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## **Effects of Socio-economic Factors on the Profitability of Small Ruminant Production among Smallholders in Egypt**

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*Article history:* Received 3 February 2021, Revised 18 March 2021, Accepted 18 March 2021, Published 23 March 2021.

**Abstract:** The objectives of this study included identifying the socio-economic characteristics of the smallholder farmers; determining the effect of these socioeconomic factors on the profitability of sheep and goats production; and making recommendations based on the results. Survey questionnaire was developed and pre-tested to collect quantitative data during the period from January 2019 to January 2020. A total of 180 farmers were randomly selected from the Delta regions and the New Valleys regions in Egypt, which represent different production systems. Respondents were farm households engaged in agricultural production. Data collected were analyzed using descriptive such as frequency and percentages. More so gross margin and regression models were also used. The results of the study showed that the average age of the respondents ranged between  $40 \pm 15.5$  -  $44.2 \pm 13.3$  years. The present results suggested higher rate of illiteracy in the Delta 50.9% than in the New Valley district 31.6%. The gross margin estimate showed that the enterprise was profitable. The livestock herds differed in size and composition between the different areas. Farmer age, family size, education level, herd size and feeding system significantly affected the profitability of small ruminant production for smallholders in Egypt. The study therefore recommends that younger people should be encouraged into small ruminant production because small ruminant animal production is laborious. Recommended policy actions should be directed towards establishment of breeding centers for dairy animals; and knowledge transfer through provision of extension services to

educate the farmers on dairy management. The farmers should also form cooperative societies to increase their access to credit facilities.

**Keywords:** Small ruminants, socio-economic characteristics, smallholder, profitability

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## 1. Introduction

Livestock farming makes a distinct contribution to the social and economic development of the rural families (Nkonki-Mandleni et al., 2019). Kuriuku et al. (2013) reported that the sale of livestock contribute 78 % of the cash income for many smallholder farmers. Small ruminants has a unique position in smallholder agriculture due to the fact that they have shorter production cycles and faster growth rates, ease of management, low investment capital, less risk of loss, low feed requirements and they are more fixable to harsh environmental climates as compared to large ruminants (FAO, 2002 and Ahuya *et al.*, 2009). Several studies highlight the importance of small ruminants livestock production for ensuring food security in rural areas and to help reduce poverty and the general well-being of the family (Peacock, 2005 and Dossa et al., 2007) and as a source of income and job creation for rural residents (Offor et al., 2018). In order to design an effective program for improving small ruminant production in Egypt and other regions with similar production conditions, it is important to understand the social and economic factors that affect its performance. Ayalew et al., 2013 suggested that information on the socio-economic and farm characteristics of farm households is critical in designing effective and appropriate livestock programs that benefit households. Moreover, Zaw Win et al., 2018 suggested that understanding the multiple factors affecting livestock farming is essential for working with households to improve livestock production. Therefore, the objectives of this study included determining the socio-economic and farm characteristics of small farmers determine the impact of these socio-economic factors on the profitability of sheep and goat production and make recommendations based on the results.

## 2. Materials and Methods

### 2.1. Study Area

The study was conducted in two agro-ecological zones of Egypt (Nile Delta and New Valley areas). The Nile Delta (or simply the delta) is one of the oldest densely cultivated areas on earth, and it is a rich agricultural area formed in Lower Egypt where the Nile River spreads and flows into the

Mediterranean Sea. It includes three governorates (Damietta, Gharbia, and Beheira). It is about 160 km long from north to south.

On the other hand, the New Valley is the largest governorate in Egypt, with an area of 458,000 square kilometers, which is nearly a fifth of the total area of Egypt. The New Valley consists of three oases (Kharga, Farafra and Dakhla Oasis). The New Valley Governorate is well-known for the cultivation of unconventional, resilient and salt-tolerant plants such as barley, triticale, fodder beet, pearl millet, sorghum, safflower, and quinoa. Small ruminants are bred in the study areas under two management systems. The management practice used by most of the small farmers in the Delta region is traditional system while the prevailing management in the New Valley area is semi-intensive system.

## 2.2. Data Collection

Survey questionnaire was developed and pre-tested to collect quantitative data during the period from January 2019 to January 2020. The questionnaire was prepared to obtain information on socio-economic characteristics of households, farm-related attributes (farm size, livestock herd size, flock structure) and quantities and costs of all variable inputs and prices of animals. One hundred eighty households were selected randomly. Each of the household was interviewed individually. Respondents were farm households engaged in agricultural production.

## 2.3. Data Analysis

Microsoft Excel was used to analyze the data. Descriptive statistics such as percentages and frequencies were conducted. To examine the profitability of small ruminant's production, the gross margin was carried out for each respondent as mean revenues less mean variable costs. Multiple regressions were used to find out the effect of social-economic factors on profitability of small ruminants production. Annual gross margin was used as a dependent variable (Y) and sex socioeconomic characteristics of the respondents as explanatory variables (X) namely age, education level, and household size. Farm size, herd size and small ruminant management system according to the statistical analysis system (SAS, 2012).

# 3. Results and Discussion

## 3.1. Socio-economic Characteristics of the Respondents

The results in Table 1 showed that the average age of household head in the Delta and New Valley regions were  $40 \pm 15.5$  and  $44.2 \pm 13.3$  years, respectively and about 57% of them have medium age between 30 to 50 years. Young people should be encouraged to small-scale production of ruminants because the production of small ruminants is a laborious process. Young adult's gives an

indication of their ability to carry out the drudgery activities involved in small ruminant production (Adams and Ohene-Yankyera, 2014). This result is like to the findings reported by Abd El-Monaimea (2014) who found that the average age of household head in the New Valley is 43.2 years old. El-Bassiony (2019) showed that the average age of householder in the Delta area was about  $46.6 \pm 13.6$  years. In this respect, Khalil *et al.* (2013) mention that the average farmer's age in the north western coastal zone of Egypt is around 51 years old which is higher than the current results. However, the present results suggested higher rate of illiteracy in the Delta 50.9% than in the New Valley district 31.6%. With high rates of illiteracy, farmers are forced to rely heavily on traditional methods of raising livestock. Abd al-Ati et al., 2019 found that the percentage of uneducated families in the New Valley governorate was 27.14%. The literacy rate estimated in both areas is higher than the 35.1% reported in Northwestern Coastal Zone of Egypt by Khalil et al., 2013. CAPMAS (2013) reported that the literacy rate for Egypt's population above 10 years of age was reported as 25.9%. In the New Valley, Abd El-Monaimea (2014) showed that the percentage of families with basic, secondary and higher education or without education were 9.8, 54.9, 3.9 and 31.4%, respectively.

The average number of household members in the Delta region was  $6 \pm 2.4$  more than in the New Valley area  $4.9 \pm 2.6$  (Table 1). Abd El-Monaimea (2014) stated that the average number of individuals per house in the New Valley area is 5.82 individuals. According to the report of CAPMS (2011), the average Egyptian household size is 4.4 persons who are lower than the current result. Metawi (2011) found that the average family size was 7.8 and 6.4 people under rain fed areas and in the cultivated areas of Egypt, respectively. The average land holding per household in Delta and New Valley areas is estimated as  $3.6 \pm 1.1$ ,  $23.4 \pm 17.1$  acres respectively (Table 1). In New Valley, Abd El-Monaimea (2014) found that the average farm size was  $7.55 \pm 1.36$  acres which is lower than the current result. Metawi (2011) showed the average farm sizes as 12.7 acres for new reclaimed areas and 2.7 acres for the old cultivated areas. The average farm size ranged from 1.58 to 1.87 acres, in three districts of Sohag governorate (Elnahas, 2008). El-Bassiony (2019) found that the cultivated area in Damitta governorate were  $6.6 \pm 3.3$  acres. The livestock herds differed in size and composition between the different areas studied. The average herd size estimated in the Delta region was  $15.9 \pm 8.2$  more than in the New Valley region,  $25.8 \pm 10.1$  (Table 1).

**Table 1.** Socio-economic characteristics of the respondents

	Location			
	Delta area		New valley area	
Characters:	frequency	Percentage%	frequency	Percentage%
Age(year)				
30-40	24	22.4	30	27.7
41-50	36	33.3	32	29.6
51-60	30	27.7	46	42.7
61-70	18	16.6	-	-
Total	108	100	108	100
Average	40±15.5		44.2±13.3	
Education level				
Illiterate	55	50.9	34	31.6
Secondary education	28	25.9	44	40.7
Tertiary education	25	23.2	30	27.7
Total	108	100	108	100
Family size(person)				
1-5	45	41.6	52	48.2
6-10	63	58.4	56	51.8
Total	108	100	108	100
Average	6±2.4		4.9±2.6	
Farm size(acres)				
landless	36	33.4	14	12.9
<10	32	29.6	-	-
11-20	40	37	22	20.3
21-30	-	-	27	25.2
31-40	-	-	15	13.8
41-50	-	-	-	-
51-60	-	-	14	12.9
61-70	-	-	16	14.9
Total	108	100	108	100
Average	3.6±1.1		23.4±17.1	
Herd size(head)				
<10	39	36.2	-	-
11-20	35	32.4	32	29.6
21-30	34	31.4	35	32.4
31-40	-	-	19	17.7
41-50	-	-	22	20.3
Total	108	100	108	100
Average	15.9±8.2		25.8±10.1	

### 3.2. Household Ownership of Different Livestock Species

The results indicated that the herd in the Delta region consisted of 5.2 crossbred cattle, 3.2 native cattle, 3.3 sheep, 2.2 goats, 2.1 buffalo (Table 2). The corresponding figure in the New Valley region was

as follows 10.9. Crossbred cattle, 8.2 sheep, 5.3 goats, 1.1 buffalo, and .4% camels. Households in the New Valley area own higher number of cattle; this may be due to relatively larger land holding and more covered by cereal crop. Abd El-Ati, et al., 2019 reported that the herd in the New Valley consists of 67.32% cattle, 18.63% lamb, 14.05% goat, and zero% buffalo. Abdel Moneimy (2014) found that the herd in the New Valley governorate contains an average of 4.18 heads of cattle, 1.74 heads of sheep and 1.76 heads of goats, and the percentage of those who keep sheep or goats only or both types was 27.45%, 7.8% and 64.71. %, respectively. Elnahas (2008) showed that householder in Sohag governorate kept an average of 0.34 of animal units of native cattle, 0.13 of crossbred cattle, 1.06 animal units of buffalo, 12.7 ewe equivalents and 6.15 doe equivalent. In addition, FAO (2007) mention that household herds among the Middle East countries from cattle, buffalo, sheep and goat were 14, 33, 57 and 43%, respectively. Zaw Win et al. (2018) reveal that herd size and the purpose of raising different types of livestock were significantly correlated with housing practices, feeding and experience of farmers. However, Neupane et al. (2018) reported that small ruminants are mostly adopted by farmers who are their constant source of agricultural income.

**Table 2.** Household ownership of different livestock species

<b>Particulars</b>	<b>Delta area</b>	<b>New valley area</b>
Herd size	15.9±8.2	25.8±10.1
Sheep, %	20.8	31.8
Goats, %	13.6	20.5
Cross bred cattle %	32.2	41.8
Native cattle %	20.2	-
Buffaloes, %	13.2	4.4
Camel, %	-	1.5

### 3.3. Profitability (Gross Margins) of Smallholder Farming

Cost and Returns estimate of small ruminant production in each region is presented in Table 3. The results showed that the average variable costs of sheep and goats estimated in the Delta region, of which animal nutrition is the most important component, was the lowest, as farmers' systems generally depend on grazing, and farmers use supplementary feeds for only two or three months, especially after that. Births or severe winter conditions. On the other hand, the data indicate that the production of sheep and goats was profitable, especially in the New Valley region, where the estimated net profit ,

respectively, were LE  $460.09 \pm 19.58$  and LE  $360.62 \pm 38$  in the Delta region, LE  $596.73 \pm 15.15$  and LE  $432.63 \pm 15.64$  in the New Valley area.

**Table 3:** Profitability (Gross Margins) of Smallholder Farming

location	Delta area	New valley area
Sheep		
Gross revenue ,LE	3240±190.06	4340.6±140.90
Variable cost ,LE	2780±170.36	3743.8±130.12
Net profit ,LE	460.09±19.58	596.73±15.15
Goat		
Gross revenue ,LE	2900.5±230.76	3200.5±180.34
Variable Cost, LE	2539.88±220.83	2767.87±150.78
Net profitless	360.62±20±38	432.63±15.64

**1USD=LE15.7108**

### 3.4. Socio-economic Factors Affecting the Profitability of Small Ruminant Production

Table 4 presents the socio-economic factors that affected the profitability of small ruminant production for smallholders in the study area. The results of the multiple regression analysis indicated that the small ruminant management system, farmer age, education level, herd size, and farm size significantly affected the profitability of small ruminant production. The change in the management system from traditional to semi-intensive increased profits by LE109 for sheep and LE72 for goats. Also, Increasing farmer age, education level, herd size, and farm size will increase the profitability of small enterprises for small ruminants. On the other hand, family size was not statistically significant ( $p = 0.6$ ). Thus profitability does not depend on the number of family members of the farmer. Family size has been described as the most important determinant of labor investment for family farms being a source of labor (Ngongoni et al 2006).

**Table 4.** Social Economic factors affecting profitability and productivity in study areas

variable≥	Sheep	Net	P-value	Goat	Net	P-value
	Income			Income		
<b>Location</b>						
1	460.09 ±19.58 <sup>b</sup>			360.62±20.38 <sup>b</sup>		
2	569.73±15.15 <sup>a</sup>	0.008		432.63±15.64 <sup>a</sup>		0.007
<b>Age</b>						
1	489.53±19.81 <sup>b</sup>			280.79±20.52		
2	516.52±15.68 <sup>b</sup>	0.001		390.43±16.72		0.026
3	565.08±15.11 <sup>a</sup>			426.77±15.23		
4	478.90±27.28 <sup>c</sup>			388.51±31.13		
<b>Education</b>						
1	551.95±16.98 <sup>c</sup>			365.93±17.33 <sup>b</sup>		
2	624.61±15.78 <sup>b</sup>	0.001		372.23±16.84 <sup>b</sup>		0.001
3	660.96±17.80 <sup>a</sup>			451.72±19.54 <sup>a</sup>		
<b>Family size</b>						
1	507.81± 15.03	0.576		397.50±15.64		0.918
2	517.86±17.9			395.76±14.45		
<b>Farm size</b>						
1	520.44±20.04 <sup>d</sup>			374.04± 20.05		
2	616.88±27.06 <sup>c</sup>			427.22±27.25		
3	636.20±19.94 <sup>c</sup>	0.001		407.09±21.30		0.012
4	686.46±25.78 <sup>a</sup>			379.64± 28.40		
5	564.46±33.73 <sup>a</sup>			359.63±35.97		
6	632.92±37.47 <sup>b</sup>			445.92±36.91		
7	630.22±30.56 <sup>a</sup>			382.86±31.78		
<b>Herd size</b>						
1	517.65±23.59 <sup>d</sup>			360.05±25.33		
2	577.41±16.95 <sup>c</sup>	0.001		369.02±17.69		0.282
3	622.75±18.39 <sup>b</sup>			397.37±18.51		
4	641.81± 32.47 <sup>a</sup>			422.77± 32.51		
5	702.92± 30.59 <sup>a</sup>			433.92±33.40		

#### 4. Conclusion

This study found that increases in farmer age, education level, farm size, and herd size significantly increased the profitability of small ruminant production. The shift from a traditional small ruminant management system to a semi-intensive management system was positively associated with the profit from sheep and goat production. Therefore, the study recommended that young people should be encouraged to small-scale production of small ruminants because their production is a laborious process. The recommended policy measures should be directed towards establishing small ruminant breeding centers in order to increase herd size and transfer knowledge by providing extension services to educate farmers about modern management techniques. Farmers should be encouraged to form cooperative societies that can help them increase their access to credit facilities that provide them with adequate inputs.

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