APPLICATION OF MULTIPLE LINEAR REGRESSION ON SOME FACTORS AFFECTING BABY'S WEIGHT AT BIRTH

Aminu Suleiman[1], Ahmad Abubakar Suleiman[2], Usman Aliyu Abdullahi [3]

[123]Department of Statistics, Kano University of Science and Technology, Wudil. Kano, Nigeria.

Abstract

This research work looked at some factors to check whether they are related or not related to baby's weight. Multiple linear regression model is used to determine the relationship between the variables (i.e. to see if mother's weight, mother's age, gestation period and sex of the baby can influence the weight of a baby at birth). From the analysis obtained we have seen that all the variables are not related to baby's weight, because the p-value of the regression from the analysis of variance is 0.401 which is clearly greater than our level of significance (0.05), therefore our assumption of null hypothesis was rejected. Based on our finding we finally conclude that the relationship between baby's weight and mother's weight, mother's age, gestation period and sex of the baby is not significant, hence baby's weight cannot be influence by any of these factors.

Keywords: baby's weight, mother weight and age, gestation period, sex of a baby, Multiple Regression.

INTRODUCTION

According to the Cambridge dictionary[1] birth is when a baby or any young animals comes out of its mother.

According to the Collins English dictionary[3] an infant is a child at the earliest stage of its life, a baby is an infant birth weight of a baby is the weight of the baby at birth. This is taken immediately after delivery and is been recorded at the time of delivery.

United State National Library MedLinePlus[2], in the health topic they explain birth weight as first weight of your baby, taken just after he or she is born. A low birth weight is less than 5.5 pounds. A high birth weight is more than 8.8 pounds. They further explained that a low birth weight baby can be born too

small, too early premature or both. This can happens for many different reasons. They include health problem in the mother, genetic factors, problem with placenta and substance abuse of the mother.

World Health Organisation (WHO) [11] also defined birthweight as the weight of the foetus or newborn obtained after birth. For live births, birth weight should preferably be measured within the first hour of live, before significantly postnatal weight loss has occurred.

A baby's low weight at birth is either the result of preterm birth (before 37 weeks of gestation) or due to restricted foetus (intrauterine) growth. Low birth weight is closely associated with foetal and neonatal mortality and morbidity, inhibited growth and cognitive development, and chronic diseases later in life. Many factors affecting the duration of gestation and foetal growth, and thus the birthweight. They relate to the infant the mother, or the physical environment and play an important role in determining the birthweight and the future weight of the infant[10].

Some low birth babies may be more at risk for certain health problems. Some may become sick the first day of life or develop infections. Other may suffer from a long terms problems such as delayed motor and social development or learning disabilities.

High birth weight are often big because mother the parent are big, or the mother has diabetes during pregnancy. These babies may be at higher risk of birth injuries and problems of blood sugar.

Also according to the world health organisation (WHO) and UNICEF, New York (2004)[10], birthweight is affected to a great extent by the mother's own foetal growth and her diet from birth to pregnancy, and thus her body composition at conception. Mothers in deprived socio-economic conditions frequently have low birthweight infants

It was also found that richer women has better birth outcomes, hence the socio economic standard of the mother was more important in determining her baby's birth size. This was attributed to the better utilization of antenatal care among richer women[9].

According to Barnard *et al.* (1993)[12] preterm infants are at higher risk for developmental disabilities than full term infants. An early difficulties was poor quality of parent child interaction.

Mokhtar Malekpour (2004)[13] since prenatal and perinatal complication (e.g. neonatl cerebral haemorrhages) occurring in preterm babies might constitute a potential risk to brain development, one might expect these babies to have more problem in area of learning, behaviour, cognition , language, sensory motor and neuropsychological development later in life.

It was also understood that high birth weight may be regarded as a predictor for dental caries, and especially, birth weight ≥4500g is a risk factor for caries increment during adolescence[14].

Another result indicated positive and significant relationship between high birth weight and bone tumour risk. Further individual with high birth weight were found to be more likely to develop OS, while European population with high birth weight exhibited a greater risk for bone tumor[15].

According to two Professors Jose M. Olmas and Eduardo Halac of university of Cordoba in their presentationa[16], they said babies born with high birth weight represent smaller group than those born with low birth weight, they are nonetheless, an important public health issues because:

1. They have immediate problem at birth
2. They are now the focus of larger epidemiological investigations because long term effects of neonatal macrosomia do not fade; rather, they persist through lifetime increasing the risk of developing obesity, metabolic syndrome, diabetes mellitus and hypertension disorders.

All these factors both immediate and remote affects weight of a baby. My interest lies on the immediate factors that affect the babies weight, the weight expressed in kilograms as its units is obviously dependent on many factors but for this piece of work our main objective is to check if mothers weight, gestation period, age and sex of a baby is in any way related to the weight of baby while giving birth to the baby.

MATERIAL AND METHODOLOGY

The data used in this research is primary data documented from Nasarawa Specialist Hospital, Kano and Aminu Kano teaching Hospital. The data include mother's age, mother's weight, and gestation period, sex of the baby and weight of the baby as at birth. All the data used in the research are qualitative except only one is quantitative which sex of the baby. So to make it qualitative we assign some variables to represent them (i.e. 1 for male, 2 for female).

To perform the statistical analysis we used multiple regression in order to achieve our objectives of knowing which among the variables contribute to baby weight at birth. Multiple linear regression is used to check whether the variables at stake will contribute to the weight of the baby or not.

REGRESSION

Regression[6] is the techniques used to study the relationship between variables. Linear regression is used for a special class of relationship, those that can be described by straight line.

MULTIPLE REGRESSIONS

Multiple regression analysis[5] is a powerful technique used for predicting the unknown value of a variable from the known value of two or more variables- also called the predictors.

By multiple regression, we mean models with just one dependent and two or more independent (exploratory) variables. The variable whose value is to be predicted is known as the dependent variable and the ones whose known values are used for prediction are known independent (exploratory) variables.

However in deciding on the best set of explanatory variable for a regression model, with the aid of statistical package SPSS the esteemed regression equation is computed based on the following assumptions.

1. The regression model errors are normally distributed.
2. The model term have a constant variance for all combination of values of the independent variables.
3. The model errors terms are independent.

The multiple regression model is given as follows

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_n X_n$$

To test the significance of regression we used Analysis of variance (ANOVA). The coefficient of determination R^2 is also computed. This R^2 is used to measure the proportion of variable in the dependent variable that is explained by the dependent variable relationship to all independent variable in the model however R^2 is now called the Multiple Coefficient of determination.

The coefficient of determination R^2 is given by $R^2 = \frac{SS_R}{SS_y} = 1 - \frac{SS_E}{SS_{yy}}$

RESULT AND NUMERICAL APPLICATION

In conducting our multiple regression analysis we use the variable weight of the baby as response variable and we use the other four variables weight of the mother, age of the mother, gestation period and sex of the baby as predictors.

REGRESSION ANALYSIS

Regression Analysis: BABYS WEIGHT versus MOTHERS AGE, GESTATION PERIOD, SEX OF A BABY AND MOTHERS WEIGHT.

H_0: There is a significant relationship between the variables.
H_1: There is no significant relationship between the variables.

The Regression equation is
BABYS WEIGHT = 5.53 - 0.0125 MOTHERS AGE - 0.0229 GESTATION PERIOD - 0.051 SEX OF A BABY - 0.0217 MOTHERS WEIGHT

Table 1.0: Coefficients

Predictor	**Coef**	**SECoef**	**T**	**P**
Constant	5.534	1.766	3.13	0.002
Mothers Age	-0.01255	0.01394	-0.90	0.370
Gestation Period	-0.02291	0.04149	-0.55	0.582
Sex of a Baby	-0.0510	0.1452	-0.35	0.726
Mothers Weight	-0.02172	0.01193	-1.82	0.071

S = 0.753522 R-Sq = 3.7% R-Sq(adj) = 0.1%

Table 1.1: ANALYSIS OF VARIANCE

Source	**DF**	**SS**	**MS**	**F**	**P**
Regression	4	2.3146	0.5786	1.02	0.401
Residual Error	105	59.6186	0.5678		
Total	109	61.9332			

Table 1.2:

Source	**DF**	**Seg SS**
Mothers Age	1	0.1471
Gestation Period	1	0.2049
Sex of a Baby	1	0.0797
Mothers Weight	1	1.8829

Table 1.3: Unusual observation

Obs	**Mothers Age**	**Baby's Weight**	**Fit**	**SE Fit**	**Residual**	**St Resid.**
40	21.0	1.4000	2.9276	0.1433	-1.5276	-2.06R
84	31.0	4.4000	2.6839	0.2173	1.7161	2.38R
85	25.0	4.6000	3.0298	0.1455	1.5702	2.12R

R denotes an observation with a large standardized residual.

Normal plot of Residuals for BABYS WEIGHT

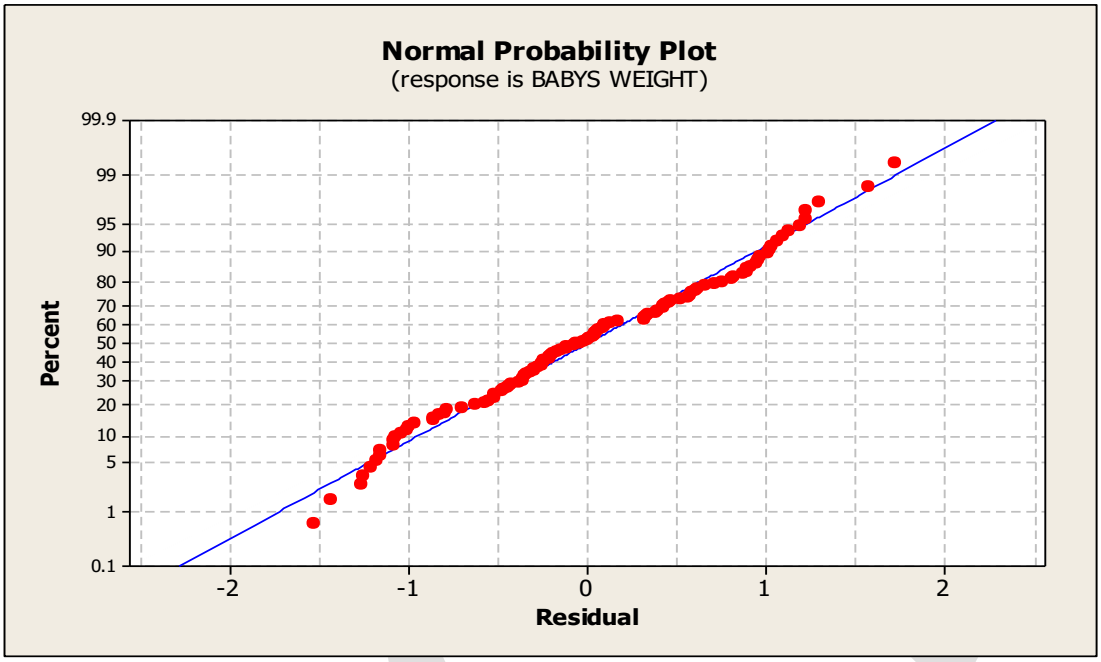

Fig. 1

Residuals vs Order for BABYS WEIGHT

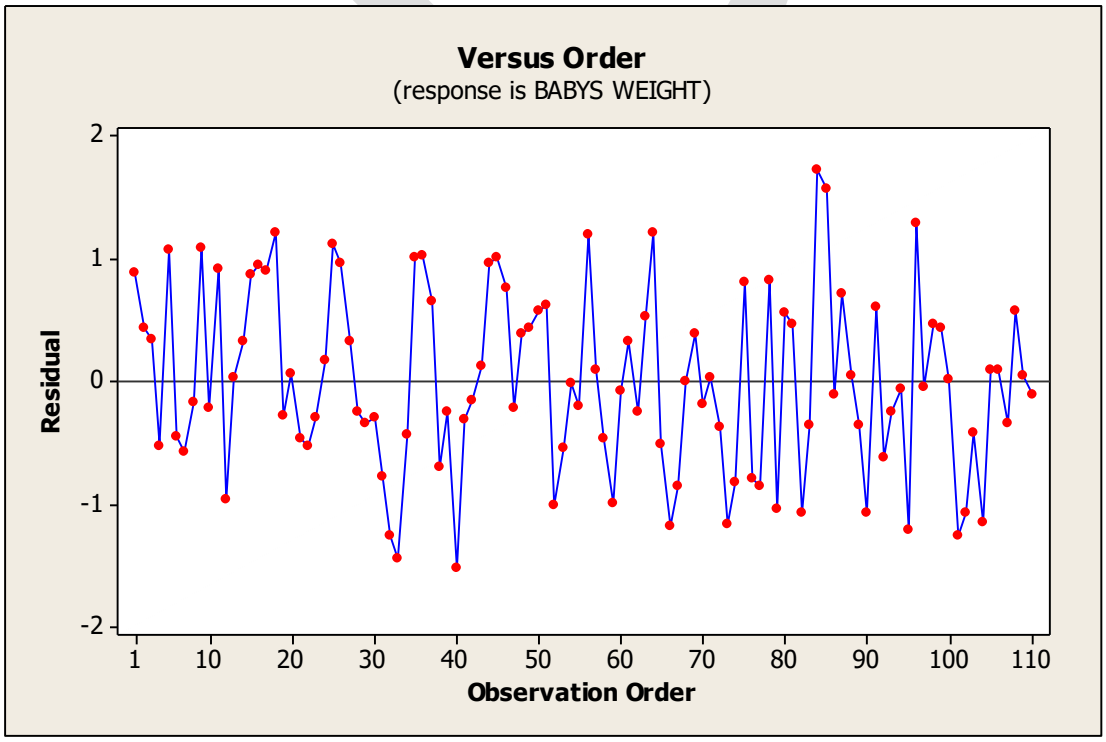

Fig. 2

Fig 1. Explained that the data is normally distributed.

DISCUSSION

From the analysis we have seen that the P-Value of multiple regression 0.401 is greater than our level of significance 0.05, therefore we reject the null hypothesis and conclude that there is no significant relationship between baby's weight and mother weight, mother's age, gestation period and baby's sex. Moreover, the analysis indicated that baby's weight does not depend on these four variables (factors).

From table 1.0, looking at the P-Values of all the coefficients which is clearly greater than level of significance 0.05. Hence we conclude that all the parameters are not significant except that of constant. Moreover the p-value of mother's weight which is 0.07 is somehow close to 0.05. So we can say that mother's weight can be related to baby's weight but the relationship is weak. May be it can influence due to eating habit.

CONCULSION

Factors affecting the weight of babies at birth have been a case affecting the world today. Where the weight of the babies varies, we decide to check some factors to see if the problem of baby's weight can be related to mother's age, weight, gestation period and sex of the babies. From the Analysis carried out, it was found that a variable, mother's weight, mother's age, gestation period and sex is not significantly related to baby's weight. The overall model is not statistically significant. Conclusively, this implies that the variable mother's age, weight, gestation period and sex has no effect on the weight of the baby at birth, only that mother's weight is nearly to have association with baby's weight.

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