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THE IMPACT OF TUBERCULOSIS (TB) ON FARMER'S INCOME, IN EASTERN SUDAN, WITH SPECIAL REFRENCE TO GASH DELTA, KASSALA STATE, SUDAN

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Abstract: **The study is designed to evaluate the impact of TB on farmer's income in the Gash delta. It depends mainly on primary and secondary data, the primary data was collected by questionnaire through direct interview of the respondents in the Gash delta agricultural scheme. The sample covers 100 farmers of TB morbidity and debility cases selected randomly from the farmers in the area, using the registration list in Aroma, Kassala and Wager hospitals after diagnosis of the disease, another 100 healthy farmers were selected using the same method of sample selection. (The total sample size was 200 farmers). Secondary data was collected from different sources related to the field of the study. Statistical procedures were used, including frequencies and inter-correlation matrix for the selected variables. The principal results are summarized in the following points:**

There is a strong positive correlation between farmer's annual income and the following variables: Age, Educational level, family size, Number of working daily hours, Annual expenditure, Price per unit of output, Farmer's productivity and strong negative correlation with infection. Finally, a set of recommendations were generated which aimed to reduce TB infection and disease in the Gash delta:

1- Periodic test and prevention of the disease.

2- Isolation of the patient farmers with active disease, before starting effective anti-tuberculosis therapy, so as to break the chain of transmission of the disease among the farmers.

3-Adequate TB control and management program is needed and integration into primary health care.

4- There is a need of health education to teach the farmers about TB disease and how to avoid its infection.

5- Aroma hospital should have to coordinate with the Gash delta agricultural scheme to play an effective role in reaching and looking after the patient farmers.

6- The Gash delta agricultural scheme management should have to seek a way for supporting the patient farmer's income.

7-The state government should have to compensate the infected farmers for the lost seasons.

8- Incorporate the international NGOs.

I. INTRODUCTION

1.1 Tuberculosis in the Sudan

Tuberculosis remains one of the formidable public health challenges in the Sudan. Meager resources and underdeveloped health infrastructure with devastating ongoing civil war since 1955 aggravate the situation. Collins, S. (1996) was the pioneer who studied tuberculosis in Sudanese and Egyptian armies. To his amazement, he found that the incidence of the disease was much Counterparts. Between 1902-1908 he reported an average annual incidence of 3.7 per 1000 in Sudanese and 1.5 per 1000 in Egyptian. From these observations Collins, S. (1996) advanced his theory of virgin soil that the isolated communities were more susceptible to infection than the advanced societies. Collins also observed that

tuberculosis was less frequent or complete absent in the Sudanese tribes in their national surrounding, including their cattle. In contrast to Cummins observations Bergen. (1967). asserted that the Sudanese had much more susceptibility and predisposition particularly to Tuberculosis because pulmonary tuberculosis is very common amongst the native Sudanese. No doubt due to the fact that they live in ill-ventilated mud dwellings, the main object of which is to exclude the powerful rays of the sun. Though this statement is generally true, yet it is not accurate because the rural Sudanese never stay indoors during the day time as they go about their economic activities as example cattle rearing, cultivating, and fishing …..Etc. Moreover some communities in the semi-arid areas do not dwell in mud huts but rather in well ventilated tents.

1.2 Socioeconomic Impact of Tuberculosis

Tuberculosis (TB) is essentially a disease of social and economic deterioration (Barr and Menzies, 1994). In fact the close connection between social and economic deprivation and the emergence of tuberculosis is well known, Rieder HL, (1994). Many authors have acknowledged that people who are cut-off from income Opportunities become vulnerable for diseases like tuberculosis. Tomes, for instance, reflecting in her essay review on new work about the history of tuberculosis, cites an English public health authority who, as early as 1903, noted that the drops in tuberculosis mortality closely parallels the decline in wheat prices, (Dhesi, 1989).

1.3 Problem Statement

Tuberculosis is not only a health problem it is a social and economical disease.75% of cases of TB occur among the productive age group (20-50 years) .Studies have found that untreated TB can lead to 20-30% reduction of household annual wages.

In the Sudan studies suggested that the rate of infection was 1.8% i.e. 1800 persons out of 100,000 persons which considered to be the highest rate of infection in the world. In the eastern region – where agriculture plays an important role in the economical and social development of the region and it satisfied the local demand for food as well as the demand in other regions in the country – The rate of TB infection increased up to 4% i.e. 4000 persons out of 100,000 persons.

1.4 Overall and Specific Objectives

1.4.1 The Overall Objective

The fundamental objective of the study is to assess the socioeconomic impact of Tuberculosis (TB) on farmer's income in the Gash Delta in the eastern region of the Sudan; to achieve this objective the study sought the following specific objectives.

1.4.2 The Specific Objectives

1- Determining the farmer's personal characteristics in the study area.

2-Determining the factors affecting farmer's income in the study area.

3-study the impact of Tuberculosis (TB) on farmer's income in the study area.

4-To suggest some recommendations and issues for policies implications to enhance the state of development, encourage farmer's income in the study area.

1.5 Hypotheses to Be Tested

The hypotheses listed below, are formulated to represent and satisfy the objectives of the study.

Due to TB morbidity, there is a difference between the infected and healthy farmers with respect to:

- Age.
- Secondary occupation.
- Marital status.
- Educational level.

- Family size.

A- Agronomic activities, which include:

- Total cultivated area.
- Time of sowing the crop.
- Time of harvesting the crop.
- Cultivation cost.
- Crop marketing.
- Numbers of working hours per day.
- Labour cost.
- Crop market price.
- Farmer's productivity.

B- There is a strong positive correlation between farmer,s annual income and the following factors:

1. Age.
2. Educational level.
3. family size.
4. Number of working daily hours.
5. Annual expenditure.
6. Price per unit of out put.
7. Farmer's productivity.

and strong negative correlation with infection.

1.6 Justification

- TB is essentially a disease of social and economic deterioration.
- 75% of cases of tuberculosis occur among the economically productive age group (20-60 years) .
- It has a negative impact on the household income due to cost of traveling to diagnosis, and nursing.
- TB causes social ramification due to isolation or rejection.

II. RESEARCH METHODOLOGY

This section describes the methods utilized to gather data for this research, it includes:

(a) The study area

(b) Sample design and sample selecting Technique

(c) Data analysis procedures

(d) Ethical Considerations.

2.1 The study area

This study was conducted in the Gash delta in Kassala state in the eastern region of the Sudan. The area represents one of the main agricultural areas in the country. It was selected based on the fact that agriculture in this area plays an important role in the economical and social development of the region and it satisfied the local demand for food as well as the

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demand in other regions in the country. TB prevalence rate is high. (The rate of TB infection increased up to 4% i.e. 4000 persons out of 100,000 persons) .

2.2 Methods of Data Collection

2.2.1 Population of the study

All farmers in the Gash delta were considered for the purpose of this study. The population is more or less homogeneous, they are mostly of the Hadendwa tribe, they are similar in their customs and they grow the same crops.

2.2.2 Determination of Sample Size

For the determination of the sample size we use the following equation :-

$$n = \frac{K \times V}{D}$$

K = Z value (the normal deviation of 0.90 probability) =1.78

V = the estimated variance (2.8).

D = the magnitude of the difference to be detected (0.05).

$$n = \frac{1.78 \times 2.8}{0.05} = 99.7 = 100$$

2.2.3 Selecting Sampling Technique

Random sample of 100 infected farmers were selected from the diagnostics cases (positive smear) in Aroma and Weger (Hadalya) hospitals using registered list as guide line. Another 100 healthy farmers is also selected using the same procedure of sample selection, which used as control, the total sample size is (n=200).

2.2.4 Data collection

The Information were collected using two main sources of data collection:

Secondary Source: depending on references such as previous studies, different ministries reports, offices.
Primary Source: depending on direct observation and questionnaire technique. There are two types of questionnaires, the first one for the respondents including the following information.

2.2.5 Data Analysis

The data were processed and transformed to computer coding form. Then fed to the computer to calculate the following:

1. Frequencies.
2. Inter-correlation matrix for the selected variables.

III. ANALYTICAL RESULTS

This chapter will present the analytical results of the study, which includes:

3.1 Frequency distribution

3.1.1 Personal characteristics of the farmers in the Gash area

3.1.1.1 Sex

100% of the farmers in the Gash area were male, Table (1).

Table (1): Frequency distribution of farmers according to sex in the Gash area.

Sex	Patient (n = 100)		Healthy (n = 100)		Total sample (n = 200)	
	Freq.	%	Freq.	%	Freq.	%
Male	100	100	100	100	200	100
Female	0	0	0	0	0	0
Total	100	100	100	100	200	100

Source: field survey.

3.1.1.2 Age

98% and 92% of the infected and healthy farmers respectively, fall within (20–60) year's age group. The mean age was 42.68 years for the infected farmers and 43.78 years for the healthy farmers. Table (2).

Table (2): Frequency distribution of farmer's according to age in Gash area.

Age (group)	Patient (n =100)		Healthy (n = 100)		Total sample (n = 200)	
	Freq	%	Freq.	%	Freq.	%
20 – 40	44	44	43	43	87	43.5
41 – 60	54	54	49	49	103	51.5
61 – 80	2	2	08	08	10	5
Total	100	100	100	100	200	100
Mean	42.68 years		43.78 years		43.23 years	

Source: field survey.

3.1.1.3 Marital status

96% among the infected farmers in the Gash area were married, and only 4% were single. On the other hand 93% of the healthy farmers were married, while only 7% were single, table (3)

Table (3): Frequency distribution of farmers according to marital status in the Gash area.

Marital Status	Patient (n = 100)		Healthy (n = 100)		Total sample (n = 200)	
	Freq.	%	Freq.	%	Freq.	%
Married	96	96	93	93	189	94.5
Single	4	4	7	7	11	5.5
Total	100	100	100	100	200	100

3.1.1.4 Educational Level

7% and 23% among infected and healthy farmers respectively, received between basic and secondary levels of education.59% and 72% received khalwa level of education. Illiteracy is 34% among infected and only 5% among healthy farmers, Table 4)

Table (4): Frequency distribution of farmers according to Educational level

Educational Level	Patient (n = 100)		Healthy (n = 100)		Total sample (n = 200)	
	Freq.	%	Freq.	%	Freq.	%
Illiterate	34	34	5	5	39	19.5
Khalwa	59	59	72	72	131	65.5
Basic school	05	05	11	11	16	08
Medium school	01	01	06	06	07	3.5
Secondary	01	01	06	06	07	3.5
Universities	0	0	0	0	0	0
Total	100	100	100	100	200	100

Source: field survey

3.1.1.5 Family size

The frequency distribution of the farmers in the sample by the family size was, 65% among the infected farmers was observed to be restricted in less than 5 individuals. On the other hand, 48% among healthy farmers was restricted between 6 and 10 individuals. The mean family size of the infected farmers was 5.08 individuals and for the healthy farmers were 7 individuals, Table (5) Table (5): Frequency distribution of farmers according to family size in the Gash area .

Valid	Patient (n = 100)		Healthy (n = 100)		Total sample (n = 200)	
	Freq.	%	Freq.	%	Freq.	%
5≤	65	65	38	38	103	51.5
6 – 10	34	34	48	48	82	41
11 - 15	1	1	10	10	11	5.5
16≥	0	0	04	04	04	02
Total	100	100	100	100	200	100
mean	5.08 individuals		7individuals		6.01 individuals	

3.1.2 Socioeconomic factors

3.1.2.1 Secondary occupation

32% of the infected and healthy farmers do not have secondary occupation, they restrict themselves to agriculture, and 68% were engaged in other jobs besides agriculture, Table (6).

Table (6): Frequency distribution of farmers according to secondary occupation in the Gash area.

Occupation	Patient (n = 100)		Healthy (n = 100)	
	Freq.	%	Freq.	**%**
labour	08	08	10	10
others	59	59	57	57
total	67	67	67	67

Source: field survey.

3.1.2.2 Total Cultivated Area

The majority of the farmers grown crops in area ranges between 1 to 5 feddans, while a very few proportion cultivate land reaches up to 20 feddans. The mean cultivated area among the infected farmers in season 2005-2006 was found to be 2.8 feddans. Compared to 5.76 feddans among the healthy farmers table (7).

Table (7): Distribution of farmers according to the Total cultivated area/farmer in the Gash area.

Total cultivated area/fed.	Patient (n =100)		Healthy (n =100)		Total sample (n =200)	
	Freq.	%	Freq.	%	Freq.	%
1-5	96	96	81	81	177	88.5
6-10	3	3	14	14	17	8.5
11-15	0	0	1	1	01	0.5
16-20	1	1	2	2	03	1.5
≥20	0	0	2	2	02	1
Total	100	100	100	100	200	100
Mean	2.8 (feddans)		5.76 (feddans)		4.28 (feddans)	

Source: field survey.

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3.1.2.3 Sowing Date and Harvesting Time

19% of infected farmers grow Sorghum off-season, compare to only 3% of healthy farmers. On the other hand, 22% of infected farmers and 5% of healthy farmers harvested it off-suitable time, table (8).

Table (8): Shows frequency distribution of farmers according to sowing date and harvesting time of Sorghum in Gash area

Item	Sowing date				Harvesting time			
	Patient		Healthy		Patient		Healthy	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Unsuitable	19	19	3	3	22	22	5	5
Suitable	81	81	97	97	78	78	95	95
Total	100	100	100	100	100	100	100	100

Source: field survey.

3.1.2.4 Numbers of Daily Working Hours

The study found that the mean numbers of daily working hours of the infected farmer is 2.78 hours, compared to 10.31 hours of the healthy farmer. Table (9).

Table (9): Numbers of working daily hours /farmer in the Gash area.

Number of working hours	Patient (n =100)		Healthy (n =100)		Total sample (n =200)	
	Freq.	%	Freq.	%	Freq.	%
0 < 2	30	30	1	1	31	15.5
2 < 4	30	30	3	3	33	16.5
4 < 6	37	37	2	2	39	19.5
6 < 8	2	2	9	9	11	5.5
8 < 10	1	1	7	7	08	04
10 < 12	0	0	23	23	23	11.5
12 < 14	0	0	51	51	51	25.5
14 < 16	0	0	4	4	04	02
Total	100	100	100	100	200	100
Mean	2.78 (hours)		10.31(hours)		6.545 (hours)	

Source: Field survey

3.1.2.5 Cultivation Cost

The mean cultivation cost among the infected farmers was found to be 134.6 SDG. Compared to 210.3 SDG. among the healthy farmers, table (10).

3.1.2.6 Marketing of the Crop Sorghum

95% of both healthy and infected farmers in the Gash area marketed their crops locally; table (11)

3.1.2.7 Labour Cost

The mean labour cost among the infected farmers was found to be 135.5 SDG. Compared to 201.3 SDG. among the healthy farmers, table (12).

3.1.2.8 Farmer Productivity

The mean output/feddan per infected farmer was found to be 2.84 sacks. Compared to 8.87 sacks/faddan of the healthy farmers, with variation of 6.03 sacks/faddan table (13).

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Table (10): Frequency distribution of farmers according to the cultivation cost per feddan in the Gash area.

Cost (SDG) Per feddan	Patient (n =100)		Healthy (n =100)		Total sample (n =200)	
	Freq.	%	Freq.	%	Freq.	%
0 < 50	15	15	1	1	16	08
50 < 100	4	4	5	5	09	4.5
100< 150	43	43	31	31	74	37
150 < 200	21	21	30	30	51	25.5
200 < 250	9	9	11	11	20	10
250 < 300	4	4	3	3	07	3.5
300 < 350	1	1	4	4	05	2.5
350 < 400	1	1	2	2	03	1.5
400 < 450	1	1	2	2	03	1.5
450 < 500	1	1	3	3	04	02
500 < 550	0	0	2	2	02	01
550 < 600	0	0	3	3	03	1.5
600 < 650	0	0	2	2	02	01
650 < 700	0	0	1	1	01	0.5
Total	100	100	100	100	200	100
Mean	134.6 (SDG).		210.3(SDG).		174.80 (SDG).	

Table (11): Frequency distribution of farmers according to the marketing of the crop in the Gash area.

Marketing type	Patient (n =200)		Healthy (n =200)		Total sample (n =200)	
	Freq.	%	Freq.	%	Freq.	%
Local	95	95	95	95	190	95
External	5	5	5	5	10	05
Total	100	100	100	100	200	100

Source: Data from field survey.

Table (12): Frequency distribution of farmers according to the labour cost in the Gash area.

Cost (SDG). Per feddan	Patient (n =100)		Healthy (n =100)		Total sample (n =200)	
	Freq.	%	Freq.	%	Freq.	%
0 < 10	20	20	15	15	35	17.5
10 < 20	66	66	40	40	106	53
20 < 30	10	10	30	30	40	20
30 < 40	1	1	3	3	04	02
40 < 50	0	0	3	3	03	1.5
50 < 60	3	3	7	7	10	05
60 < 70	0	0	1	1	01	0.5
70 < 80	0	0	1	1	01	0.5
Total	100	100	100	100	200	100
Mean	135.5(SDG).		201.3(SDG).		196.75 (SDG).	

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Table (13): Frequency distribution of farmers according to the farmer productivity in the Gash area.

Number of sacks /feddan	Patient (n =100)		Healthy (n =100)		Total sample(n =100)	
	Freq.	%	Freq.	%	Freq.	%
0 < 2	36	36	1	1	37	18.5
2 < 4	23	23	1	1	24	12
4 < 6	36	36	4	4	40	20
6 < 8	3	3	3	3	06	03
8 < 10	2	2	36	36	38	19
10 < 12	0	0	55	55	55	27.5
Total	100	100	100	100	200	100
Mean	2.84 (sack)		8.87 (sack)		5.905 (sack).	

Source: Data from field survey.

3.1.2.9 Crop Market Price

The mean crop market price among the infected farmers was found to be 43.5 SDG. Per sack, Compared to 49.6 SDG. among the healthy farmers, table (14).

3.1.2.10 Annual Expenditure

Annual expenditure ranges between less than 1000 (SDG) to more than 3000 (SDG) among both healthy and infected farmers, depending on family size. The mean annual expenditure among the infected farmers was found to be 2175 SDG. Compared to 1889.2 SDG. among healthy farmers, table (15).

3.1.2.11 Annual Income

Annual income in the Gash area varies between less than 1000 SDG to more than 4000 SDG among the infected farmers. While among healthy farmers reached up to 10000 (SDG). The mean annual income of the infected farmer was found to be 300.44 (SDG), compared to 486.58 (SDG) of the healthy farmers. Farmer's annual income generates from two main sources which are:

1- Annual farm income.

2- Annual off-farm income Table (16).

Table (14): Frequency distribution of farmers according to the crop market price in the Gash area.

Price Per sack of Sorghum SDG.	Patient (n =100)		Healthy (n =100)		Total sample (n =200)	
	Freq.	%	Freq.	%	Freq.	%
0 < 20	13	13	1	1	14	07
20 < 40	0	0	1	1	01	0.5
40 < 60	85	85	89	89	174	87
60 < 80	2	2	9	9	11	5.5
Total	100	100	100	100	200	100
Mean	43.5 (SDG).		49.6(SDG).		46.45(SDG).	

Table (15): Frequency distribution of farmers according to annual expenditure in the Gash area.

Annual expenditure (SDG.)	Patient (n =100)		Healthy (n=100)		Total sample (n=200)	
	Freq.	%	Freq.	%	Freq.	%
0 < 100	1	1	2	2	3	1.5
100 < 200	34	34	43	43	77	38.5
200 < 300	49	49	52	52	101	50.5
300<400	16	16	3	3	19	9.5
Total	100	100	100	100	200	100
Mean	217.5/ SDG.		188.092/ SDG.		203.9750 SDG.	

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Table (16): Frequency distribution of the farmers according to annual income in the Gash area

Average income(SDG)	Annual farm income(SDG)		Annual off-farm income(SDG)		Total Annual income(SDG)	
	Freq.		Freq.		Freq.	
	Patient	Healthy	Patient	Healthy	Patient	Healthy
< 1000	28	14	35	24	6	03
100 0< 2000	37	20	41	30	13	12
200 0< 3000	20	20	8	10	12	11
3000 < 4000	10	5	16	36	48	15
4000 < 5000	5	15	0	0	21	09
5000 < 6000	0	15	0	0	0	16
6000 < 7000	0	04	0	0	0	11
7000 < 8000	0	07	0	0	0	08
8000 < 9000	0	0	0	0	0	08
9000 < 10000	0	0	0	0	0	04
10000 < 11000	0	0	0	0	0	03
Total	100	100	100	100	100	100
Mean	1651.0	3176.2	1336.1	1776.3	3004.4	4865.8

Source: field survey

3.2 Results of Correlation Analysis

This part will represent the significant correlation among the variables for the total sample (n=200). The matrix of Inter correlation computed for the sample is presented in, (AppendixA1,2,3).

Annual income is positively correlated with:

1. Educational level (r=0.18642).
2. family size (r=0.22314).
3. Number of working daily hours (r=0.33274).
4. Annual expenditure (r=0.19273).
5. Price per unit of out put (r=0.145591).
6. Farmer's productivity (r=0.38089)

and negatively correlated with infection (r=-0.43484).

IV. DISCUSSION

This section is going to discuss the finding of the analytical results of the study, so as to evaluate the impact of TB on farmer's income in the Gash delta.

4.1 The Impact of TB on Farmer's Annual Income in the Gash Area

The study found a significant and strong negative correlation with the farmer's annual income and disease infection (r=-0.43484), as the farmer getting ill, his annual income decreases by 186.14 units. According to the frequency distribution the mean annual income of the infected farmer was 3004.4 (SDG), compare to 4865.8 (SDG) of the healthy farmers, fig. (1). The vast majority of the infected farmers (79%) earned annual income ranged 1000 < 4000 (SDG.), while the healthy farmer's annual income may reaches up to 10000 (SDG.) fig. (2). The study concluded that the negative impact of TB on farmer's annual income is due to its negative effect on the main factors that affect farmer's annual income in the Gash area, which are:

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1-Farmer's Productivity: Farmer's annual income has a significant and strong positive correlation with the farmer's productivity (r=0.38089). Actually annual farm income which is the farmer's productivity times total cultivated area times price per unit of output, is the main component of annual income fig (3). TB has a negative impact on farmer's productivity, thus result in a negative impact on farmer's annual income.

2-Secondary Occupation: Farmer's annual income has a significant and strong positive correlation with the secondary occupation (r=0.35043). The mean annual off-farm income for the infected farmers was found to be 1336.1(SDG.), compare to 1776.3 (SDG.) for the healthy farmers, fig. (3). the loss from inability to work will vary with the severity of the disease and the age of the patient, with older patients losing more

time away from work. However, in India, which currently has the largest number of cases in the world, one study shows that the average period of loss of wages was three months (Rajeswari et al., 1999). The impact of lost earnings will obviously vary with the nature of the occupation.

Fig. (1) The mean annual income of the farmers in the Gash area

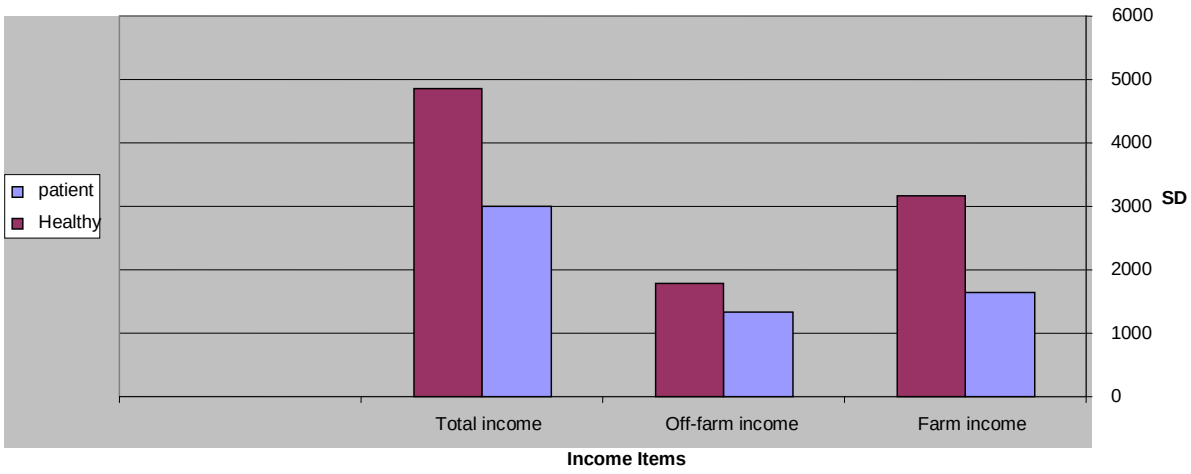

Fig. (2) Frequency distribution of the farmers with respect to annual income in the Gash area

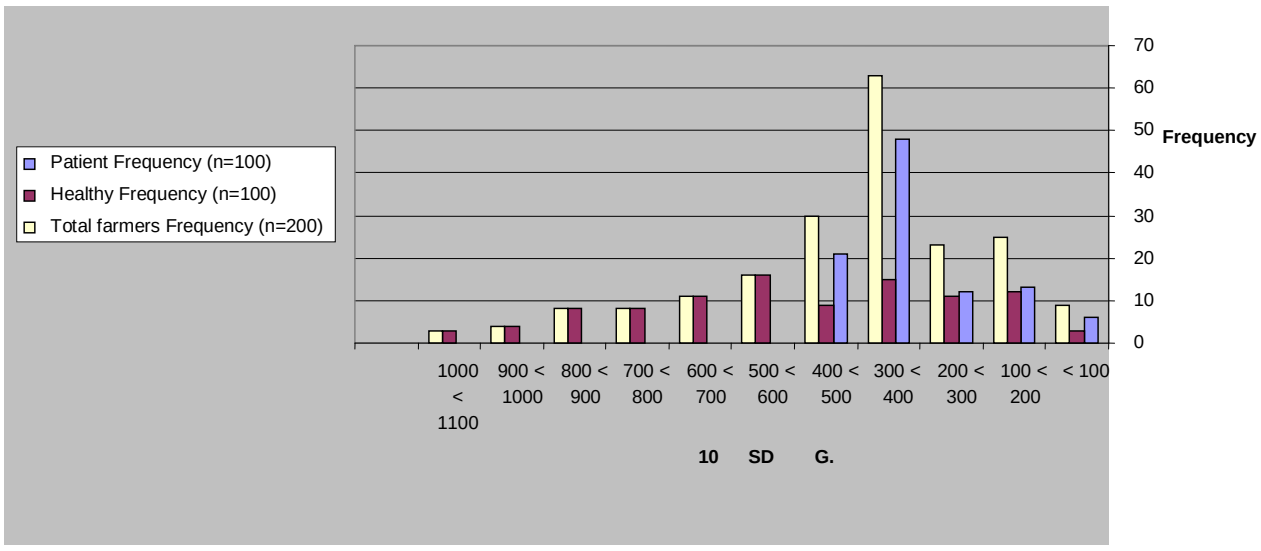

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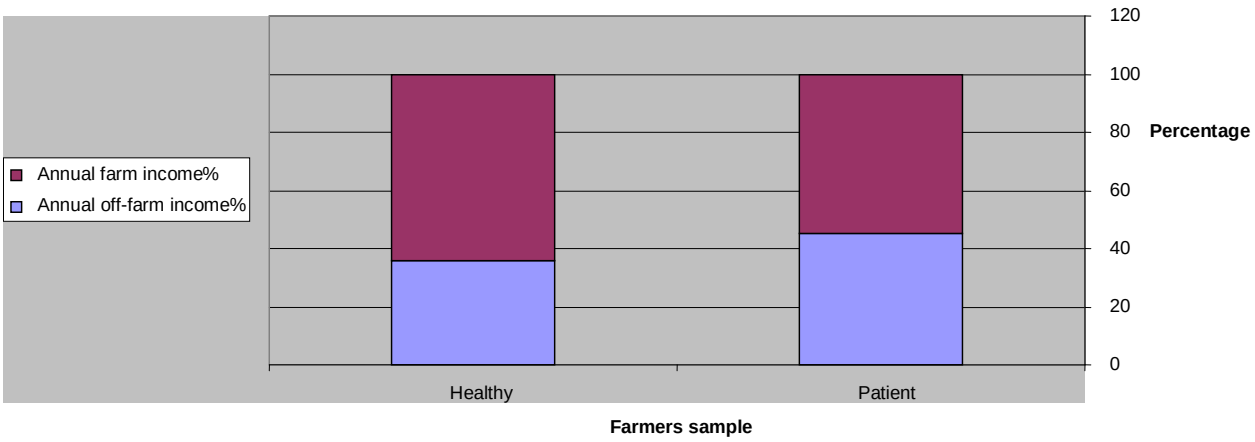
Fig. (3) Percentage of the farm and off - farm income with respect to total income for the tow farmers samples



3-Educational Level: The study found that farmer's annual income has a significant positive correlation with educational level (r=0.18642), More educated farmer generates more annual income by 65.86 (SDG.), TB patient farmer is less educated and the chance of supplemented his annual income is low compared to the healthy farmer, this can be seemed obvious from the distribution of the off-farm income, table (15) and fig. (3), moreover their productivity is low which result in low annual farm income.

4-External Marketing: Healthy farmer will market his crop externally, if the crop market price in the local market declines due to high crop supply. The infected farmer due to TB morbidity cannot do so, since TB increases fatigability.

5-Labour Cost: The mean labour cost among the infected farmers was found to be 135.5 SDG. Compare to 201.3 SDG. This indicates that healthy farmer hires labour for the intensive labour work operations. In some cases infected farmer hires labour to perform the field work when he was ill, most infected farmers cannot afford to hire labour to carry the agricultural activities due to income constraints. The results in usual cases they neglected the agricultural duties.

6- Total Cultivated Area: The total area owned by the farmer in the Gash area is controlled by the Gash agricultural scheme management, depending on the total annual flooded area and the ability of the farmer to utilize it. The study found that TB decreases area under cultivation by 2.96 feddan. The mean cultivated area among the infected farmers was found to be 2.8 feddans, compared to 5.76 feddans among the healthy farmers. This is due to TB disease weakened farmers ability to work. According to WHO, a sick worker means disrupted workflow, TB results in reduced farmer's annual income due to chronic illnesses which leads to poor crop yields due to reduction of the area under cultivation, Haddad and Gillespie, (2001).

7-Age: Older farmer has a large family size with employer members that supplement his income, moreover, due to his agricultural experiments his crop yield become high which increases income. Age is a very important risk factor for tuberculosis, as it plays a role in all stages from exposure to mortality. Tuberculosis infection prevalence, i.e. the probability of being infected at some time during one's life, increases with age . As a result, the risk of reactivation disease increases with age, and the risk of primary tuberculosis declines, (other things being equal), (Styblo K. (KNCV), (1991). Progression from tuberculosis infection to pulmonary tuberculosis disease is also strongly age dependent. Smear-positive pulmonary tuberculosis usually occurs among patients aged 15 years and over.

8-Cultivation Cost: As has been discussed above increasing cultivation cost means proper and timely agricultural operation, high farmer's productivity hence high farmer's annual income. TB restricts all these factors thus restrict farmer's annual income.

9- Family Size: The study found that there is a positive correlation between farmer's annual income and the number of his family members (r=0.22314), The negative impact of TB on annual income through family size may be due to TB mortality by causing individual death or morbidity by weakened their ability to work.

10-Harvesting Time: Due to TB morbidity the infected farmer delay harvesting of the crop which from the agronomic point of view, results in low crop yield that generates low annual income.

11-Sowing Date: Due to TB morbidity the infected farmer delay sowing of the crop which from the agronomic point of view results in low crop yield thus generates low annual income.

12-Local Marketing: Local marketing reduces cost of transportation of the crop to the external market.

13- Number Of Working Daily Hours: Farmer's annual income has a significant and strong positive correlations with the number of working daily hours (r=0.33274), TB reduces number of working daily hours by 7.53 hours/day which reduces farmer's productivity by 4.29 sacks/feddan, that result in low annual income. international NGOs.

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APPENDIX (A1)

Matrix inter-correlation of the variables for all sample of farmers

Variables	Secondary occupation	Educational level	Marital status	Family size	Total cultivated area	Sowing date	Harvesting time	Cultivation cost	Local marketing
Secondary occupation	1.0000								
Educational level	.24761	1.0000							
Marital status	-.00058	-.21894	1.0000						
Family size	-.12378	-.08023	.16436	1.0000					
Total cultivated area	.09660	.17327	.01980	.07618	1.0000				
Sowing date	-.03174	.14086	-.04803	.09468	.17000	1.0000			
Harvesting time	.00123	.09997	-.05775	.08733	.17817	.83173	1.0000		
Cultivation cost	-.12070	.19318	-.02395	.22415	.15099	.25649	.23948	1.0000	
Local marketing	.03724	-.05438	.03451	-.00622	.02643	.06045	.14980	-.02837	1.0000

APPENDIX (A2)

Continue, Matrix inter-correlation of the variables for all sample of farmers

Variables	Secondary occupation	Educational level	Marital status	Family size	Total cultivated area	Sowing date	Harvesting time	Cultivation cost	Local marketing
Working hours	.08790	.35998	-.11862	.27615	.25884	.27112	.25938	.39302	-.03920
Labour cost	-.0538	.18713	.02500	.04568	.52058	.10825	.10291	.03079	.03243
Annual income	.33043	.18641	-.03985	.22314	.12624	.09846	.08645	.06379	.03521
Annual expenditure	.10894	-.11015	.14916	.10902	.05047	.03283	-.03633	-.06896	-.08198
Price per unit of output	-.01678	.14838	-.03775	.02866	.15489	.68701	.57832	.33266	-.09821
Age	-.26827	-.18532	.18947	.52419	.03287	.04087	.04647	.17694	-.10308
External marketing	.10247	-.01055	-.11088	-.00039	-.02356	-.09192	-.06601	.14069	-.33109
Farmer's productivity	.7910	.32818	-.12539	.32594	.26255	.34119	.35346	.36886	.02419

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APPENDIX (A3)

Continue, Matrix inter-correlation of the variables for all sample of farmers.

Variables	Working hours	Labour cost	Annual income	Annual expenditure	Price per unit of output	Age	External marketing	Farmer's productivity
Working hours	1.0000							
Labour cost	.16181	1.0000						
Annual income	.33274	.13439	1.0000					
Annual expenditure	-.11243	.02704	.19273	1.0000				
Price per unit of output	.29182	.09713	.14559	.05542	1.0000			
Age	.07504	-.03088	.11934	.11613	.07237	1.0000		
External marketing	.06764	-.01284	.09054	.03137	.06441	.05870	1.0000	
Farmer's productivity	.85575	.15792	.38089	-.06015	.35135	.11347	.01474	1.0000

CRITICAL VALUE (1-tail, .05) = + or - .11668
CRITICAL VALUE (2-tail, .05) = +/- .13877
Source:(Data from field survey).