



INFLUENCE OF MATERNAL AGE AND CONSANGUINITY ON PREGNANCY OUTCOME IN SIVAGANGAI, TAMIL NADU, SOUTH INDIA

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among both authors. Author TS collected data, performed the statistical analysis and wrote the first draft of the manuscript. Author JCM designed the study protocol and managed the analyses of the study. Both authors read and approved the final manuscript.

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ABSTRACT

India is one of the developing countries, which has many types of sub population with peculiar culture practices. Consanguinity is one among them. The consanguinity may increase the chance of producing offspring with congenital anomalies and having adverse pregnancy outcome. The maternal age of women plays an important role in delivering the healthy newborn. Maternal age is directly proportional to the adverse pregnancy outcome. The present study was aimed to calculate the adverse pregnancy outcome in Sivagangai population in relation to consanguinity and maternal age factor. Among the total population studied (8743), 11.1% were faced adverse pregnancy outcome. In the present study, 2.5% of spontaneous abortion, 0.4% of induced abortion, 1.8% of still birth, 2.4% of preterm birth and 3.7% of low birth weight was recorded, where 15.6% of negative pregnancy outcome was recorded in inbreeding population and 9.3% were recorded in out breeding population. The maximum adverse pregnancy outcome (90%) was recorded in the women aged between 30 to 35 followed by 18 to 21 group (21.8%). There are no well accepted measures in this area regarding this hereditary health problem associated with customary consanguinity. This community based study should be ideal for true and first hand estimation of congenital anomalies associated with negative pregnancy outcomes. Women who are in the later stages of their reproductive life are at great risk for having negative pregnancy outcome. Since the delivery outcome is associated with consanguinity and late marriage, this assessment is unique information to take necessary steps to prevent such health issues of future generation.

Keywords: Consanguinity; maternal age and adverse pregnancy outcome.

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1. INTRODUCTION

Health is a functional and metabolic efficiency of a biological system. Nowadays, human being are striving much to live along with various types of health issues. Due to thick population density, diversity of health issues is a common issue in our country. Most of the health issues are due to drug addiction, less physical exercise, imbalanced diet, hereditary impairments and diseases. Parents play a pivotal role on their child health and behaviors. The healthy mothers can deliver both physically and mentally healthy children. The gestation periods of a mother is a vital days for the developing embryo. Normally, pregnancies last between 37 to 41 completed weeks, which leads to the complete development of an infant's organs and systems [1]. Still birth is a type of fetal death in mother's womb after the survival of 28 weeks. Some are born before the gestational period with live or dead. In global estimation, 2.64 million of babies were born dead in 2009 and 14.5% decline in the stillbirth between 1995 and 2009 [2 and 3].

Problems during pregnancy may affect physical or mental health of the baby. These complications can evoke the mother's health, the fetus's health or both. These may also lead to damage the genetic makeup and can be transmitted to next generation. The genetic disorder causes various malformations such as congenital disorder, birth defects, cancer etc. Congenital anomalies are the structural and functional changes that occur during the fetus development. It can also be caused due to genetic factor or improper antenatal care during the pregnancy period. The substance which causes the congenital anomalies is called teratogens. This may cause intrauterine growth retardation, abortion, low birth weight, fetal death and improper neural development. The developmental anomalies occurred in fetus due to intrinsic and extrinsic factors. The intrinsic factors inside the body make some people more likely to alter the development of fetus than others. The lethal pollutants in the environment may cause gene alterations based on the accumulation inside the cells. The alterations may not cause any ill effect to person's health but cause permanent changes in certain genes which lead to impairment in the developing fetus. The extrinsic factors include lifestyle choices like cigarette smoking, excessive alcohol consumption, poor diet, lack of exercise, excessive sunlight exposure and sexual behavior which increases the exposure to certain viruses. Various other factors such as medical drugs, hormones, radiation, viruses, bacteria, and environmental chemicals from various sources can also alter the development pattern of embryo. All these factors act as maternal pre - conception

mutagenic agents and maternal post - conception teratogenic agents. Pre-conception mutagenic agents can cause chromosomal abnormalities and syndromes. The post-conception teratogenic agents cause organ defects. In embryonic development, the sensitive period of organogenesis may be few days or a week. When the fetus exposed to the teratogenic agents during the time of sensitive period, pattern formation of organ will be affected. The teratogenic agents have negative impact after the sensitive periods. In human fetal development, the sensitive period will be the first trimester of the pregnancy period. During this period the fetus is susceptible for organ anomalies and infectious diseases. Diseases such as HIV, syphilis, hepatitis, herpes, gestational diabetics and high blood pressure may also cause pregnancy complication. Not only the infection diseases but also hereditary anomalies trigger the adverse birth outcome in women. There are many types of infections that can cause an increased risk of miscarriage, stillbirth or neonatal death, preclampsia, low amniotic fluid, ectopic pregnancy, gestational diabetics and placenta previa. Infections such as bacterial vaginosis lead to premature birth, gonorrhea which can contaminate the amniotic fluid and cause preterm labor. Fetal anemia can trigger a miscarriage. Streptococcus can cause severe complications in newborns and fatal. Toxoplasmosis causes birth abnormalities and intellectual disabilities. Listeria can cause miscarriage, stillbirth, and birth abnormalities. Cytomegalo virus is often harmless but can also cause birth abnormalities and intellectual disabilities. Not every woman who gets one of these infections will have a pregnancy loss.

Children who are born prematurely or with low birth weight also have a higher risk of learning disabilities, behavioral problems and anomalies. These anomalies occur due to recessive lethal mutation in the genes. They are derived from both paternal and maternal parents. It is well known that consanguinity increases the chance of the husband and wife carrying the identical gene derived from a common ancestry. It is estimated that one billion current global populations prefer consanguinity [4 and 5]. The rate of consanguinity was higher in lower socioeconomic classes. The children of such marriage having greater risk of being homozygous for the harmful genes and consequently suffer from autosomal recessive disorder and congenital malformations. The health problems in both maternal parent and fetus leads to negative pregnancy outcome. Since the negative delivery outcome is associated with heredity and parents' health, an assessment has been carried out to find out the impact of endogamy on pregnancy out in Sivagangai, Tamil Nadu.

2. METHODOLOGY

The present study was a population based cross sectional investigation, carried out in Sivagangai district, during the period of January 2017- December 2018. A total number of 8743 delivered women were taken for investigation. Most of the negative pregnancy outcome is associated with autosomal recessive disorders inherited from their parents, which leads to fetal developmental anomalies. Such erroneous fetal development influences abortion, still birth, low birth weight and preterm birth during pregnancy. Since endogamy is also triggering such anomalies, assessments on adverse pregnancy outcome have been made to enrich our work. These families were selected by simple random sampling method. Information was collected through personal visit to the selected families. The details about their subjects in terms of clinical features and pregnancy outcomes such as still birth, low birth weight, abortion and preterm birth of the pregnant women were taken by face-to-face interview in the local language according to the standard procedure [6]. The types of pregnancy outcome in relation endogamy in the study population were recorded. The maximum care was taken to avoid any wrong interpretation by the representatives. The collected data were then

processed to get the pattern of pregnancy outcome and defects. The types of pregnancy outcome have also been classified based on maternal age and heredity [7].

3. RESULT

In the present study the adverse pregnancy outcome among the consanguineous and non consanguineous group and their age of pregnancy were recorded. Among the total samples of 8743 cases, 2471 were inbreeds and 6272 were out breeds. The women at the gestation period during the age group of 18 to 21 was 803, 21 to 25 was 3927, 25 to 30 was 3861 and 30 to 35 was 152. The details of the impact of consanguinity in relation to adverse pregnancy outcome in Sivagangai with different age group are presented in Table 1 and 2. The odd ratio was calculated in order to assess the association between the odds of pregnancy outcome of consanguineous parents (exposed) and non consanguineous parents (unexposed). The risk ratio was calculated to determine the ratio of the probability of an outcome of the pregnancy of kinship parents to the probability of an outcome in the pregnancy outcome of non consanguineous parents.

Table 1. Influence of consanguinity on abortion and still birth versus maternal age

	Age	C	NC	Odd ratio	Risk ratio	χ^2 value	P value	95% CI
Spontaneous abortion	18-21	16	23	1.56	1.52	1.82	0.17	0.82-2.84
	21-25	34	49	1.75	1.72	6.29	0.01	1.12-2.66
	25-30	38	41	2.48	2.43	16.94	<0.0001	1.57-3.75
	30-35	17	7	1.98	1.74	49.44	<0.05	0.79-3.81
Induced abortion	18-21	6	3	4.48	4.39	5.31	0.02	1.10-17.44
	21-25	9	3	7.52	7.47	12.65	0.0003	2.02-27.54
	25-30	6	3	5.26	5.24	6.88	0.008	1.31-20.54
	30-35	8	5	8.99	6.78	16.59	0.00004	2.39-19.22
Still birth	18-21	9	13	1.54	1.52	0.98	0.322	0.65-3.51
	21-25	17	20	2.13	2.11	5.47	0.01	1.11-4.02
	25-30	19	22	2.28	2.26	7.28	0.006	1.23-4.16
	30-35	12	51	1.41	1.20	0.6	0.43	0.76-1.89

Table 2. Statistical applications of impact of maternal age on adverse pregnancy outcome

	Age	C	NC	Odd ratio	Risk ratio	χ^2 value	P value	95% CI
Preterm birth	18-21	14	25	1.24	1.23	0.41	0.52	0.65-2.32
	21-25	21	28	1.88	1.86	4.9	0.02	1.06-2.27
	25-30	24	29	2.19	2.16	8.4	0.003	1.26-3.70
	30-35	15	54	1.36	1.17	0.58	0.44	0.78-1.76
Low birth weight	18-21	29	37	1.81	1.72	5.38	0.02	1.08-2.73
	21-25	36	49	1.85	1.82	7.98	0.004	1.19-2.79
	25-30	38	54	1.87	1.84	8.84	0.002	1.22-2.77
	30-35	19	70	1.43	1.15	0.72	0.39	0.84-1.56

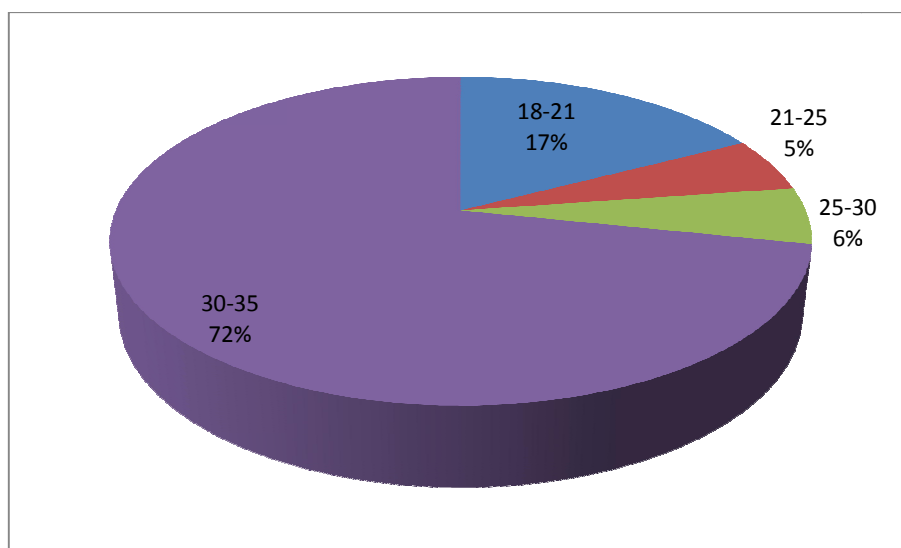


Fig. 1. Negative pregnancy outcome in ratio to maternal age

In the present observation, the negative pregnancy outcome either in first or second or third pregnancy were recorded as 21.8% between the age of 18 to 21, 6.7% were between 21 to 25, 7% were between 25 to 30 and 90% were aged between 30 and 35. Among the total negative pregnancy outcome, the highest percentage was observed in the women aged between 30 and 35.

4. DISCUSSION

Consanguinity is the important factor which influences the risk of pregnancy related problems. Among the total studied women population, 11.1% were faced adverse pregnancy outcome. 15.6% negative pregnancy outcome was recorded in inbreeding population and 9.3% were recorded in outbreeding population. The studies of Tuncbilek (2001) [8] reported that the risks of pre-reproductive mortality, stillbirth, and infant death are higher in the offspring of consanguineous marriage. In this investigation, 9.1% of mothers were between the age of 18 to 21, 44.9% were between 21 to 25, 44.1% were between 25-30 and 1.7% were between 30 to 35. The maximum number of adverse pregnancy outcome (90%) was recorded among the women aged between 30 to 35 and 21.8% were between 18 to 21. The age of the pregnant woman plays the significant risk factor for negative impacts. Miscarriage rates increases steadily with age, with more substantial increases after the age of 35[9]. In those under the age of 35, the risk is about 10% while it is about 45% in those over the age of 40 [10]. Risk begins to increase around the age of 30 [11].

In the present study, 2.5% of spontaneous abortion, 0.4% of induced abortion, 1.8% of still birth, 2.4% of preterm birth and 3.7% of low birth weight was recorded. According to the Medical Termination of Pregnancy Act in 1971, abortion has been legalized in India in order to save the physical and mental health of woman's life, economic and social necessity if contraception failed among married couples and erroneous fetal developments [12]. Induced abortion has been encouraged for fetus with anomalies and for lower socioeconomic family. Preterm birth is quiet common physiological phenomenon which happens due to pregnancy with triplets or other multiple problems with the uterus, cervix or placenta, certain infections particularly in the amniotic fluid and lower genital tract, high blood pressure, diabetes, stressful life events, too much amniotic fluid and abnormal vaginal bleeding during pregnancy [13]. Many stillbirths are due to defective placenta. The placenta is the important organ which connects the baby's blood supply to the mother's and nourishes the baby in the womb. Any defects in the placenta can leads to stillborn babies. Low birth weight is either caused by preterm birth or the infant being small for gestational age, or a combination of both. The risk factors behind negative birth outcome are multiple pregnancies, previous low birth weight infants, poor nutrition, heart disease or hypertension, untreated coeliac disease, drug addiction, alcohol abuse, insufficient prenatal care, smoking, lead exposure and other types of air pollutions [14 and 15]. The risk factors for miscarriage are infections, lifestyle factors, occupational exposures, chemical exposure and shift work are associated with increased risk for miscarriage [16 and 17]. Some other risks include

endocrine, genetic, uterine or hormonal abnormalities, reproductive tract infections and tissue rejection caused by an autoimmune disorder [18]. The conditions that associated with stillbirth include bleeding before or during labour placental abruption, pre-eclampsia, cord prolapse, knotted intrahepatic cholestasis, obstetric cholestasis, severe itching during pregnancy and a genetic physical defect in the baby, pre-existing diabetes, an infection in the mother also affects the baby.

This study revealed that the prenatal loss was elevated in consanguineous marriages. The spontaneous abortions were 2.2 times higher in consanguineous marriages than in non consanguineous marriages and the superior risk of spontaneous abortions was found to be highly statistically significant. Studies by Verma et al., 1992 [19]; Nath et al. 2004 [20] and Kuntla et al, 2013 [21] showed that the abortions were higher in consanguineous groups than in non consanguineous groups. The study on stillbirths was 3.7 times more in consanguineous marriages than in non consanguineous marriages and was found to be statistically significant [6]. However, the study by Joseph and Mathew, 2005 [22] showed any statistically significant difference in stillbirths among consanguineous groups and non consanguineous groups. The study of Verma et al (1992) [19] reported that the neonatal and infant mortality was higher in consanguineous mating.

Assessing the effect of inbreeding on different neonatal health outcomes such as prematurity and birth defects remain highly attractive in inbred population. As endogamy associated with identical recessive autosomal disorder, it is the important causative factor for the congenital anomalies and negative pregnancy outcome. Due to their lower prevention and higher mortality, the birth defects are considered to be a significant health problem in Sivagangai. There are no well accepted measures in this area regarding this hereditary health problem associated with customary consanguinity. This population based study should be ideal for true and first hand estimation of congenital anomalies associated with negative pregnancy outcomes. Women who are in the later stages of their reproductive life are at great risk for having negative pregnancy outcome. Our result indicates the positive correlation between the endogamy and the incidence of congenital anomalies associated with negative pregnancy outcome. The results from this study show that there is a substantial need to inform older, as well as younger, women about reproductive issues. This includes guidelines, both in general and in clinical practices, on becoming pregnant.

5. CONCLUSION

The present study is the first hand information on the prevalence of consanguinity and its impact on adverse pregnancy outcome in Sivagangai Population. The present study estimated that the negative fetal outcome was higher in consanguineous population. This leads to conclude that there is an association between the consanguinity and fetal health issues. Hence it is important to create awareness about the negative effect of inbreeding on pregnancy outcome and congenital defects. More number of further genetic works should be carried out to identify its fundamental genetic causes. This study will be utilized to take necessary steps to prevent further impact of consanguinity and recommend the government to provide educational and financial help for the needy affected population.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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