CHAPTER 80

Characterization of the manifestations of Down Syndrome in Brazil between 2016 and 2020: an epidemiological study

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ABSTRACT
Objective: to relate the classifications of trisomy 21 according to the number of live births in Brazilian states between 2016 and 2020. Methodology: refers to a retrospective, descriptive study of live births with T21 that occurred between 2016 and 2020 in Brazil. The information pertinent to the preparation of the study was immediately removed from the Information System on Live Births (SINASC) of the Department of Informatics of the Unified Health System (DATASUS) of the Ministry of Health (MS). Results and discussion: it can be observed, in the three classifications of Down syndrome, the state of São Paulo with the highest percentage (149 cases corresponding to 60.82%), in the meiotic nondisjunction, and the lowest percentage is the state of Mato Grosso do Sul. south (1 case referring to 0.4%), it can be observed that the classification that presented the lowest percentage of live births was mosaicism, with São Paulo also being the state that presented the highest percentage compared to the others (45 cases referring to 46 .40%). Conclusion: This research made it possible to analyze the three classifications of trisomy at a global level, and pointed out the need to collect primary data that, as they come from existing database systems, depend on the quality of filling out the notification forms, and new research related to the theme.

Keywords: Down syndrome, Classification, Hospital information systems.

1 INTRODUCTION

According to the World Health Organization (WHO), Down Syndrome (DS) or trisomy 21 (T21) is not a disease, but a genetic alteration that happens in the cell division of the egg, which results in an extra pair on chromosome 21, called trisomy (Brazil, 2019).

As a genetically determined human condition, it is the most common chromosomal alteration in humans and the main cause of intellectual disability in the population. The presence of the extra chromosome 21 in the genetic constitution determines specific physical characteristics and developmental delay. It is known that people with trisomy 21, when attended and properly stimulated, they have the potential for a healthy life and full social inclusion (Brasil, 2013).

In this context, Down Syndrome is characterized as the first known cause of intellectual disability, representing approximately 25% of all people with the syndrome. It is estimated that in Brazil it occurs 1 in every 700 births, which totals around 270 thousand people with T21 in the world, in addition, the incidence is 1 in a thousand births alive (Brazil, 2019).

In this sense, at a historical level, it is understood that the first reports about DS date from the mid-20th century. XIX, however, it is believed that this cellular alteration, manifested in the human phenotype, was always present. Furthermore, studies of the Olmec culture, in the period from 1500 BC to 300 AD, show the representation of children and adults who differed from the others of their tribe and who had a similar description with people under the condition of SD (Pietricoski & Justina, 2020).

In addition, simple or standard trisomy 21 is understood to be caused by chromosomal nondisjunction, usually of meiotic origin, respecting about 95% of DS cases. Occasionally occurring, this type of change genetics is characterized by the presence of an extra chromosome 21, in a tricopy configuration, with the following description of karyotype = 47, XX+ 21 female and 47, XY + 21 male (Coelho, 2016).

Thus, DS by chromosomal translocation (or Robertsonian translocation) usually occurs due to chromosomal rearrangements with gain of genetic material, respecting between 3 to 4% of the cases, which may be casual or be inherited from one of the parents. In this case, the karyotype identifies trisomy 21 not as a free chromosome, but translocated with another chromosome, often involving chromosome 21 and chromosome 14. Thus, the karyotype description corresponds to the following configuration: 46, XX, t (14; 21) (14q21q) in sex female and at 46, XY, t (14; 21) (14q 21q) in males (Coelho, 2016).

Furthermore, the third type of genetic alteration associated with DS corresponds to mosaicism, the cause of more sporadic incidence of DS among the three types, respecting between 1 and 2% of cases. Its occurrence is casual and the zygote begins to divide normally, producing the distribution error of the chromosomes in the 2nd or 3rd cell divisions. O Mosaicism in DS is therefore characterized by the presence of two cell lines, one normal with 46 chromosomes and another trisomy with 47 chromosomes, with chromosome 21 being extra free (Coelho, 2016).

The clinical diagnosis of DS is based on the recognition of physical features. The more features specific features of DS are identified, it increases the safety of the clinical diagnosis. The laboratory diagnosis of DS is made through genetic analysis called karyotype, is the representation of the set of chromosomes present in the cell nucleus of an individual, taking into account some classifications of trisomy 21 (Pietricoski & Justina, 2020).

Thus, the present study aims to relate the classifications of trisomy 21 according to the amount of live births in Brazilian states in the time frame from 2016 to 2020.

2 METHODOLOGY

This research is configured as a retrospective, descriptive study of live births with T21 that occurred between 2016 to 2020 in Brazil. The pertinent information for the elaboration of this study was taken directly from the Information System on Live Births (SINASC) via the Department of Informatics of the Unified Health System (DATASUS) of the Ministry of Health (MS).

Retrospective studies have the ability to establish the possible factors that precede or characterize an illness or ailment. This type of research can also ensure that measures of likely causal factors have not been influenced by the knowledge of which individuals had the pathology of interest, characterizing the impartiality of the research (Freire & Pattussi, 2018).

Also in this sense, in carrying out descriptive studies, the researcher plays the mere role of merely spectator, without developing any intervention that could interfere with the natural course and/or the outcome of the study. At observational research can be conducted in the form of four types of study, depending on the design. Are they: case series, cross-sectional study, cohort study and case-control study, with the study (Freire & Pattussi, 2018).

Furthermore, it is essential to show that descriptive research occurs when the researcher records and describes the facts observed without interference from the samples found. This study typology seeks to describe the characteristics of particular population or phenomenon or also the establishment of relationships between variables (Prodanov & Freitas, 2013).

The study region corresponds to Brazil, consisting of 11 states by T21 mosaicism (Table 1), 19 states by T21 meiotic (Table 2), 21 states by T21 translocation (Table 3). According to the ICD-10 classification, the live births whose underlying cause was one of the following ICD-10 codes: Q900-Trisomy 21-n-meiotic disjunction, Q901-Trisomy 21 mosaicism (mitotic non-disjunction), Q902-Trisomy 21, translocation.

Through investigations carried out in May 2022, which were obtained through bank information of SINASC data available on the DATASUS website, it was possible to calculate the percentage of the causes above described for the period from 2016 to 2020.

The variables used with the DATASUS/MS pertaining to the sociodemographic properties were the following: year of birth, federation unit and classification. After extracting the data, they were organized using the

Microsoft Excel® 2010 tool, in order to facilitate the calculation of the percentage of the established categories, and the results represented by tables for better observation and understanding of readers.

3 RESULTS AND DISCUSSION

According to the data collected from the states, the percentage of live births can be obtained, being developed tables and graph, according to classification and states, in the last 5 years (2016 to 2020).

In Brazilian states, there were 97 cases of T21 due to mosaicism, in the 5-year interval (2016-2020) according to DATASUS, with São Paulo (46.40%), Rio Grande do Sul (15.46%) and Espírito Santo (12.37%) with the highest percentage and the state of Rio de Janeiro (1.03%) Mato Grosso (1.03%) with a lower percentage, it can be seen that this number does not follow a constancy according to the years, as shown in table 1.

Furthermore, approximately 95.00% of children have simple trisomy 21, in which there are 47 chromosomes with an extra chromosome 21 present, in 1.00 to 2.00% of people with the SD phenotype, there are 2 lines cells, one typical and the other with trisomy 21, a condition called mosaicism (Moriyama, 2022).

In addition, as described by Moriyama (2022), the classification of DS by mosaicism in comparisons with the others is much smaller, as it was noticed when analyzing the following 3 tables according to the years and states the index of live births in the last 5 years with a total of 97 births

Table 1: Percentage of live births with T21, mosaicism (mitotic n-isjunction) according to Brazilian states, 2016 to 2020.

Years												
Variables	2016		2017		2018		2019		2020		Total	
States	N	%	N	%	N	%	N	%	N	%	N	%
Sao Paulo	9	9.28%	11	11.34%	4	4.17%	9	9.28%	12	12.37%	45	46.40%
Rio Grande do SUL	3	3.09%	3	3.09%	5	5.15%	2	2.06%	2	2.06%	15	15.46%
Holy Spirit	2	2.06%	3	3.09%	4	4.17%	3	3.09%	0	0.00%	12	12.37%
Minas Gerais	2	2.06%	1	1.03%	0	0.00%	2	2.06%	3	3.09%	8	8.25%
Federal District	0	0.00%	0	0.00%	0	0.00%	1	1.03%	3	3.09%	4	4.17%
Bahia	0	0.00%	0	0.00%	1	1.03%	1	1.03%	1	1.03%	3	3.09%
Santa Catarina	1	1.03%	0	0.00%	0	0.00%	1	1.03%	1	1.03%	3	3.09%
Goiás	0	0.00%	1	1.03%	2	2.06%	0	0.00%	0	0.00%	3	3.09%
Pernambuco	0	0.00%	1	1.03%	0	0.00%	0	0.00%	1	1.03%	2	2.06%
Rio de Janeiro	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	1.03%	1	1.03%
Mato Grosso	0	0.00%	1	1.03%	0	0.00%	0	0.00%	0	0.00%	1	1.03%
Total	17		21		16		19		24		97	
%	17.53%		21.65%		16.49%		19.58%		24.74%		100%	

Source: Data SUS.

It was found that in the state of São Paulo (60.82%), Acre (8.98%) and Minas Gerais (5.30%), presented higher T21 indexes by meiotic n-disjunction, while Alagoas (0.40%) and Mato Grosso do Sul (0.40%) present a lower percentage. It was also noticed that in recent years there has been an increasing incidence of cases, however, in 2019 a decline was obtained, according to table 2 below.

Despite this, although the meiotic T21 in 2018 showed an increase of 21.22% in births, in 2019 there was a relapse to 17.55%, but in 2020 there is a big difference of 26.53% with 65 cases in the Brazilian states, with São Paulo being the state with the highest number of cases compared to the others (Table 2).

Table 2: Percentage of live births with T21 n-meiotic disjunction according to Brazilian states, 2016 – 2020.

	Years											
Variables	2016		2017		2018		2019		2020		Total	
States	N	%	N	%	N	%	N	%	N	%	N	%
Sao Paulo	17	6.93%	33	13.47%	32	13.06%	29	11.83%	38	15.51%	149	60.82%
Acre	4	1.63%	9	3.68%	5	2.04%	1	0.40%	3	1.22%	22	8.98%
Minas Gerais	4	1.63%	3	1.22%	2	0.81%	1	0.40%	3	1.22%	13	5.30%
Rio Grande do Sul	1	0.40%	0	0.00%	4	1.63%	2	0.81%	3	1.22%	10	4.08%
Paraná	0	0.00%	0	0.00%	1	0.40%	3	1.22%	4	1.63%	8	3.26%
Holy Spirit	1	0.40%	0	0.00%	4	1.63%	2	0.81%	1	0.40%	8	3.26%
Federal District	1	0.40%	0	0.00%	0	0.00%	0	0.00%	5	2.04%	6	2.45%
Bahia	1	0.40%	0	0.00%	1	0.40%	2	0.81%	2	0.81%	6	2.45%
Ceará	0	0.00%	1	0.40%	0	0.00%	2	0.81%	2	0.81%	5	2.04%
Santa Catarina	0	0.00%	2	0.81%	1	0.40%	0	0.00%	1	0.40%	4	1.63%
Mato Grosso	0	0.00%	2	0.81%	0	0.00%	0	0.00%	1	0.40%	3	1.21%
Rio de Janeiro	1	0.40%	0	0.00%	1	0.40%	0	0.00%	0	0.00%	2	0.80%
Goiás	0	0.00%	0	0.00%	0	0.00%	1	0.40%	1	0.40%	2	0.80%
Pernambuco	1	0.40%	0	0.00%	0	0.00%	0	0.00%	1	0.40%	2	0.80%
amazon	1	0.40%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.40%
Amapa	0	0.00%	0	0.00%	1	0.40%	0	0.00%	0	0.00%	1	0.40%
large northern river	0	0.00%	1	0.40%	0	0.00%	0	0.00%	0	0.00%	1	0.40%
alagoas	0	0.00%	1	0.40%	0	0.00%	0	0.00%	0	0.00%	1	0.40%
Mato Grosso do Sul	0	0.00%	2	0.80%	0	0.00%	0	0.00%	0	0.00%	1	0.40%
Total	32		53		52		43		65		245	
%	13.06%		21.63%		21.22%		17.55%		26.53%		100%	

Source: DataSUS.

In this lens, according to Candace et al. (2014), in most autosomal trisomies, trisomy 21 is more often the result of errors in the oocysts (referring to maternal errors) and accounts for 90% of cases among these meiotic maternal errors. It is worth mentioning that maternal age was identified as the potentiating risk factor for T21. IT IS

It is important to point out that Down syndrome does not occur only due to disjunction errors, even though, in most cases,

In some cases, the extra chromosome is derived from this incorrect division. In Table 2 it is possible to observe a higher rate of births living through the states that have the highest prevalence, different from Table 1. That said, in the context of T21 by translocation in Brazil, São Paulo (30.80%), Minas Gerais (19.09%), Espírito Santo (6.58) have higher percentages of cases, contrary to Piauí (0.50%) and Alagoas (0.50%), which have a lower percentage, as shown in Table 3.

Table 3: Percentage of live births with T21 translocation according to Brazilian states, 2016 to 2020.

	Anos											
Variáveis	2016		2017		2018		2019		2020		Total	
Estados	N	%	N	%	N	%	N	%	N	%	N	%
São Paulo	14	7.07%	14	7.07%	11	5.55%	8	4.04%	14	7.07%	61	30.80%
Minas Gerais	2	1.01%	12	6.06%	8	4.04%	10	5.05%	7	3.53%	39	19.69%
Espírito Santo	2	1.01%	0	0.00%	3	1.51%	5	2.52%	3	1.51%	13	6.56%
Santa Catarina	1	0.50%	1	0.50%	4	2.02%	6	3.03%	1	0.50%	13	6.56%
Sergipe	0	0.00%	5	2.52%	6	3.03%	1	0.50%	0	0.00%	12	6.06%
Rio Grande do Sul	1	0.50%	1	0.50%	5	2.52%	3	1.51%	2	1.01%	12	6.06%
Distrito Federal	0	0.00%	1	0.50%	3	1.51%	4	2.02%	2	1.01%	10	5.05%
Goias	2	1.01%	0	0.00%	3	1.51%	2	1.01%	1	0.50%	8	4.04%
Rio de Janeiro	1	0.50%	2	1.01%	1	0.50%	0	0.00%	0	0.00%	4	2.02%
Paraná	0	0.00%	0	0.00%	3	1.51%	1	0.50%	0	0.00%	4	2.02%
Rio Grande do Norte	0	0.00%	0	0.00%	0	0.00%	2	1.01%	1	0.50%	3	1.51%
Rondônia	1	0.50%	0	0.00%	0	0.00%	0	0.00%	2	1.01%	3	1.51%
Maranhão	0	0.00%	1	0.50%	1	0.50%	0	0.00%	1	0.50%	3	1.51%
Ceará	0	0.00%	0	0.00%	0	0.00%	1	0.50%	2	1.01%	3	1.51%
Mato Grosso	0	0.00%	2	1.01%	0	0.00%	0	0.00%	1	0.50%	3	1.51%
Paraiba	0	0.00%	0	0.00%	1	0.50%	0	0.00%	0	0.00%	2	1.01%
Pernambuco	0	0.00%	0	0.00%	0	0.00%	1	0.50%	0	0.00%	2	1.01%
Bahia	0	0.00%	0	0.00%	1	0.50%	1	0.50%	0	0.00%	2	1.01%
Acrê	0	0.00%	0	0.00%	0	0.00%	1	0.50%	0	0.00%	1	0.50%
Piauí	0	0.00%	0	0.00%	1	0.50%	0	0.00%	0	0.00%	1	0.50%
Alágoas	1	0.50%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.50%
Total	25		39		51		46		37		198	
%	12.62%		19.69%		25.75%		23.23%		18.68%		100%	

Source: DataSUS.

In addition, the so-called Robertsonian translocations, which occur in 3 to 4% of DS cases.

It may be incidental or inherited from one of the parents. Chromosome 21 trisomy, in this case, is identified in the karyotype not as a free chromosome, but translated to another, more frequent chromosome, the translocation involving the chromosome 21 and 14 (Brazil, 2013).

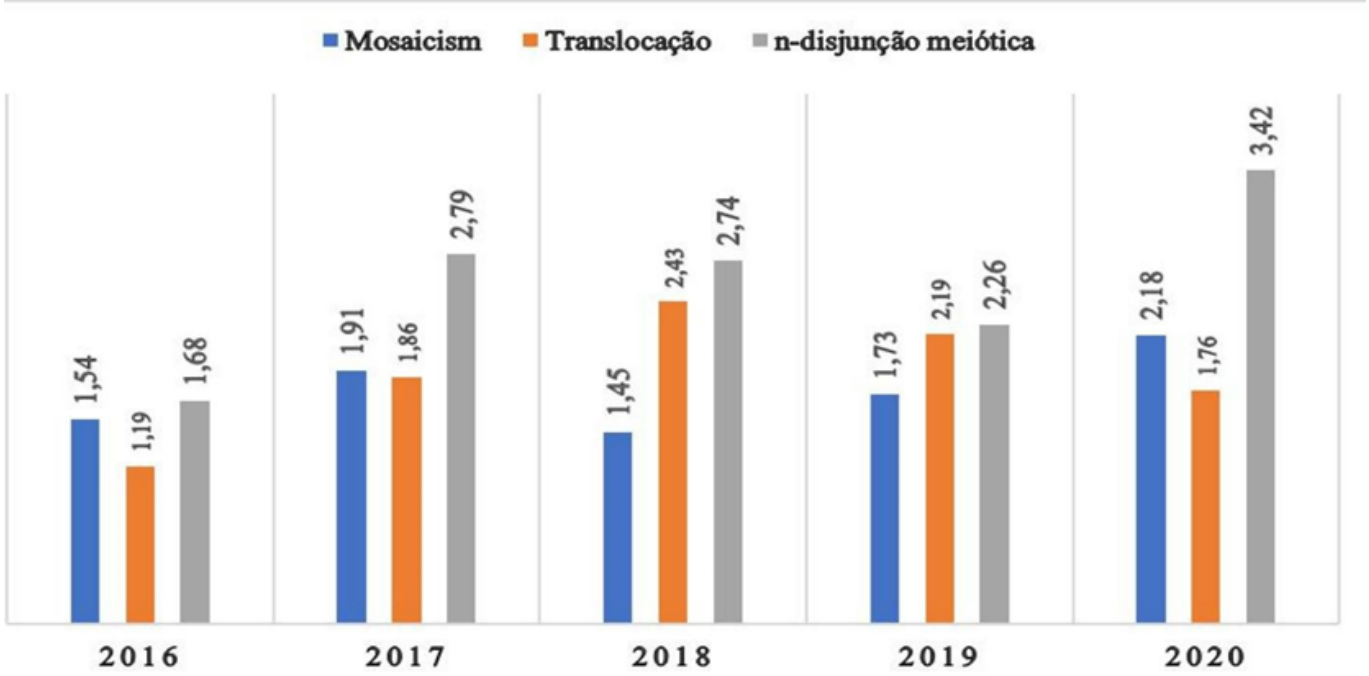
Unlike the other results, it was possible to observe that the number of live births by translocation was a total of 198 people in the last 5 years, considering that it is not as frequent compared to meiotic classification, but also it does not have a low index like mosaicism.

In T21, the translocation in Brazil, showed an oscillation from the year 2016 to 2018, it grew 13.13% already in the year 2018 to 2020 there is a 7.07% reduction in births, with São Paulo being the state with the highest prevalence of 30.80% of live births in the last 5 years (Table 3).

In addition, according to graph 01 below, the classifications were in order, n- meiotic disjunction with greater percentage, while moisaicism and translocation suffer some variations according to the years. And in line with the saying above, meiotic n-disjunction classifications have a higher percentage in live births in the last 5 years, manifesting an increase in births with Down Syndrome in 2020.

Graph 1: Comparison of T21 classifications according to year of birth, 2016 to 2020.

- Mosaicism
- Translocation
- Meiotic Nondisjunction



4 CONCLUSION

From the discussion exposed in this study, it is understood that the three classifications of Down Syndrome were created to systematize the terms of health, illness and functionality, as well as to allow their differentiation according to their respective genetic manifestations. Due to the data mentioned and exposed, it is observed that, in relation to the t21 classifications, meiotic n-disjunction was the most represented among the occurrences in the years that make up this clipping temporal.

It is added that, as evidenced in the literature, the classification of DS by mosaicism represented the lowest occurrences between demonstrations. Notwithstanding this, at the geographic level, it was noticed that in the three classifications, the state of São Paulo became highlighted by the large percentage evidenced, this finding is associated with its quantitative grid populational.

In this sense, this research made it possible to analyze the three classifications of trisomy 21, explaining, quantitatively, the percentage distributions of SD at the national level, evaluating the information provided in the DATASUS system, combining them with the current literature. This study nurtures a horizon for further research on this topic, providing new insights of the SD, as well as facilitating the process of including these people in society, through the understanding of their existence, especially in the states with the highest population rate.

Finally, the need to collect primary data for new studies is highlighted, since, knowing that the information that supported this research, as they come from existing database systems, depend on the quality and veracity of filling out the notification forms.

Thus, it is suggested the production of more studies aimed at deepening these materials, as well as a synthesis of studies of current elements about DS is suggested, especially after the pandemic period experienced, to understand the new live birth rates and their national distributions.

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