STUDY THE EFFECT OF SOME ENVIRONMENTAL FACTORS ON DOWN'S SYNDROME

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ABSTRACT

Based on several studies linked the occurrence of Down's syndrome (DS) to maternal exposure to certain exogenous and endogenous factors, we evaluated the socio-demographic features of 20 families with DS with consanguinity analysis. Also, we evaluated certain associations of some maternal factors which might affect the outcome. In this study, we estimated serum levels of zinc, selenium and thiamine as well as amino acids profile in blood and urine of the 20 children with DS as a base of nutritional intervention. With the advances of molecular cytogenetics and development of fluorescent in situ hybridization technique (FISH technique), we did a comparative diagnostic study between the ordinary karyotype (G banding) and FISH technique as tools of diagnosis. We found a significant difference regarding both maternal and paternal age being higher among cases than the control group ($P<0.05$ for each), while study of gender, age spacing, birth order, social class and consanguinity revealed a non significant association ($P>0.05$ for each). Maternal habits (tea, coffee, alcohol intake and smoking) and maternal chronic diseases were insignificantly associated with DS pregnancies ($P>0.05$ for each). Although there were insignificant associations of maternal exposure to a variety of exogenous factors, lack of supplementation with folic acid tablets before and during pregnancy showed a highly significant association among mothers of children with Down's syndrome ($P<0.0001$). Also there were insignificant associations with manifestations of bad obstetric history. Preterm and delivery with Caesarean section were significantly associated among cases ($P<0.05$ for each). We found a

highly significant decrease in serum levels of zinc, selenium, and thiamine among our cases with DS compared to the control children (P<0.0001), while the amino acids profile was normal among both cases and control children. Also, on performing karyotyping using (G banding) we found that all our patients are of the nondisjunction trisomy 21. On the other hand, FISH technique failed to prove diagnosis in two cases out of our twenty cases. We found no evidence of seasonality of births among our patients to explain the nondisjunction process.

In conclusion, the positive associations of some maternal factors with DS have to be considered -with the maternal age- as minor factors which may contribute to Down's syndrome. The decrease in serum levels of zinc, selenium and thiamine should be considered on nutritional intervention for those children with DS. Also, diagnosis of trisomy 21 should be based on the ordinary karyotype.

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GLOSSARY

Amniocentesis
A technique for obtaining a sample of fetal cells.

Amniocytes
The fetal cells floating in the amniotic fluid.

Aneuploid
A chromosome number that is not an exact multiple of the haploid number.

Apoptosis
A common process throughout life that helps the body to get rid of cells it doesn't need.

Autosome
Any chromosome which is not a sex chromosome (X or Y).

Brachycephaly
Head shape which is flattened at the back.

Chromosome
Thread-like, darkly staining bodies within the nucleus, made up of chromatin and DNA, which carry the genetic information.

Clinodactyly
Small inward curving little finger.

De novo
Occurring for the first time, rather than inherited.

Epicanthic fold
Fold of skin at the inner canthus of the eye. Particularly common in Down's syndrome but can be seen as a normal variant in some unaffected children.

Fibroblast
The precursor cells which are found in connective tissue.

Gamete
Ovum and sperm.

Gonadal
Referring to the gonads. Ovaries and testes.

Incidence
The incidence of a genetic disorder is the number of persons who are born with this disorder in a specified group per year.

Interferon
A substance produced inside the body in response to viral infections.

Karyotype
An arranged pictorial presentation of the chromosomes of a cell.

Kerala
An Indian city.

Lymphocytes
A sub-group of white blood cells.

Mean value
Is the sum of observations divided by the number of observations.

Meiosis (meiotic)
The type of cell division which occurs in gamete formation, with halving of the somatic number of chromosomes so that each gamete is haploid.

Microcephaly
Small sized head

Mitochondria
Structures in each cell that convert molecules into energy.

Mitochondrial inheritance
A type of inheritance – also called maternal inheritance – that applies to genes in mitochondrial DNA.

Mitosis (mitotic)
The type of cell division which occurs in replication of somatic cells.

Oocyte
Haploid female gamete.

Phalanx / phalanges
The bones in the fingers and toes.

Prevalence
The prevalence of a genetic disorder is the total number of persons who have this disorder in a specified group at a given time.

Robertsonian translocation
A translocation between two acrocentric chromosomes, involving fusion at the centromeres.

Sample Range
Difference between the highest and lowest values.

Sandal gap (sandal sign)
A gap between the big toe and the other four toes.

Standard deviation
The square root of the variance.

Sonolucent
Allowing ultrasound to pass through without refection. Giving a dense black appearance on an ultrasound scan, implying fluid filled.

Telomere
Specialized DNA sequence located at the end of chromosomes.

Trait
A character

Translocation
Transfer of chromosome material from one chromosome to another. If there is exchange of genetic material from one chromosome to another, this is called a reciprocal translocation.

Trisomy
Three, rather than the usual two copies of a chromosome.

Variance
Measure of spread of observations about the mean.

Zygote
Fertilized ovum

LIST OF ABBREVIATIONS

AA---------- Atomic absorption
AAI----------Atlanto-Axial Instability
AAS ----------Atomic absorption spectrophotometry
AFP----------Alpha fetoprotein.
ASD ----------Atrial septal defect
ATP ----------Adenosine Tri Phosphate
CDC----------Center for Disease Control and Prevention
DNA-----------Deoxyribonucleic acid
DSCR----------Down's Syndrome Critical Region
FDA----------Food and Drug Administration
FISH----------Fluorescence in situ hybridization
GC----------Gas chromatography
GLC----------Gas-liquid chromatography
GSC----------Gas-solid chromatography
GSH-Px ---------- Glutathione peroxidase
hCG----------Human chorionic gonadotropin
HMPS----------Hexose monophosphate shunt
IgG---------- Immunoglobulin G class
IDDM---------- Insulin dependent diabetes millitus
I Q---------- Intelligence quotient
MMWR---------- Morbidity and mortality Weekly Report
Mt DNA---------- Mitochondrial DNA
OC ----------Oral contraceptives
PAP A----------Pregnancy associated protein A
PDA---------- Patent ductus arteriosus
SOD---------- Superoxide dismutase
TLC----------Thin layer chromatography
UNSCEAR----------United Nation Scientific Committee on the Effects of Atomic Radiation
VSD----------Ventricular septal defect

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