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Genetics

BIOLOGICAL FACTORS AND MULTIPLE REGRESSION ANALYSIS FOR HUMAN FERTILITY AMONG FOUR DIFFERENT ENDOGAMOUS POPULATIONS OF COASTAL ANDHRA PRADESH.

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ABSTRACT : Multiple regression analysis was done to examine the impact of the biological factors on fertility. This paper focuses on the biological factors on human fertility. Here fertility is used as the number of children ever born for a woman. This variable is easily measurable. The entire set of variables related to fertility are classified into the important biological factors influencing the fertility are age at marriage, age at menarche, age at first conception and age at last conception. To examine the impact of the factors on fertility by multiple regression analysis and the effect of each group on fertility is discussed separately and collectively. The resultant zero order correlation coefficients indicate that there is no serious problem of multicollinearity in estimated regression model. In all the four population groups, the R2 values are statistically significant which indicates that all the explanatory variables considered in the model together explain 63% of the variation in fertility among Kapu population, 55% among Settibalijas, 50% among Paki's and 67% among Yerukala population.

KEYWORDS : Biological factors influencing the fertility, age at marriage Variables. Age at menarche Variables. Age at first conception Variables. Age at last conception variables, Regression Coefficient. Determinants of Fertility. Biological Factor Analysis.

INTRODUCTION

Multiple regression is an extension of simple linear regression. It is used when we want to predict the value of a variable based on the value of two or more other variables. The variable we want to predict is called the dependent variable (or sometimes, the outcome, target or criterion variable). The variables we are using to predict the value of the dependent variable are called the independent variables (or sometimes, the predictor, explanatory or regressor variables). Biological factors affecting human fertility, Reproduction is a quintessentially biological process, and hence all fertility analyses must consider the effects of biology. Such factors, in rough chronological order, include the age of onset of potential fertility. The age at which women become fecund apparently declined significantly during the 20th century; as measured by the age of menarche (onset of menstruation), British data suggest a decline from 16–18 years in the mid-19th century to less than 13 years in the late 20th century. This decline is thought to be related to improving standards of nutrition and health. Since the average age of marriage in western Europe has long been far higher than the age of menarche, and since most children are born to married couples, this biological lengthening of the reproductive period is unlikely to have had major effects upon realized fertility in Europe. In settings where early marriage prevails, however, declining age at menarche could increase lifetime fertility. Fecundability also varies among women past menarche. The monthly probabilities of conception among newlyweds are commonly in the range of 0.15 to 0.25; that is, there is a 15–25-percent chance of conception each month. This fact is understandable when account is taken of the short interval (about two days) within each menstrual cycle during which fertilization can take place. Moreover, there appear to be cycles during which ovulation does not occur. Finally, perhaps one-third or more of fertilized ova fail to implant in the uterus or, even if they do implant, spontaneously abort during the ensuing two weeks, before pregnancy would be recognized. As a result of such factors, women of reproductive age who are not using contraceptive methods can expect to conceive within five to 10 months of becoming sexually active. As is true of all biological phenomena, there is surely a distribution of fecundability around average levels, with some women experiencing conception more readily than others.

Fertility depends on a number of social, economic and biological factors. As the focus of this study is only on the biological factors, only these are considered here. The important biological factors influencing the fertility are age at marriage, age at menarche, age at first conception and age at last conception. To examine the impact of the factors on fertility.

The multiple regression model

$Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4$

Where

Y is fertility : which is measured by total number of live births.

x_1 is age at marriage which is measured in years.

x_2 is age at menarche which is measured in years.

x_3 is age at first conception which is measured in years.

x_4 is age at last conception which is measured in years.

And a, a_1, b_1, b_2, b_3, b_4 are the parameters, is estimated for each of the four caste populations by the method of least squares.

Studies pertaining to fertility of women is important in view of their important biological factors influencing the fertility are age at marriage, age at menarche, age at first conception and age at last conception. To examine the impact of the factors on fertility by multiple regression analysis and the effect of each group on fertility is discussed separately and collectively. The resultant zero order correlation coefficients indicate that there is no serious problem of multicollinearity in estimated regression model. (Salikumar, 1992; Joseph Raj, 1996; Chiranjeevulu, 2003; Sampoornam, 2003; Ramachandran, 2005). Biswas (1972) has examined the linear model with single equation, Fertility rate increases upto 20-24 for women and slowely declines and also currently majority of the married women feel that they don't want more than one child (NFHS-3). Kannan et al. (1998) have analysed birth interval in human fertility. Among all the variables included has positive association with human fertility are Age at marriage, Education of women, Education of spouse, Employment of women, Employment of spouse, Income of women, Income of spouse (Coale, 1995; Ghosh, 1975; Zachariah, 1981; Jolly, 1991; Johnson, 1993; Dabral and Malik, 2005). In view of the importance acquired by the women force in the development of the country, this study is taken in Narsapuram Mandalam, West Godavari district, Andhra Pradesh. All the selected caste groups were enumerated and house to house survey was made by personally interviewing the wife and husband of each family for demographic information. The questions in the demographic schedule posed to the subjects and answers elicited. The answers were cross checked by checking the information given by the couple from the people who were present at the time of interview along with the couple.

MATERIALS & METHODS

The total sample of 400 households had been selected from these four different endogamous groups, 100 households each from the four different caste groups were randomly selected in the same ecological niche so that the environmental influences if at all are present, they are similarly affecting all the four different endogamous caste groups. The four endogamous groups included in the present investigation are Kapu (forward caste), Sattibalija (backward caste), Paki (scheduled caste), and Yerukula (scheduled tribe) of Narsapuram Mandal of West Godavari District of Andhra Pradesh.

RESULTS

The following endogamous population groups, biological factors and multiple regression analysis and the effect of each group on fertility is discussed separately and their multiple regression results are given below.

KAPU (Forward Caste) : The estimated multiple regression model for Kapu population is

$$y = 3.453 + 0.0405\, x_1 - 0.0486\, x_2 - 0.328^{*}\, x_3 + 0.213^{*}\, x_4$$

(0.873) (0.800) (6.632) (12.120)

$R^2 = 0.627$, F = 40.063.

Zero order correlation coefficients among Kapu's are presented in the table .1

	Live births	Age at marriage	Age at menarche	Age at first conception	Age at last conception
Live birth	1.000				
Age at marriage	-0.231	1.000			
Age at menarche	-0.080	0.293	1.000		
Age at first conception	-0.176	0.708	0.291	1.000	
Age at last conception	0.572	0.218	0.166	0.524	1.000

Values in the parentheses are the respective 't' values.
* Significant at 1% level.
** Significant at 5% level.

Settibalija (Backward caste) : The estimated multiple regression model for Settibalija population is

$y = 3.949 + 0.0204\, x_1 - 0.116\, x_2 - 0.300^{*}\, x_3 + 0.242^{*}\, x_4$
(0.528) (1.022) (6.438) (10.363)
$R^2 = 0.552$, F = 31.182.

Zero order correlation coefficients among Settibalija's are presented in the table.2

	Live births	Age at marriage	Age at menarche	Age at first conception	Age at last conception
Live birth	1.000				
Age at marriage	-0.220	1.000			
Age at menarche	-0.180	0.255	1.000		
Age at first conception	-0.244	0.688	0.213	1.000	
Age at last conception	0.489	0.263	0.029	0.506	1.000

Values in the parentheses are the respective 't' values.
* Significant at 1% level.
** Significant at 5% level.

Paki (Scheduled caste) : The estimated multiple regression model for Paki population is

$y = 4.408 + 0.0324\, x_1 - 0.340\, x_2 - 0.120 x_3 + 0.207^{*}\, x_4$
(0.237) (-1.639) (0.918) (6.818)
$R^2 = 0.50$, F = 13.381.

Zero order correlation coefficients among Paki are presented in the table. 3

	Live births	Age at marriage	Age at menarche	Age at first conception	Age at last conception
Live birth	1.000				
Age at marriage	0.017	1.000			
Age at menarche	-0.111	0.331	1.000		
Age at first conception	0.106	0.832	0.350	1.000	
Age at last conception	0.578	0.241	0.121	0.431	1.000

Values in the parentheses are the respective 't' values.
* Significant at 1% level.
** Significant at 5% level.

Yerukala (Scheduled Tribe) : The estimated multiple regression model for Yerukala population is

$y = 1.355 + 0.126^{**}\, x_1 - 0.133 x_2 - 0.192^{*}\, x_3 + 0.208^{*}\, x_4$
(2.312) (0.655) (4.053) (13.271)
$R^2 = 0.668$, F = 44.233.

Zero order correlation coefficients among Yerukala's are presented in the table .4

	Live births	Age at marriage	Age at menarche	Age at first conception	Age at last conception
Live birth	1.000				
Age at marriage	0.028	1.000			
Age at menarche	0.053	0.481	1.000		
Age at first conception	0.033	0.550	0.317	1.000	
Age at last conception	0.786	0.042	0.125	0.300	1.000

Values in the parentheses are the respective 't' values.
* Significant at 1% level.
** Significant at 5% level.

DISCUSSION

Zero order correlation coefficients indicate in the table no.1 that there is no serious problem of multicollinearity in estimated regression model. The value of the R2 is statistically significant. It indicates that all the explanatory variables considered in the model together explains 63% of the variation in the fertility. But the coefficients of only two variables namely age at first conception and age at last conception are found to be statistically significant. Therefore, the significant biological factors influencing the fertility in Kapu population are age at first conception and age at last conception. Other things remaining the same, in every one year increase in the age at first conception leads to 0.328 units dicline in fertility, and every one year increase in the age at last conception leads to 0.213 units increase in fertility among Kapu population.

Zero order correlation coefficients indicate in the table no. 2 that there is no serious problem of multicollinearity in estimated regression model. The value of the R2 is statistically significant. It indicates that all the explanatory variables considered in the model together explains 55% of the variation in the fertility. But the coefficients of only two variables namely age at first conception and age at last conception are found to be statistically significant. Therefore, the significant biological factors influencing the fertility in Settibalija population are age at first conception and age at last conception. Other things remaining the same, in every one year increase in the age at first conception leads to 0.300 units dicline in fertility, and every one year increase in the age at last conception leads to 0.242 units increase in fertility among Settibalija population

Zero order correlation coefficients indicate in the table no.3 that there is no serious problem of multicollinearity in estimated regression model. The value of the R2 is statistically significant. It indicates that all the explanatory variables considered in the model together explains 50% of the variation in the fertility. But the coefficients of only one variable namely age at last conception is found to be statistically significant. Therefore, the significant biological factors influencing the fertility in Paki population is age at last conception. Other things remaining the same, in the every one year increase in the age at last conception leads to 0.207 units increase in fertility among Paki population.

Zero order correlation coefficients indicate in the table no.4 that there is no serious problem of multicollinearity in estimated regression model. The value of the R2 is statistically significant. It indicates that all the explanatory variables considered in the model together explains 67% of the variation in the fertility. But the coefficients of three variables namely age at marriage, age at first conception and age at last conception are found to be statistically significant. Therefore, the significant biological factors influencing the fertility in Yerukala population are age at marriage, age at first conception and age at last conception. Other things remaining the same, in every one year increase in the age at marrige leads to 0.126 units increase in fertility, every one year increase in the age at first conception leads to 0.192 units dicline in fertility, and every one year increase in the age at last conception leads to 0.208 units increase in fertility among Yerukala population.

CONCLUSION

Multiple regression analysis was done to examine the impact of the biological factors on fertility. The biological factors considered are age at marriage, age at menarche, age at first conception and age at last conception. The resultant zero order correlation coefficients indicate that there is no serious problem of multicollinearity in estimated regression model. In all the four population groups, the R^2 values are statistically significant which indicates that all the explanatory variables considered in the model together explain 63% of the variation in fertility among Kapu population, 55% among Settibalijas, 50% among Paki's and 67% among Yerukala population. Among Kapu's and Settibalija's, coefficients of only two variables namely age at first conception and age at last conception are found to be

statistically significant. Which indicates 0.328 units decline in fertility among Kapu's and a decline by 0.300 units among Settibalija's with every one year increase in the age at first conception, other things remaining the same. Similarly, every one year increase in the age at last conception leads to 0.213 units increase in fertility among Kapu's and 0.242 units increase in fertility among Settibalija's. Among Paki's the coefficients of only one variable i.e, age at last conception is found to be statistically significant which implies an increase of 0.207 units in fertility with every one year increase in the age at last conception. Among the Yerukala population, the coefficients of three variables namely age at marriage, age at first conception and age at last conception are found to be statistically significant indicating 0.126 units increase in fertility with every one year increase in the age at marriage, 0.192 units decline in fertility with every one year increase in age at first conception and 0.208 units increase in fertility with every one year increase in the age at last conception, assuming all other things are the same.

Comparing R-square and the level of significance of the coefficients together reveal that biological factors the two variables namely age at first conception and age at last conception are found to be statistically significant in kapu and Settibalija stands increase in fertility, age at last conception are found to be statistically significant stands increase in fertility in Paki and the coefficients of three variables namely age at marriage, age at first conception and age at last conception are found to be statistically significant increase in the fertility of women of Yerukula tribe.

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