



Review Article

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AYURVEDA: THE BASIS OF CONTEMPORARY GENETICS AND ITS PRESENT DAY RELEVANCE

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ABSTRACT

The concept of genetics was in existence since the time of ancient Acharyas. They referred to Sanchari, Kulaja, Kulodbhava Vikaras while referring to hereditary disease and congenital disorders. These can now be studied in the light of Modern Genetics. The genetic entities such as chromosome, genes, nucleotide sequence are referred in our samhitas in different terminologies. The time when inventions for detailed study like electron microscope were not there, our Acharyas revealed such minutest of the entities. Proposed article aims to compare the references in the ancient Ayurvedic texts to their possible comparative correlations of modern Genetics. For this purpose, the references related to genetics were collected from various ancient texts and analysed thoroughly in relation to what the present day genetic science says. It was found that Ayurveda holds the basis to modern genetics and has number of references revealing the minute genetic entities, the genetic defects, their cause of occurrence as well as the details of precaution measures to be taken to prevent or limit the occurrence of genetic disorders which are day by day increasing in prevalence.

Keywords: Genetics, Sanchari, Kulaja, Kulodbhava Vikaras.

INTRODUCTION

Genetics is the study of heredity¹. Genomics is defined as the study of genes and their functions, and related techniques². The human genome is divided into 23 different chromosomes, including 22 autosomes (numbered 1-22) and the X and Y sex chromosomes. Adult cells are diploid, meaning they contain two homologous sets of 22 autosomes and a pair of sex chromosomes. Females have two X chromosomes (XX), whereas males have one X and one Y chromosome (XY)³. India, like other developing countries, is facing an accelerating demographic switch to non-communicable diseases. In the cities congenital malformations and genetic disorders are important causes of morbidity and mortality. Due to the high birth rate in India a very large number of infants with genetic disorders are born every year almost half a million with malformations and 21,000 with Down syndrome⁴. There are a number of factors that significantly increase the prevalence of genetic disorders in the Indian subcontinent. Consanguineous marriages are a major factor. This custom is common, accounting for almost 30-40% of marriages among south Indians and Muslims of North India, and a smaller percentage among other communities like the Sikhs and Maharashtrians⁵. Sushruta mentioned about Aadibalapravrutta Rogas⁶ and Janmabala Pravrutta Rogas⁶ during the classification of diseases. These signify the genetic or heredity diseases. A number of references give a projection and emphasis on the Atulyagotriya Vivaah (non- consanguineous marriages), the reasons for hereditary diseases, how Garbha Vikrati (fetal anomaly) occurs and Supraja Nirmiti in our ayurvedic texts and makes us think how could genetics be referred to at that time.

Aim

1.) To study the references of genetics scattered in Ayurveda and compare them with their probable co-relations in modern genetics.

2.) To evolve and study the relevance of measures to limit the occurrence of genetic disorders using methods mentioned in Ayurvedic texts.

Ayurvedic literary review and its modern comparison

1.) In Charak Samhita Sharir sthan⁷, Charak has mentioned the "lok Purush Saamya Siddhanta". The interpretation of this in modern genetics can be The Human Genome. The numerous Moortiman Bhavpadarth can be compared to the numerous genes. Each gene when expressed leads to a specific phenotypic characteristic that can be compared to its moortiman swaroop. An observed trait is referred to as a phenotype, the genetic information defining the phenotype is called the genotype⁸. The genome is estimated to contain approximately 25,000 genes. Even the smallest chromosome contains between 200-300 genes⁹.

2.) In Charka Samira sharir sthan¹⁰, charak mentioned about the cause of congenital anomalies and hereditary disorders. He there only said that the Beeja or its part, if vitiated causes the anomaly in that specific part. In the shlok he explained that if a genetic component is involved, the disease is carried to the further generation otherwise not.

3.) In sharir sthan Charka mentioned about Vikrut Garbha, Stree Vyapada¹¹ and Purush Vyapada¹². Now to understand it in detail in terms of genetics we can relate –

a.) Beeja - It may be compared to the male and female gametes i.e. The sperm and the ovum. These two carry complete set of instructions on how the body is supposed to be built. This genetically coded instructions are the Genetic constitution of an organism which determines different traits of an individual such as Eye colour, Haircolour, Height, Weight, skin colour etc.

b.) Beeja Bhaag - It may be compared to a chromosome. The genomes are the set of chromosomal complements which are passed on as units from generation to generation one from each of the parents. Thus Beeja Bhaga is held responsible for the

expression of different characteristics of individual and origin of different organs and tissues of the body.

c.) Beeja Bhaagavayav - This is the most fundamental entity which can be grossly compared to a gene. It is the basic physical and functional unit of heredity which is mainly responsible for expression of a particular trait in an individual. These are specific sequences that encode instructions on how to make proteins which in turn are responsible for the expression of a trait.

4.) In Charak Samhita sharir sthan¹³, Acharya laid down the reason for malformed embryos and foetal abnormalities. He holds the following factors responsible for malformation during pregnancy viz. unhealthy gametes, anomalies in the uterus, improper Aahar food habits and Vihaar (routine) by the pregnant women.

The study of congenital malformations constitutes the science of Teratology. Among the hereditary causes anomalies may be caused by defects in specific chromosome or in a specific gene. Hence all hereditary defects are caused ultimately by failure of the cells to synthesise the right proteins at the right time. In producing an anomaly, the genetic defect may directly affect or may have an indirect effect. For example, a genetic defect that leads to the agenesis of testes, may indirectly influence the developing external genitalia by interfering with the production of hormones necessary for their development. Similarly, an anomaly of a blood vessel may interfere with the blood supply of an organ and hence adversely affect its development. 80% of all congenital malformations are produced by a combination of genetic and environmental factors. Of the remaining 20%, half are caused exclusively by genetic or chromosomal factors and the remaining half exclusively by environmental factors¹⁴. Even this fact is explained by Charak¹³ that apart from beejadosh other factors such as environmental, also play a role in the development of foetal abnormalities.

5.) In Charak Samhita Chikitsa sthan¹⁵ acharya mentioned that defective beeja is not able in producing santati. In nidana sthan of Sushruta samhita¹⁶, Sushruta explained as embryos with major abnormalities are aborted early in pregnancy, and this may occur due to krimi (viral infection such as TORCH) Vata (unknown cause such as mutation), Abhighata (physical harm or teratogenic impact).

6.) In the context of Stree Vyapada¹¹ And Purush Vyapada¹² Charakacharya has mentioned about vitiation of Beeja,

Beejabhaga, Beejabhagavyava And Ekdesha of Beejabhag (nucleotide sequence). While describing these Charak mentioned about Tranputrik and Vaarta whose physical appearance is like male and female respectively but they are Apurush and Astree (i.e. referring to their infertility). By comparative study of these in the modern perspective these features closely correspond to Klinefelter's syndrome and Turner's syndrome. Even characteristics mentioned in Shandi Yonivyapad¹⁷ correspond closely to Turner's syndrome and its occurrence due to Beejadosh is clearly mentioned in the shlok.

Klinefelter's syndrome describes the phenotype of the most common sex chromosome abnormality in humans and occurs in one of every 600 newborn males. The typical symptoms are a tall stature, narrow shoulders, broad hips, sparse body hair, gynecomastia, small testes, absent spermatogenesis, normal to moderately reduced Leydig cell function, increased secretion of follicle-stimulating hormone, androgen deficiency, and normal to slightly decreased verbal intelligence. With a frequency of 4%, KS is described to be the most common genetic reason for male infertility. The most widespread karyotype in affected patients is 47, XXY¹⁸.

The 45, X chromosome constitution occurs with surprising high frequency, present in at least 1-2% of all pregnancies. More than 99% of all 45, X conceptions are spontaneously aborted. Nonetheless, Turner's syndrome causes gonadal dysgenesis, resulting in infertility and failure to undergo secondary sexual development, along with a number of other phenotypic features¹⁹. Subject is always a female.

7.) Genetic Counselling - Now days there has been a significantly rising role of Genetic Counselling which is actually a communication process which deals with the human problems associated with the occurrence or risk of genetic disorders in a family. In a multi-centric study on the causes of referral for genetic counselling the top four disorders were repeated abortions (12.4%), identifiable syndromes (12.1%), chromosomal disorders (11.3%) and mental retardation (11%)²⁰. Couples seek genetic counselling at different stages- 1. Before marriage 2. Pre conception period such as in advanced maternal age 3. During pregnancy 4. After birth of an offspring with genetic disorder.

This Genetic counselling has been dealt beautifully by the Acharyas likewise in Charak samhita²¹ Atulgotriya Vivaah i.e. avoidance of Consanguineous marriages has been proposed.

Relationship to each other	Relationship type	Proportion of genes they have in common
Identical twins (monozygotic)		All (100%)
Brothers and sisters, non-identical (dizygotic) twins, parents and children	First degree relatives (1°)	Half (1/2, 50%)
Uncles and aunts, nephews and nieces, grandparents and half brothers and half sisters	Second degree relatives (2°)	Quarter (1/4, 25%)
First cousins, half uncles and aunts and half-nephews and nieces.	Third degree relatives (3°)	Eighth (1/8, 12.5%)

Most studies in India have shown that early postnatal mortality is higher in the progeny of consanguineous unions, due at least in part to the expression of deleterious recessive genes. Consanguinity associated deaths are largely during the first year of life²².

Congenital disorders^{23,24,25} including neural tube defects^{26,27} and congenital heart defects^{27,28,29} are more common in consanguineous progeny.

Both the acharyas Charak and Sushruta have proposed the avoidance of Garbhopghaatkar Bhavas³⁰ during pregnancy. These Garbhopghaatkar Bhavas can be correlated to the

teratogens which are Substances such as chemicals or radiation that cause abnormal development of an embryo³¹.

In Charak samhita³² Acharya mentioned that potential development of Gharbhasharir (foetal development) requires Shukrashonita Prakruti, Kalagarbhashaya Prakruti, Maturaaharvihaar Prakruti, Mahabhootvikara Prakruti- Counselling to avoid consanguineous marriage - Appropriate age of marriage and conception will determine Shukrashonita Prakruti (healthy gametes). Modern genetic studies show the correlation of advanced maternal age and predisposition of genetic syndromes, especially Down's syndrome. Table³³ shows the frequency of Down's Syndrome as per maternal age-

Age (years)	Frequency of foetuses with Down Syndrome to Normal Foetuses at 16weeks of pregnancy	Frequency of live Births of babies with Down's syndrome to Normal Births
15-19	-	1/1250
20-24	-	1/1400
25-29	-	1/1100
30-31	-	1/900
32	-	1/750
33	1/420	1/625
34	1/325	1/500
35	1/250	1/350
36	1/200	1/275
37	1/150	1/225
38	1/120	1/175
39	1/100	1/140
40	1/75	1/100
41	1/60	1/85
42	1/45	1/65
43	1/35	1/50
44	1/30	1/40
45 and older	1/20	1/25

Above table shows the relation of how predictable is the occurrence of Down's Syndrome with conception at advanced maternal.

Counselling about importance of normal menstrual cycle and uterine anomalies will determine Kalagarbhashaya Prakruti (appropriate time of conception).

Counselling to consume healthy diet, Shadrasa Yukta Aahara for the proper growth of the foetus & to avoid teratogenic exposure likewise hazardous radiations and medications. This will determine Maturaaharvihaar Prakruti (advisable diet and routine).

Counselling to follow specific Garbhini Charya (regime to be followed during gestation period) for each month for healthy growth and development of the foetus will determine Mahabhootvikara Prakruti (healthy body composition without anomalies)

Sushruta³⁴, laid the importance of four factors for the formation of garbha viz. Ritu-fertile period or Ritukala, Kshetra-healthy uterus without any anomaly, ambu-proper nutrition and nourishment of Garbhini (pregnant woman), and Beeja-gametes. Thus counselling the patients who either conceives in elderly age or those who have a persistent genetic disorder running in their family or those where custom of consanguineous marriages is common, above views mentioned in classical texts will certainly help in the avoidance of genetic disorders.

CONCLUSION

Hence counselling during pre conception period and post conception period is a view explained in Ayurveda long back and today it is in practice by the name of genetic counselling. These methods may prove beneficial in avoiding genetic disorders or kulaja vikaras in developing countries where Genetic counselling to remote areas is not easily accessible and affordable.

There need not be any contradiction between Ayurveda and Modern Medicine. The two systems may truly and effectively complement each other, when structural knowledge is judiciously integrated and interpreted in the Ayurveda paradigm of 'whole person' functional performance. Contrary to common perception, through the ages, the seers of Ayurveda recognised the need to ensure that Ayurveda was relevant to contemporary needs and developments³⁵. The concept of Beeja, Beejabhaga, and Beejabhagavyav is a highly evolved concept of genetics representing even the minutest entity of modern genetics. Thousands of years ago our aacharyas have already told about

this concept. Thousands of the genes have been discovered & many more are still to be discovered. Human genome project is an effort to unfold each and every beejbhagavyav responsible for expression of a particular trait and thus benefit the society by preventing the occurrence of genetic disorders.

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