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Graphical image of Trisomy Ultrascan related Total edge magic labelling

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Abstract

INTRODUCTION: The goal of this research is to investigate child syndromes at the overall level using total edge magic labelling. luckily discussed with chromosomal diseases consisting of Down's syndrome, the syndrome of Edwards, and Patau syndrome.
OBJECTIVES: Ultrasound is used to check for Patau's, Edwards, and Down syndrome between 11 and 14 weeks of pregnancy. These syndromes can be determined before the baby is born. The name for trisomy 21 or Down syndrome. Trisomy 18 or Edwards syndrome; trisomy 13 or Patau syndrome.
METHODS: The ultrasound screen test was converted to a graphical image, and Total edge magic labelling was implemented. A bijection from VUE to the numbers, {1, 2, 3, … p+q} with the characteristic that each everybody uv Ɛ E, Γ(u)+ Γ(uv)+ Γ(v) = Ψ for some constant Ψ, is known as Total edge magic labelling.
RESULTS: The results of this test will determine the baby's type of trisomy. This study's impartial was to assess the efficacy of screening for 21, 18, and 13 trisomies at the 12-week mark in pregnancy.
CONCLUSION: The intended audience of this paper is a man or woman with a chromosomal disorder who should know about the health of their ancestors. A couple can go for genetic counselling and then plan for a baby.

Keywords: Edge magic labelling, Trisomies, Ultra scan screen

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1. Introduction

Graph theory can be used to precisely identify a lot of problems in reality. The most essential component of graph theory is labelling [1]. The Internet, electricity, biochemistry, medical technology, computer science, networks for communication, and genetics all depend on labelling [2,3]. The Königsberg, Germany, footbridge problem originated in 1735. Based on Euler, after passing the bridge and returning to the initial location, one can't return without swimming in the river [4,5]. Total edge magic labelling was introduced in 2001 by *W.D. Wallis* [6].

The Father of Genetics, according to Mendel, is usually referred to. *Gregor Johann Mendel* was interested in learning about the procedure of generation. He initiated collecting data on a pea plant [7]. Trisomies 21,18,13 represent Chromosomal Syndromes because they contain an excess of genetic material [8].
Down syndrome is a chromosomal disorder also known as trisomy 21. In 1886, British doctor *John Langdon Down* gave the condition the term Down syndrome. *Jerome Jean Louis Marie Lejeune*, a French human scientist, made the discovery of an additional genetic material chromosomal on the 21st chromosome in 1958 [9,10]. Trisomy 18 is another name for the chromosomal condition known as Edwards syndrome. Edwards syndrome was given that name by English geneticist *John Hilton Edwards* in 1960.

On the 18 chromosome, a researcher named Edwards found an additional genetic material chromosome [11,12]. Trisomy 13 is another name for the chromosomal condition known as Patau syndrome. Patau syndrome was first delineated by doctors *Klaus Patau and Eeva Therman* in 1960.*Thomas Bartholin* in 1657 observed an extra genetic material chromosome on the 13 chromosome [12,13]. Chromosome disorder is detected by collecting data on Nuchal Translucency, human chorionic gonadotropin, Pregnancy Associated Plasma Protein A from 12 weeks of pregnancy time. [14,15]. Data can be extracted intrusively [16] communicated to store the data for further use [17,18].

2. Definitions

2.1. Down syndrome

Trisomy 21 is also known as down syndrome. An extra genetic material on the 21st pair of chromosomes. An additional chromosome or extra chromosome content produces a disease referred to as Down syndrome. The development of the new born's body and memory are impacted by this extra copy. During their lives, it may cause difficulties with both the mind and body. Persons with Down syndrome can behave and resemble each other similarly, but each one has unique skills.

2.2. Edwards syndrome

Trisomy 18 is also known as Edward syndrome. An extra genetic material on the 18st pair of chromosomes. A genetic disorder in infancy named Edwards syndrome causes serious disabilities. An additional copy of chromosome 18 is the element that produces it, and kids born with it normally cannot survive for any more than a week. Instead of the normal 2 copies, children with Edwards syndrome contain 3 copies of either all or parts of chromosome 18. Trisomy 18 is another name for it.

2.3. Patau syndrome

Patau syndrome is another name for trisomy 13. An extra genetic material on the 13st pair of chromosomes. When a person's DNA has the 13th chromosome three times as opposed to twice, a genetic disease known as trisomy 13 (Patau syndrome) develops. Along with having an impact on the development of the face, brain, and heart, trisomy 13 causes physical growth problems throughout the entire body of a kid. Trisomy 13 increases the chance of infertility and preterm birth, as well as the possibility of life-threatening symptoms.

2.4. Total edge magic labelling

A bijection from VUE to the numbers, {1, 2, 3, … p+q} with the characteristic that each everybody uv Ɛ E, Γ(u)+ Γ(uv)+ Γ(v) = Ψ for some constant Ψ, is known as Total edge magic labelling. Total edge magic labelling of G denotes such a bijection. If vertex magic exists, vertices have the same characteristic.

3. Nuchal translucency screening

Between 11 and 14 weeks of gestation, an ultrasound is used to check for Patau's, Edwards, and Down syndromes. The likelihood of having any of these syndromes can be determined before the baby is born. Additional tests will be done to confirm the type of trisomy or if the baby has a trisomy defect. Less than 2.5mm of Nuchal translucency places the pregnancy at low risk. Greater than 2.5mm of Nuchal translucency places the pregnancy at high risk (Figure. 1) . Category for issues including foetal anomalies.

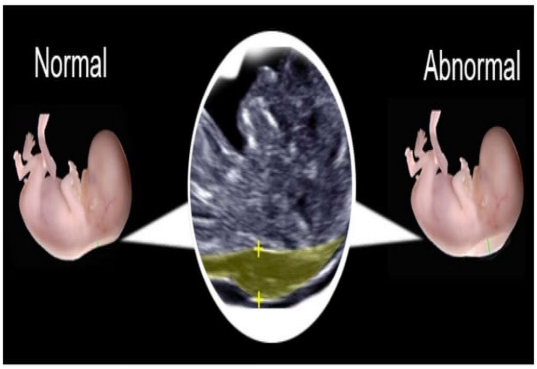

Figure 1. Nuchal translucency screening

The 10th and 14th weeks of pregnancy are when Down Syndrome, Edward Syndrome, and Patau Syndrome screening tests are administered. The blood test and ultrasonic screen for the 12th week are completed consecutively. So, it is known accurately. Integrated testing, which combines the results of an ultrasound scan and a blood test, is used to identify trisomies. The ultrasound screen evaluates the baby's cervical fluid's "Nuchal translucency" as well as its free HCG and PAPP-A levels. Trisomies were also given to the infant based on the mother's age and the test findings. Determine the elements that make symptoms present.

4. Ultrasound screening test in Down Syndrome baby (12 week)

Hearing loss, heart issues, stomach issues, hearing and vision issues, etc. are more common in children with Down syndrome. Some of these are fatal,

and many of them are Medically treatable. If the nuchal translucency fluid level is > 2.5 mm, there is a Possibility of Down's syndrome.

Absence of Nasal bone and nasal tip (NB), Head size (HS), low-set ears (LS), Abnormal function of the heart and lungs (AH&AL), Abnormal pelvis (AP) or widened pelvis, Umbilical hernia (UH), sandal gap (SG), Measurement of Nuchal translucency (NT) greater than 2.5 mm (Figure. 2). A graphical image connected to Total edge magic labelling (Figure. 3).

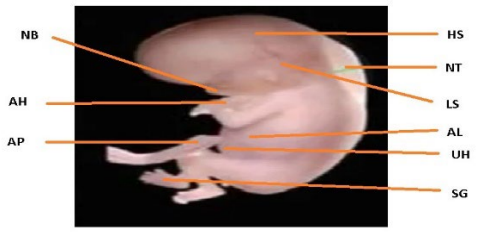

Figure 2. Ultrasound screen – Down syndrome

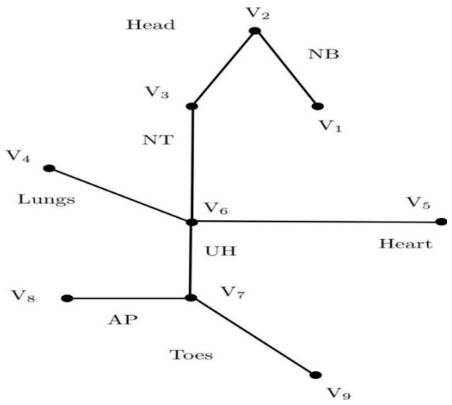

Figure 3. Graphical image – Down Syndrome

4.1. Theorem

Down syndrome scan graph DS_8 is a Total edge magic labelling.

Let $V(DS_8) = \{v_1, v_2, v_{i+2}; 1 \le i \le 3, v_6, v_{i+6}; 1 \le i \le 3\}$

$E(DS_8) = \{e_1, e_2, e_{i+2}; 1 \le i \le 3, e_6, e_{i+6}; 1 \le i \le 2\}$

Down syndrome scan graph DS_8,

$\Gamma: V \cup E \rightarrow \{1,2,3,\ldots..p+q\}$

$p= 9, q= 8, n=8;\ \ \Gamma: V \cup E \rightarrow \{1,2,3,\ldots..17\}$

Vertex labels:

$\Gamma(v_1) = n+2, \Gamma(v_2) = n-6, \Gamma(v_6) = 1, \Gamma(v_7) = n-5$

$\Gamma(v_{i+2}) = n+2i-6; 1 \le i \le 3,$

$\Gamma(v_{i+7}) = n+2i-5; 1 \le i \le 2,$

Edge labels:

$\Gamma(e_1) = n+1, \Gamma(e_2) = 2n-1, \Gamma(e_6) = 2n+1,$

$\Gamma(e_{i+2}) = 2n+2-2i; 1 \le i \le 3,$

$\Gamma(e_{i+6}) = 2(n-1)+1-2i; 1 \le i \le 2.$

The constant Ψ of Total edge magic labelling

$\Psi_1 = \Gamma(v_1) + \Gamma(e_1) + \Gamma(v_2)$

$= \{n+2 + n+1 + n-6\} = 3n-3$

$\Psi_1 = 21. \quad (1)$

$\Psi_2 = \Gamma(v_{i+2}) + \Gamma(e_{i+2}) + \Gamma(v_6)$

$$= \{[\sum_{i=1}^{3}(n+2i-6) + \sum_{i=1}^{3}(2n+2-2i)] + 1\}$$

$$= \{[\sum_{i=1}^{3}(3n+2i-2i-3)]\}$$

$=3n-3$

$\Psi_2 = 21. \quad (2)$

$\Psi_3 = \Gamma(v_{i+7}) + \Gamma(e_{i+6}) + \Gamma(v_7)$

$$= \{[\sum_{i=1}^{2}(n+2i-5) + \sum_{i=1}^{2}(2(n-1)+1-2i)] + n - 5\}$$

$$= \{(n-5) + \sum_{i=1}^{2}[(n+2i-5) + (2(n-1)+1-2i)]\}$$

$=\{n-5+3n-6\}$

$=4n-11$

$\Psi_3 = 21. \quad (3)$

$\psi_1 = \psi_2 = \psi_3 = \psi$

Trisomy 21 has a link with the constant ψ value in Equations 1, 2, and 3.
It is simple to state that Γ is the total edge magic labelling and ψ_1, ψ_2, and ψ_3 are the integers.

Example.1

Down syndrome scan graph DS_8 as shown in Figure 4.

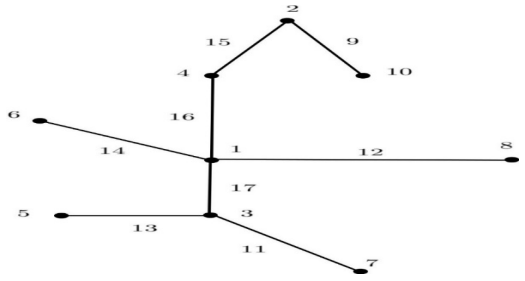

Figure 4. Down syndrome screen graph DS_8

Thus, Γ Function is a Total edge magic labelling for n = 8. Hence, DS_8 is total edge magic labelling.

Hence, All the constants Ψ total edge magic labelling is 21.

5. Ultrasound screening test in Edward Syndrome baby (12 week)

Most babies with Patau syndrome and Edward syndrome die before birth or a few days after birth. It is uncommon for newborn to live to maturity. All newborns with these syndromes will experience a variety of issues, some of which may be very significant. These could involve serious issues with their brains.

Low-set ears (LSE), Overlapping fingers (OF), Abnormal function of the heart and lungs (AH and AL), club feet (CF), Abnormal navel (AN), Measurement of Nuchal translucency (NT) greater than 3 mm (Fig. 5). A graphical image related to Total edge magic labelling (Fig. 6).

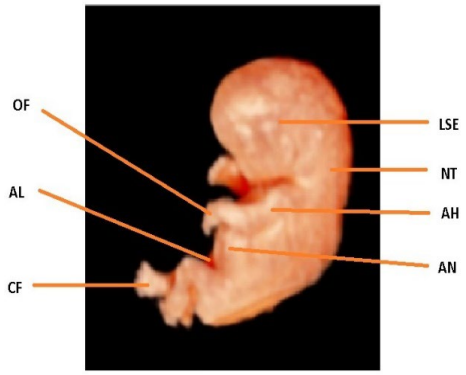

Figure 5. Ultrasound screen – Edward syndrome

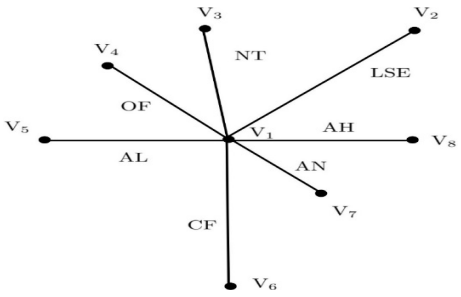

Figure 6. Graphical image – Edward syndrome

5.1. Theorem

Edward Syndrome scan graph ES_7 is a Total edge magic labelling.

Let V (ES_7) = $\{v_1, v_{i+1}; 1 \leq I \leq 7\}$

E ($ES_{7)}$ = $\{e_{i+1}; 1 \leq i \leq 7\}$

Edwards syndrome scan graph ES_7,

Γ:V U E→{1,2,3,…..p+q}, p= 8, q= 7, n=7;

Γ:V U E→{1,2,3,…..15}

Vertex labels

Γ (v_1) = 1, Γ (v_{i+1}) = [n+1+]; $1 \leq i \leq 7$,

Edge labels

Γ (e_{i+1}) =[n+2-i]; $1 \leq i \leq 7$,

The constant Ψ of Total edge magic labelling

$\Psi = \Gamma(v_{i+1}) + \Gamma(e_{i+1}) + \Gamma(v_1)$

$$= \{[\sum_{i=1}^{7}(n+1+i) + \sum_{i=1}^{7}(n+2-i)] + 1\}$$

$$= \{[(\Sigma_{i=1}^{7}(2n+3))] + 1\}$$

=2n+4

Ψ_3 =18. (4)

Trisomy 18 has a link with the constant ψ value in Equation 4.
It is simple to state that Γ is the total edge magic labelling and ψ is an integer.

Example. 2

Edwards syndrome scan graph ES_7 as shown in Figure 7.

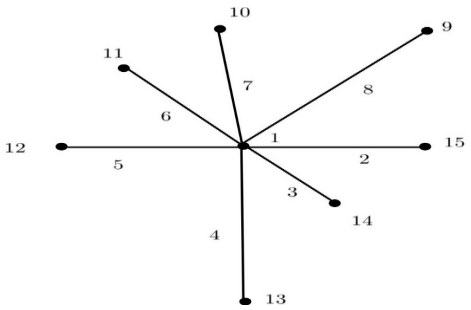

Figure 7. Edward syndrome screen graph ES_7

Thus the Function Γ is a Total edge magic labelling for n=7.

Hence, ES_7 is Total edge magic labelling.

6. Ultrasound screening test in Patau Syndrome baby (12 week)

Abnormal function of the heart and lungs (AH &AL), Small Head (SH), Cleft Lip and Palate (CP), Measurement of Nuchal translucency (NT) greater than 3 mm (Fig. 8). A graphical image related to Total edge magic labelling (Fig. 9).

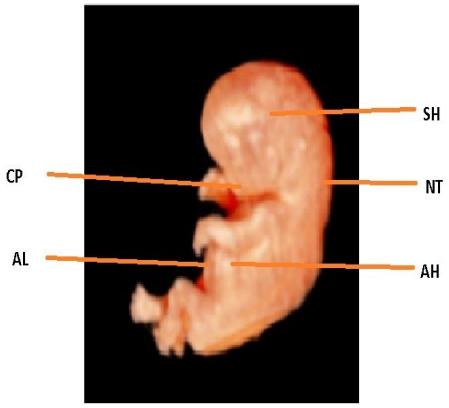

Figure 8. Ultrasound screen – Patau syndrome

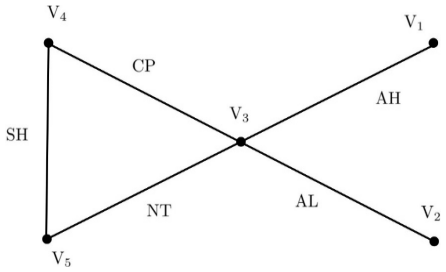

Figure 9. Graphical image –Patau syndrome

6.1. Theorem

Patau Syndrome scan graph PS_5 is a Total edge magic labelling.

Let V (PS_5) = {v_i;1≤ i ≤2, v_3, v_{i+3}; 1≤ i≤2}

E (PS_5) = {e_i;1≤ i≤2, e_3, e_{i+3}; 1≤ i≤2}

Patau syndrome scan graph PS_5,

Γ:V U E→{1,2,3,…..p+q}

p= 5, q= 5, n=5; Γ:V U E→{1,2,3,…..10}

Vertex labels

Γ (v_i) =n+i-3; 1≤ i≤2,

Γ (v_3) =1,

Γ (v_{i+3}) =3i-n+4; 1≤ i≤2,

Edge labels

Γ (e_i) = [2n-i]; 1≤ i≤2,

Γ (e_3) = [n+1]

Γ (e_{i+3}) = [2n+3-3i]; 1≤ i≤2.

The constant Ψ of Total edge magic labelling.

$\Psi_1 = \Gamma(v_i) + \Gamma(e_i) + \Gamma(v_3)$

$$= \{[\sum_{i=1}^{2}(n+i-3) + \sum_{i=1}^{2}(2n-i)] + 1\}$$

$$= \{[\sum_{i=1}^{2}(3n-3)] + 1\}$$

$\psi_1 = 3n-2$

$\psi_1 = 13.$ (5)

$\psi_2 = \Gamma(v_{j+3}) + \Gamma(e_{j+3}) + \Gamma(v_3)$

$$= \{[\sum_{i=1}^{2}(3i-n+4) + \sum_{i=1}^{2}(2n+3-3i)] + 1\}$$

$$= \{[\sum_{i=1}^{2}(3i-n+4) + (2n+3-3i)] + 1\}$$

$$= \{[\sum_{j=1}^{2}(n+3i-3i+7)] + 1\}$$

$=\{n+8\}$

$\Psi_2 = 13.$ (6)

$\Psi_1 = \Psi_2 = \Psi$

Trisomy 13 has a link with the constant ψ value in Equations 5,6.
It is simple to state that Γ is the total edge magic labelling and ψ_1, and ψ_2, are the integers.

Example. 3

Patau syndrome scan graph ES_5 as shown in Figure 10.

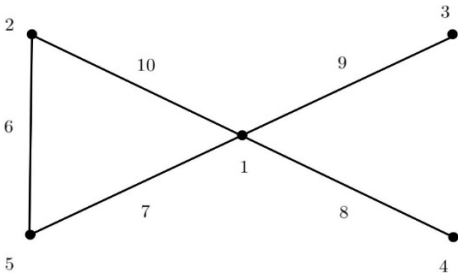

Figure 10. Patau syndrome screen graph PS_5

Thus, the function Γ is total edge magic labelling for n = 5. Hence, PS_5 is Total Edge Magic Labelling.

7. Result and Discussion

Table 1. Finding rate (%) & Wrong -positive rate (%)

S.No	Aneuploidy screening	Trisomy 21	Trisomy 18	Trisomy13
1	NT (MoM) Normal level <2.5	2.9	3.2	3.1
2	Beta- hCG (MoM) Normal level >2.5	2.1	0.3	0.5
3	PAPP-A (MoM) Normal level >=2.5	0.5	0.2	0.3
4	Detection rate(%)	>95	>93	>93

MoM (Multiple of Median), (NT-Nuchal Translucency), (hCG- human chorionic gonadotropin), (PAPP- A Pregnancy Associated Plasma Protein A).

Table 1 encapsulates the finding rate (%) & Wrong -positive rate (%). Trisomy 21 at the risk cut off of 1:100, along with 18 and 13, According to estimates, the Finding rate for TS21 using screening with NT, beta HCG, and PAPP A was more than 95% with an overall Wrong -positive rate of less than 5%, while for TS18 and TS13 it was more than 93% with a Wrong -positive rate of below seven percent.

8. Conclusion

Screening NT, beta HCG, and PAPP A can be used to detect Trisomies more clearly. Fortunately explored chromosomal diseases in this study. Inevitably know that chromosomal diseases such as Down syndrome, Edwards syndrome, and Patau syndrome are born. The intended audience of this paper is a man or woman with a chromosomal disorder who should know about the health of their ancestors. A couple can go for genetic counselling and then plan for a baby. Next work: how to calculate blood tests with the mother's age factor.

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