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Abstract

In Sudan like most of developing countries the total marital fertility rate stands higher than developed countries. According to MICS 5 data the TMFR in Sudan is 4.04; which is ranged between 5.29 in rural Blue Nile state in south and 2.75 in urban River Nile state in north Sudan. There are significant differences in mean of the TMFR with different education level as ANOVA reveal. Kendall's tau_b show that there is significant correlation between female education level and TMFR, age at the first birth and percentage of women using contraceptive. The multiple regression model shows that female education level and age at the first birth have significant impact on TMFR and they explain 77% of change in TMFR in Sudan.

Keywords : Contraceptive, Education, Total Marital Fertility Rate, Urbanization.

Introduction

In spite of the rapid increase in population; the total fertility rate has been declining all over the world since 1970. In Africa the TFR decreased from 6.70 to 4.44 but in Sudan the estimated TFR decreased to 4.75 which is the double of TFR of the world 2.47.(Pew Research Center, 2015 and World Population Prospects 2019).

There are many factors behind the high fertility rate in developing countries, social and economic factors. The age at marriage is one of the strongest determinants of fertility rate. The lower the age at the first birth the longer the reproductive span, which results in higher fertility rate. Female education level is the main determinants of the variation in the age at marriage (Kabir *et al*, 2001). A secondary level of education has the greatest impact of education on fertility (Akman, 2002). More educated woman is associated positively with the use of modern contraceptive (Omariba, 2006). The education of both sexes and age of woman at marriage are useful to control TFR (Khattak 2011).

So the conditions of the trends in age at marriage, education attainment, urbanization and family planning programs will ensure continuing fertility decline.

Objective of the study

This paper aims at estimating the total marital fertility rate (TMFR) in Sudan depending on Multiple Indicators Cluster Survey (MICS 5) data. In addition it aims to determine the impact of female education level, woman age at the first birth, contraceptive use and urbanization on TMFR in Sudan.

Methods

Total marital fertility Rate (TMFR) is the average of number of children per married woman; that a hypothetical cohort of women would bear over their reproductive life estimated over a given period and assuming no mortality, immigration or emigration occurs.

The total number of women in MICS5 survey was (18302), the married women was (12942). TMFR is estimate for the different mother education level group; no educated, primary, secondary and higher.

Nonparametric correlation; Kendall's tau_b; is estimate to determine the correlation between education level and TMFR, woman age at the first birth, percent of women use contraceptive and urbanization. The one way analysis of variance is develop to compare the mean of TMFR, woman age at the first birth, percent of women use contraceptive and urbanization in different education level as main factor that effect on TMFR directly or indirect throw other variables.

Multiple linear regression model is develop for the TMFR as dependent variables and woman age at the first birth, education level, percentage of women using contraceptive and urbanization percent as an explanatory variables; to determine the impact of these variables on TMFR and how can we use them to control fertility rate.

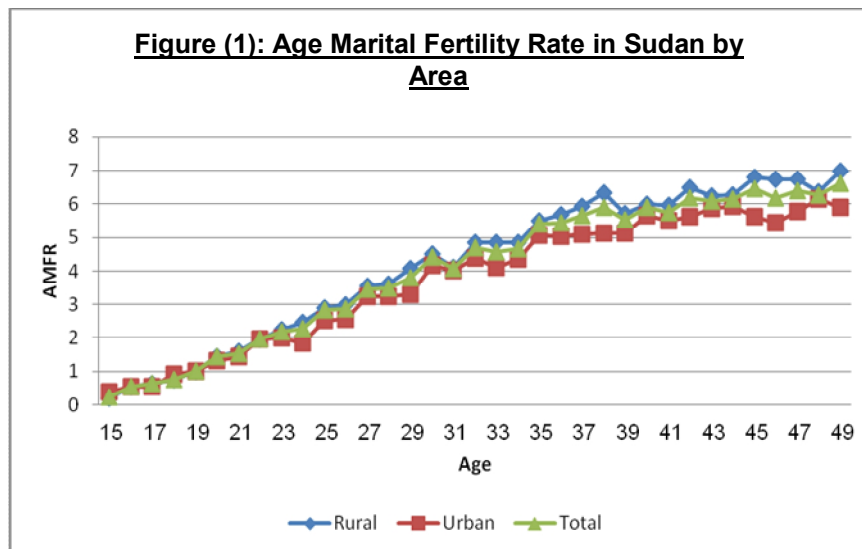
Results

According to MICS5 data for Sudan, TMFR is (4.04) per woman – well above replacement level (2.1), the minimum typically needed to maintain a stable population. Red Sea state has the minimum TMFR; but it still above the replacement level; and the maximum TMFR was in East Darfor. The west state have the maximum TMFR in Sudan which are greater than 4.01. Table (1).

Table (1): Sudan Total Marital Fertility Rate by Area

	State	Rural	Urban	Total
North	Northern	2.89	3.22	2.95
	River Nile	3.57	2.75	3.29
East	Red Sea	2.31	3.16	2.78
	Kassala	3.86	3.82	3.82
	Gadarif	4.35	4.44	4.29
Center	Khartoum	3.73	3.31	3.38
	Gezira	3.58	3.66	3.55
South	White Nile	4.02	4.29	4.02
	Sinnar	4.14	3.80	4.03
	Blue Nile	5.29	4.26	4.85
West	North Kordofan	4.39	4.24	4.24
	South Kordofan	4.90	4.66	4.72
	West Kordofan	4.34	4.10	4.22
	North Darfor	4.86	4.28	4.66
	West Darfor	4.82	4.64	4.76
	South Darfor	4.74	4.49	4.67
	Central Darfor	4.49	4.96	4.46
	East Darfor	5.06	5.26	5.06
Total		4.19	3.73	4.04

Urban women show comparatively lower TMFR (3.73) than the rural women (4.19). Table (1). For all ages the TMFR in rural area is more than in urban area but there is significant difference between them, figure (1). There is a moderate negative significant correlation between TMFR and the percent of urbanization as Kendall's tau_b show (-0.474).

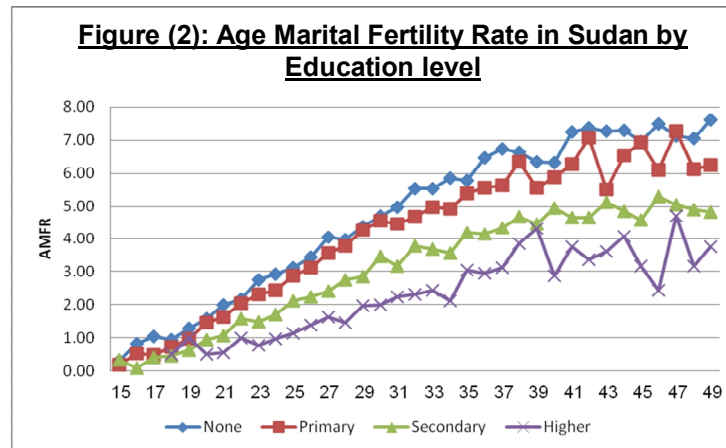


Most theories predict that better-educated women had fewer children than less-educated women; so in Sudan for all state the TMFR decline as the education level increases, table (2). There is significant difference in mean of the TMFR in different level of education as one way analysis of variance (ANOVA) reveal, table (3). The least significant difference test (LSD) show that the mean of the TMFR in each level of education is significantly different from other at 1% significance level. There is a strong negative significant correlation between TMFR and the education level as Kendall's tau_b show in table (3) .

Table (2): Sudan Total Marital Fertility Rate by Education Level

	State	No education	Primary	Secondary	Higher	Total
North	Northern	5.32	3.34	2.89	2.12	2.95
	River Nile	3.98	3.66	3.26	1.78	3.29
East	Red Sea	2.91	2.76	3.03	2.12	2.78
	Kassala	3.92	3.58	3.79	1.60	3.82
	Gadarif	4.46	4.57	3.26	2.75	4.29
Center	Khartoum	4.63	4.20	3.22	2.42	3.38
	Gezira	4.80	4.28	3.17	2.28	3.55
South	White Nile	4.78	4.55	3.21	2.32	4.02
	Sinnar	4.82	3.88	3.38	2.61	4.03
	Blue Nile	5.35	4.54	2.84	2.50	4.85
West	North Kordofan	5.06	3.92	3.40	1.92	4.24
	South Kordofan	5.47	4.63	3.86	3.25	4.72
	West Kordofan	4.86	3.88	3.30	1.60	4.22
	North Darfor	5.25	4.41	3.44	2.58	4.66
	West Darfor	5.20	4.16	3.95	4.33	4.76
	South Darfor	5.40	4.59	3.68	2.81	4.67
	Central Darfor	4.68	4.04	3.95	2.75	4.46
	East Darfor	5.86	4.62	3.91	3.12	5.06
Total		4.82	4.09	3.42	2.49	4.04

Figure (2) show the decline of the TMFR as education level increased for different ages of women in reproductive span in Sudan.



Better-educated women are more likely to be aware of modern contraceptives and to adopt new birth-control methods. There is a moderate positive significant correlation between education level and the percentage of women using contraceptive as Kendall's tau_b show in table (3). There is significant difference in using contraceptive with different level of education; as the LSD test shows that women with secondary and higher education are significantly using contraceptive more than other .

Table (3): ANOVA and Correlation for TMFR, Contraceptive use and Age at the first birth by Education level

	No education	Education level			F	Kendall's tau_b
		primary	secondary	higher		
TMFR	4.82	4.09	3.42	2.49	54,082**	-0.732**
Contraceptive use	6%	13%	18%	24%	10.637**	0.465**
Age at the first birth	19.72	19.77	22.17	25.72	105.504**	0.743**

** Significant at 0.01 level

Women education level is correlate strongly, positively and significantly with the age at the first birth; there is significant difference in mean of the age at the first birth with different education level as the LSD test reveal. So the better educated women in Sudan will be out of the risk of pregnancy before 20 years old.

Regression model

Change on TMFR in Sudan is caused by many factors; the major one of them are the woman education level, age at the first birth, percentage of women using contraceptive, and urbanization percent. A technique of least square is employed to check the impact of these factors on TMFR. The model is given by this equation:

$$TMFR = \beta_0 + \beta_1 age + \beta_2 edu + \beta_3 contra + \beta_4 urban + \mu_i$$

Where:

age: mean age of woman at the first birth.

edu: woman education level.

contra: percentage of women using contraceptive.

urban: urbanization percentage.

β_0 : model intercept.

$\beta_i (i=1,2,3,4)$

are the coefficients of the explanatory variables.

U_i : is the random error and assumed to follow a normal distribution with zero mean and constant variance.

Table (4): Regression model results, TMFR as dependent variable

explanatory variables	Coefficients	Standard Error	t-statistics	P - value
intercept	9.223**	0.801	11.509	0.000
Age	-0.215**	0.047	-4.568	0.000
Edu	-0.313*	0.124	-2.524	0.014
Contra	0.109	0.649	0.168	0.739
Urban	-0.113	0.339	-0.334	0.867

R- Square = 0.775, Adjusted R- square = 0.761, F-statistics = 57.624, P-value = 0.000

** Significant at 0.01 level

* Significant at 0.05 level

According to the estimated multiple regression model table (4); the regression model is significant at 1% significance level as the F-statistics reveal. The age at the first birth and education level are negatively affect TMFR in Sudan; The age at the first birth affect is significant at 1% significance level. Education level is significant at 5% significance level. But contraceptive use and urbanization percent are not significant at 5% significance level; so they were removed from the model:

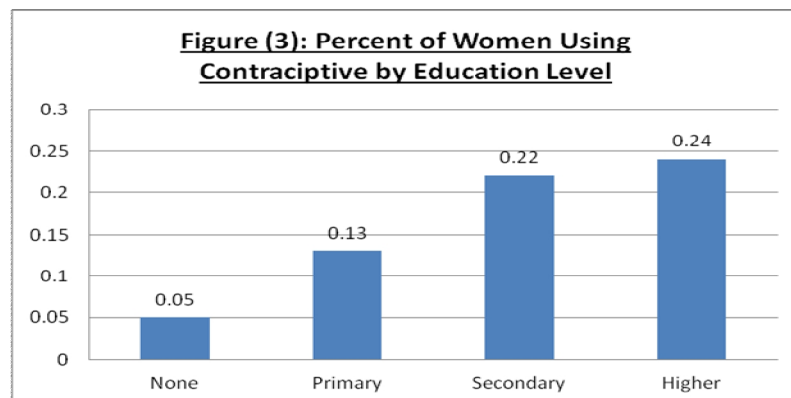
Table (5): Regression model results, TMFR as dependent variable with the age at first birth and education level as explain variables.

explanatory variables	Coefficients	Standard Error	t	P - value
intercept	9.185	0.801	11.960	0.000**
Age	-0.213	0.047	-4.728	0.000**
Edu	-0.331	0.124	-3.133	0.003**

R- Square = 0.774, Adjusted R- square = 0.768, F-statistics = 118.338, P-value = 0.000

** Significant at 0.01 level

As shown in table (5) in the modified model the affections of education level be more significant than in table (4). The adjusted determinant coefficient reveal that the age at first birth and education level explain 77% of the change in TMFR in Sudan. But female education has indirectly affection on TMFR; more educated female are using more contraceptives than non educated ones or those with primary education as ANOVA in table (3) and LSD test show.



Conclusion

A key finding of this research is that the education is the main factor for controlling the total marital fertility rate (TMFR). I have clearly confirmed that the rising of education level will decrease the TMFR directly or indirect. The age at first birth decreases when the female be more educated; so the reproductive span will be short. More educated females have a good awareness of family planning and contraceptive use.

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