which lead to an increase in the stock of human capital. A healthy person has more time to provide labour service (Mushkin, 1962). They have higher mental acuity and stamina to work as compared to unhealthy workers. This underlies the reason behind investing in proper health care through curing and preventing diseases. Incentives to invest in health capital are therefore powerful, just as they are by investing in education and job training.

Investment in health compliments investments in education and training because healthy people will work at a higher level of intensity. Their returns will also be higher if they are educated and healthy (Gillis, Malcolm, Dwight, Michael and Donald, 1987).

The relevance of this theory to the current study stems from the observation that jigger infestation affects the health of the farmers. By extension it may have a negative effect on productivity. Other aspects of health that may impact on productivity include chronic and non-chronic diseases. Training by extension officers and the level of education are important aspects of the human capital theory. They may also influence productivity in similar fashion to jigger infestation.

Production Functions

It is a function which relates the physical output to physical inputs. It is one of the key concepts of mainstream neoclassical theories. It is mainly used to allocate resources used as inputs in an efficient way in the process of production Daly, 1997).

The Cobb-Douglas Production function is an example of a production function which represents the technological relationship between the quantities of two or more inputs. For example, the function can be used to indicate the output which can be realized form the combination of different quantities of like physical capital and labor as stated by Cobb and Douglas (1928).

It can be expressed mathematically as shown below:

Y=F (K, L)

$$Y_t = A_t L_t^{\alpha} \quad K_t^{\beta} + e \qquad (2)$$

Where A represents technological advancement, L represents Labour and K represents Capital.

The function is significant to the study because the study investigated different amounts of agricultural production realized from the use of different inputs including two different sets of labour; that is, infected and uninfected labour.

Empirical literature review

A study was conducted by Audibert et al. (2003a, 2003b, 2009) to investigate the economic effect of malaria in Cote d'Ivoire. The study findings were not consistent. The findings showed that malaria is a limiting factor for property accumulation because it reduces the living standards of households as well as also indicating that malaria negatively affected the farmer's technical efficiency. Furthermore, other results indicated that malaria had no effect on economic activity. Baldwin and Weisbrod (1974) conducted a study in Santa Lucia to examine the effects of parasitic diseases on agricultural productivity capturing productivity in terms of earnings per week. The results of the study indicated that parasitic infections have statistically significant negative effects on agricultural labor productivity.

Another study was conducted by Audibert and Etard (2003) using longitudinal data to estimate worker productivity benefits of health. The study findings indicated that there was an increase of 26 percent of the production per family labor person per day in the experimental group as compared to the control group.

A study by Fox et al. (2004) to find out the attendance and productivity of tea estates in the western part of Kenya. The findings of the study revealed that those workers who were not infected with HIV/AIDS plucked between 4.11 and 7.93 Kgs more than those infected with HIV/AIDS. Looking at the number of sick leaves requested for, the study established that those workers who were not infected with HIV/AIDS had sick and annual leave days as compared to those who were infected. The study also found out that the earnings of pickers whose contract was terminated because of HIV/AIDS earned 18 percent less in the final year before their termination. On the other hand, while investigating whether malaria had an effect on productivity of farmers in Côte d'Ivoire, Girardin et al. (2004) established that farmers who were suffering from malaria produced half the yields and incomes which those not suffering produced.

In another study which used Cobb Douglas production function, Kim et al (1997) investigated whether jiggers had an effect on productivity of coffee in south western part of Ethiopia. The findings of the study revealed that those male farmers suffering from jigger infestation suffered significant losses in economic productivity. The study also found out that, those farmers above the age of 35 years had diminished earnings.

Another study was carried out to investigate the effects of jigger infestation Murang'a County by Nyagero, et al; (2012). The study used a cross-sectional descriptive study design on a sample size of 271 household. The study findings revealed that higher odds of jigger infestation were associated with low productivity.

A stochastic production function was used by Ulimwengu (2009) in Ethiopia to establish whether the impediments of farmers affected efficiency in agricultural production. The study findings revealed that healthy farmers had more produces and labour supply than unhealthy farmers. Furthermore, the study also indicated that there is inefficiency in production due to the number of days lost as result of physical incapacitation or sickness.

Ajani and Ugwu (2008) conducted a study to investigate the relationship between health conditions and agricultural production in north central part of Nigeria. The study established that an improvement in the health of a farmer is positively related to agricultural productivity.

RESEARCH METHODOLOGY

The study adopted Cobb-Douglas Production function because it investigated different amounts of agricultural production realized from the use of different inputs including two different sets of labour; that is, infected and uninfected labour. Since production is involved, this model was the most suitable. The study used econometric model as an empirical model. Various variables included in the model were measured and operationalized. The target population was 28,943 Households in Murarandia division in Murang'a County according to the 2009 Kenya census report. The study used stratified random sampling technique and convenience sampling to come up with the sample. The sample size of 384 was selected using Fisher formula. This study used questionnaires to collect primary data. Pilot study was conducted in the five homes with similar background with the same instrument which was used in the actual study to ascertain validity. Reliability was also investigated using Cronbach's alpha.

RESULTS AND DISCUSSIONS

4.1 Descriptive statistics

A response rate of 195/384 (50.7%) was obtained for the study. The response rate was considered adequate given the logistical and geographical diversity of the study area.

Table 1 Descriptive Statistics (Frequency and Percentage)

Variable	Frequency	Percentage
Gender		
Female	90	46.43
Male	105	53.57
Jigger Infestation		
Not infected	64	32.65

Infected	131	67.35
Chronic Diseases		
Suffering	61	31.12
Not suffering	134	68.88
Education level		
Primary	128	65.31
Secondary	53	27.55
College	14	7.14
Marital status		
Single	2	1.02
Married	170	86.73
Widowed	20	10.71
Divorced	3	1.53

Descriptive results in Table 1 indicated that 67.35% of farmers who responded are infected with Jiggers. This implies that prevalence of jigger infestation among farmers in Murarandia Division in Muranga County is higher than the prevalence rate of 4.5% of Kenya. Descriptive results also indicated that only 46% of the respondents were female implying that the majority (54%) of the respondents were male. This implies that majority heads of households in the division are men. Only 31.12% of the respondents suffer from chronic diseases. In relation to education level of the respondents, majority of the respondents (65.31%) had primary education as the highest level of education, 27.55% had secondary education as the highest level of education while only 7.14% had college education as the highest level of education. This implies that majority of the respondents were poorly educated. Majority (87%) of the respondents were married while 11% were widowed.

4.2 Regression analysis.

Before running the regression model, multicollinearity was tested using both correlation matrix and variance inflation factors. No variable recorded VIF values greater than 10 hence there was no problem of multicollinearity. The Normality of the residuals was also tested using the graphical method and the residuals were found to be normally distributed.

Regression was run with jigger infested labour and with uninfected labour so as to compare the two.

Table 2 Regression Results with uninfected labour

				Number of observations =64		
				F(10, 53)		4.96
				Prob > F		0.000
				R-squared		0.4834
				Adjusted R-squared		0.3859
Annual production	Coefficients	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Age	-1257.71	2068.729	-0.61	0.546	-5407.05	2891.638
Gender (Male)	46766.25	45391.93	1.03	0.308	-44278.4	137810.9
Education level						
Secondary	216417.4	46256.5	4.68	0.000	123638.6	309196.2
Tertiary	181213.8	126184.5	1.44	0.157	-71880.1	434307.8
marital status						
Divorced	-91584.1	135339.2	-0.68	0.502	-363040	179871.9
Married	-124917	223493.9	-0.56	0.579	-573189	323354.7
capital	2.093054	0.481301	4.35	0.000	1.127687	3.058421
Training frequency	-10089.5	22102.73	-0.46	0.65	-54422	34242.96
chronic	-99776.6	119571.3	-0.83	0.408	-339606	140053
Constant	255544.1	173651.2	1.47	0.147	-92756.1	603844.2

The regression model with uninfected labour has a coefficient of determination of 0.4834 which implies that 48.34 % of changes in the amount of production is explained by the predictor variables. The results also indicate that when jigger uninfested labour is used; secondary level of education and capital used significantly affect annual production. Secondary level of education has a positive and significant relationship with annual production.

The relationship between capital and annual production is also positive and significant. The results indicate that when uninfected labour is used, then one unit of capital produces 2.0 units of annual production. Regression was also run using jigger infested labour and the results are as presented in Table 3.

Table 3 Regression Results with jigger infested labour

				Number of observation =131		
				F(9, 121)		17.87
				Prob > F		0.00
				R-squared		0.5707
				Adjusted R^2		0.5387
Annual production	Coefficients	Std. Err.	t	P>|t|	[95% Conf.	Interval]
age	98.8485	864.0286	0.11	0.909	-1611.72	1809.421
Gender(Male)	-9157.774	17294.88	-0.53	0.597	-43397.6	25082
Education level						
Secondary	149072.8	21372.07	6.98	0.000	106761.1	191384.5
Tertiary	52554.26	31218.58	1.68	0.095	-9251.16	114359.7
Marital status						
Divorced	27067.81	28732.06	0.94	0.348	-29814.9	83950.51
Married	-260298.2	71958.9	-3.62	0.000	-402760	-117837
capital	1.317113	0.163108	8.08	0.000	0.994197	1.640029
Training frequency	9263.331	9318.186	0.99	0.322	-9184.48	27711.14
chronic	-11410.76	25433.49	-0.45	0.654	-61763.1	38941.54
constant	78592.58	45313.13	1.73	0.085	-11116.7	168301.9

The regression model with jigger infested labour has a coefficient of determination of 0.5707 which implies that 57.07% of changes in the amount of production is explained by the predictor

variables. The results further indicate that Secondary level of education; married marital status and capital are significantly related to annual production.

The relationship between capital and annual production when jigger infested labour is employed is positive and significant. The results indicate that one unit of capital produces 1.3171 units of annual production.

The comparison between the uninfected labour and jigger infected labour reveals that more output is realized when uninfected labour is used (2.093 versus 1.3171 units). Jigger infested labour produces 0.7759 units less than uninfected labour. The implication is that, jigger infestation leads to low agricultural productivity.

4.3 T-test to compare mean annual production of jigger infested and uninfected labour

The study also conducted t-test to test for statistical difference between the mean annual production of jigger infested labour and that of uninfected labour so as to ascertain the productivity of the two groups.

Table 4 T-test

Two sample t test with equal variances							
Group	Observations	Mean	Std. Err.	Std. Dev.	Null hypothesis	P value	Decision
Uninfected	64	294701.4	25850.26	206802.1			
Infected	131	175396	12362.87	141499.5	H0: There is no difference in mean	Pr (T>t)=0.000	Reject null hypothesis
combined	195	214552.6	12498.14	174527.1			
diff		119305.5	25265.99				

Results in Table 4 indicates that jigger infected labour has a mean annual production of 175396 Kenya shillings while uninfected labour has a mean annual production of 294701.4 Kenya shillings despite the fact that infected respondents were more than uninfected. The results indicate that there is a statistical difference between the mean annual production of infected and uninfected labour. Jigger infested labour produces Kshs. 119305.5 less than uninfected labour. This therefore leads to the conclusion that the productivity of jigger infested labour is lower as compared to uninfected labour.

CONCLUSIONS AND CONTRIBUTION TO POLICY PRACTICE AND THEORY

Conclusions

The main objective of the study was to determine the effect of jigger infestation on agricultural productivity among farmers of Murarandia Division in Muranga County.

The first objective of the study involved detrmining the extent of jigger infestation in Murarandia Division in Murang'a County. Study findings indicated that 67.35% of farmers who responded are infected with Jiggers. This implies that prevalence of jigger infestation among farmers in Murarandia Division in Muranga County is higher than the prevalence rate of 4.5% of Kenya.

The study furthermore analyzed the effect of jigger infestation on agricultural productivity in Murarandia Division in Muranga County. Findings indicated that when uninfected labour is used, then one unit of capital produces 2.072 units of annual production whereas when jigger infested labour is employed, then one unit of capital produces 1.235 units of annual production. The study findings revealed that more output is realized when uninfected labour is used (2.072 versus 1.235 units). Jigger infested labour produces 0.837 units less than uninfected labour. The study hence concluded that jigger infestation leads to low agricultural productivity among farmers of Murarandia Division in Muranga County

Recommendations for policy, practice and theory

The County government of Muranga should liase with its health department in a bid to reduce jigger infestation in the county. There is need to eradicate jigger infestation because it negatively affects the agricultural productivity in the area as it has negative effects on health. Among the ways to eradicate jigger infestation is creation of awareness through the media. The county government should have campaigns to educate the residents on importance of clean environment free from dust which are incubating grounds for jiggers. The residents should also be educated on different ways of controlling and treating infestation.

The county government should also have deliberate policies to treat, free of charge, those infested with jiggers. It should be noted in all hospitals that treatment of jigger infested patients requires no payment. The county government in a bid to reduce the infestation rate should deliver fumigants to residents of the area. The county government should have a deliberate policy to freely supply the fumigants to infected families.

Suggestions for Further Research

A comparative study should be done between various Divisions within Muranga County as well as other Counties to compare and contrast the findings as far as effects of jigger infestation on agricultural productivity are concerned. Other studies should also focus on the effect of jigger infestation on other sectors of the economy apart from the agricultural sector.

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