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Born Twins: Fascinating Fact Of Nature

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ABSTRACT

Although twins born are occurring in all societies, its study continues to fascinate just because, we are not sure about the reasons for its occurrence. Therefore, right understanding of its typology, factors responsible for twinning, monozygotic and dizygotic multiples, occurrence and their distribution become prime requisite for the study. Early studies and statistics available direct us towards genetics and environment's role in the existence of above phenomenon. So, where does the answer lies, is it in either of them or is it their combination responsible, which is the need of hour in study of human variation.

Introduction

Studies on twins born or multiples continue to be mystery. Twins and multiples are the subjects of much fascination to explore. It is still a scattered phenomenon despite of increased number in recent times. Very few encounters are witnessed of twins and much fewer in multiples like triplets, quadruplets etc. Because of their scattered phenomenon, it is more certain to be misunderstood. Like the cause for twins and multiples to be born (Prindle Fierro 2020).

Twin's typology

There are different reasons for twinning. It is not the same in every case. Zygosity will help us understand the underlying causes of twins. It classifies twins into Monozygotic and Dizygotic multiples. Monozygotic multiples form from a single zygote (fertilized egg) that further splits after fertilization. Monozygotic twins are more commonly known as identical twins because they originate from a single egg/sperm combination and share the same genetic background, so they often look alike and share many of the same characteristics. Monozygotic twins are always the same gender (with very few, very rare, exceptions) (Prindle Fierro 2020).

Development of Monozygotic twins

This type of twin formation accelerates when one sperm fertilizes one egg (oocyte). And the fertilized egg (called a zygote) then travels to the uterus, this cell divides and grows into a blastocyst. In the case of monozygotic twins, the blastocyst further splits and develops into two embryos. Monozygotic twins occur when a single fertilized egg divides into two. Later on, these two embryos grow into two babies.

Monozygotic ("mono" means single and "zygote" means fertilized egg) is the term used to describe this phenomenon.

On other hand, Dizygotic/fraternal twins are formed as a result of fertilization of two separate eggs by two sperms. Thus, resulting into development of two embryos at the same time, individually. Dizygotic twins are common with fertility treatments that cause multiple eggs to be released or more than one embryo to be transferred into the uterus (Gurevich 2021a).

Overall twinning rates of both monozygotic and dizygotic vary globally. The cumulative twinning rate over the studied period was 11.70 per 1000 live births. The MZ and DZ twinning rates were estimated respectively as 3.67 and 8.03 per mill (Gurevich 2021a).

In India, for example, the National average rate of twin births is 9 per 1000 live births whereas, with exception in Kodinhi village, Malappuram district, Kerala has the rate around 45 per 1000 live births, which is said to be increased in recent times, since 2008 [4]. However, most of the variation is due to differences in dizygotic twin rates. The rate of monozygotic twins is very consistent around the world about 3 to 5 in every 1,000 twin births (Sahu and Josyula 2016).

In some tribal and isolated populations, monozygotic twins seem to run in the family or in the greater tribe. It remains unknown if genetics are at play or the environment, but it's likely that something in the environment triggers the split, or it occurs randomly like in above mentioned exception.

However, dizygotic twins are often witnessed in families. This is mainly thought to be due to genes that increase the number of eggs released. Interestingly, in vitro fertilization (IVF) appears to increase the likelihood of having monozygotic twins.

IVF research has helped us in understanding the formation of identical twins in best possible way. IVF embryos are more similar than naturally conceived embryos to split into identical twins. A fertility doctor can transfer just one embryo—in hopes of reducing the risk of non-identical twins—but identical twins may still occur, and more frequently than in the general population.

Usually in embryo development, a fluid-filled cavity develops inside the embryo, which is known as the blastocoel and there is also collection of cells known as the inner cell mass, which will eventually form into foetus.

Whilst IVF, the blastocoel may collapse on its own. This typically destroys the embryo, sometimes the embryo survives, causing the inner cell mass to split into two. These two inner cell masses lead to the development of twins.

The embryo is initially kept in an artificial solution in the lab, in the environment as close to natural as possible, although it isn't exactly the same environment as inside a woman's reproductive system. Perhaps this solution increases the risk of collapse.

Opinions differ on when to transfer the embryo into the woman's uterus. It seems that transferring the embryo later may slightly increase the odds of identical twinning (Gurevich 2021b).

Objective of study

The study intends to understand the factors responsible for twin born. It covered the typology, occurrence and distribution of monozygotic and dizygotic multiples.

The Genetics of Twinning

It was believed that monozygotic twins shared the exact same DNA. But it isn't completely true, because every time cells split, there is possibility of mutations, starting as early as the first split. This is one of the reasons why identical twins are at an elevated risk of congenital diseases.

After one split, cell masses continue splitting on their own. With each split, there is a chance of mutation. Usually, by birth, the genes of twins are extremely similar but not identical. Over time, genetic dissimilarities tend to increase. This is due to epigenetics—the way the environment changes how our DNA is expressed.

Some studies have witnessed that considerable DNA differences are often observed in older identical twins than in young identical twins. Upbringing of these in different environments is a likely contributor. Despite, being look alike and share similar characteristics, monozygotic twins cannot be called as clones. Although two embryos have the same genetic components to start, but slight differences develop over time.

When twins are born with genetically different sexes, they are commonly dizygotic. Monozygotic twins are typically born as the same genetic sex. However, while it is extremely rare, it is possible for monozygotic twins to be two different sexes. This again explain the idea that genetic mutations can occur from the very first split.

If an egg carries two X chromosomes (normally egg should carry just one X chromosome) and is fertilized with a Y sperm, you can get an XXY embryo. This is also known as Klinefelter syndrome. This can also end up by splitting XXY embryo into monozygotic twins as one twin with XX expression (female), and the other with XY (male). Of course, it is rare situation. The other rare way to have identical twins of different sexes is when an egg with one X chromosome, and sperm with a Y chromosome, it's possible for one twin to result with only the X chromosome (usually written as XO), and the other XY.

Thus, one twin will be a girl (with the congenital disorder known as Turner syndrome), and the other twin will be a boy. It is assumed that 99.99% of boy-girl twins are not monozygotic twins (Gurevich 2021b).

A rare form of monozygotic twins is semi-identical or half-twins, which occurs when two separate sperm fertilize one egg. This is another situation where you can get two sexes, but these are not truly "identical" twins since you started with two and not one sperm fertilizing the egg.

In 2007, the first case was identified, and another was found in 2014. In these rare cases, scientists hypothesized that the egg was fertilized by two separate sperm. At first glance, it appeared that the twins would be identical, but they were born as genetically different sexes. When the twins' DNA was examined more closely, it became apparent that each twin actually had both XX (female) and XY (male) chromosomes.

Conjoined twins are another rare form of monozygotic twinning, where separation is not complete after split in the zygote. Most conjoined twins die in utero or are stillborn. Mostly, monozygotic twins do have separate amniotic sacs although they share one placenta which is termed as monochorionic-diamniotic (or Mo-Di), and it occurs between 60% and 70% of the time with monozygotic twins.

Sharing one placenta elevates risks to the pregnancy, due to the possibility of twin-to-twin transfusion syndrome. The pregnancy must be watched very carefully if Mo-Di twins are diagnosed.

Another possibility is for the twins to each have their own placenta and amniotic sac. This is known as dichorionic-diamniotic (or Di-Di) twins. The risks in a Di-Di pregnancy are lower than with a Mo-Di pregnancy. There is a misconception that Di-Di twins are always fraternal (non-identical), but this is not true. About 30% of monozygotic twins are Di-Di.

The riskiest combination is when twins share one amniotic sac and one placenta. This only occurs in monozygotic twins and never with non-identical twins. This is known as monochorionic-monoamniotic (Mo-Mo) twins, and it is relatively rare, occurring in only 5% of twin pregnancies. With Mo-Mo twins, the biggest risk is that the babies can become entangled in the umbilical cords. There is also a risk of twin-to-twin transfusion syndrome and a higher risk of prematurity.

Early studies found that only 50% of Mo-Mo twins survived, but later studies have found more encouraging results, with the perinatal (the period immediately before and after birth) mortality rate closer to 20%. The only way to be sure about zygosity is with a DNA test. If the twins have the same DNA markers, they are most likely monozygotic. If they have different markers, they are dizygotic.

The genetic similarities in the DNA of monozygotic twins explain why they look remarkably similar and can even share similar traits, interests, behaviours, and personalities. Monozygotic twins will also have the same blood type. Sometimes, zygosity can be determined during pregnancy, but it depends on the timing of the split. Some monozygotic twins develop with a single, shared placenta and are enclosed in a single chorion or amnion. Healthcare providers can look for these tell-tale signs on an ultrasound, but it's not definitive of monozygotic twins.

Amniocentesis can also be used to determine twin zygosity before birth, but it is an invasive procedure and is not generally part of routine prenatal care. There is some research looking into using less-invasive prenatal DNA testing to determine twin zygosity. Talk to your OBGYN or your child's paediatrician about DNA testing options.

The twins are probably not monozygotic/identical if, they are boy/girl twins, they have different blood types, they look very different. The twins might be monozygotic/identical if, they are the same sex and look very similar, they shared one placenta. The twins are also monozygotic/identical if, DNA testing confirms they are identical and they shared one amniotic sac. DNA tests can be used to compare the twins' genetic markers and confirm that they are monozygotic. However, genetics do not determine everything about a person. For example, research has shown that monozygotic twins do not necessarily have the same genetic risk factors for disease.

Furthermore, identical twins do not have the same fingerprints. While the patterns are similar, they

are not exactly alike. A set of identical twins is still made up of two separate people. Environmental influences, epigenetic differences, and life experiences make each twin a unique individual. Dizygotic or multizygotic multiples form from two or more zygotes, which are separate eggs fertilized by separate sperm that share the same period of gestation. Dizygotic twins are more commonly known as fraternal twins. With their own unique combination of genes, they have the same genetic connection as any other siblings but share a womb during gestation. Dizygotic twins can be boys, girls, or a combination.

Dizygotic twins form from two separate eggs fertilized by two separate sperm. In most cases, a woman only releases a single egg, or ovum, from her ovaries during an ovulation cycle. But sometimes, for various reasons, multiple eggs are released in a cycle. If sexual intercourse or insemination occurs and the eggs are fertilized, multiples can result. Dizygotic twins occur when two eggs are fertilized by two sperm, implant in the uterus, and develop into two foetuses. The term multizygotic can also describe two twins, as well as other multiples, such as triplets, quadruplets, quintuplets or more. It simply differentiates multiples that originated from separate zygotes, as opposed to monozygotic multiples that form from a single fertilized egg that splits.

Unlike monozygotic twinning, which is inexplicable, there are several causes of dizygotic twinning. Ultimately, they can all be traced back to some factor that causes a woman to hyper ovulate, or release more than one egg in a cycle. Some women are wired to release more than one egg at once perhaps because of a genetic disposition. Others may do so because of hormonal influences. Perhaps they are breastfeeding, are taking fertility drugs, or have just stopped taking birth control pills. Older women may hyper ovulate as their bodies lead up to menopause. There are many other explanations, including diet, race, obesity and family history. Dizygotic twins share the same genetic commonalities as any other siblings, as they receive half of their DNA from their mother and half from their father. Generally, they are about 50% genetically identical.

There are some ways to establish for sure whether twins are dizygotic.

- If they are a boy and a girl - they are ***definitely*** dizygotic (with rare exception)
- If they have different blood types - they are ***definitely*** dizygotic
- If there is one placenta - they are ***probably not*** dizygotic
- If there are two placentas - they ***can be*** dizygotic, but could also be monozygotic
- If there are monochorionic - they are ***not*** dizygotic
- If they are monoamniotic - they are ***definitely not*** dizygotic
- If they look alike - they ***could be*** dizygotic
- If a DNA analysis reveals differences in markers - they are ***definitely*** dizygotic
- If a DNA analysis reveals highly compatible markers - they are ***not*** dizygotic

Dizygotic twins can be boys, girls or one of each. All boy/girl twins are dizygotic twins, with very rare exceptions. It may be possible to determine if twins are dizygotic during pregnancy, but sometimes it cannot be confirmed until after they are born. Many people—including medical professionals—assume that twins are dizygotic if they are in different sacs and have two separate placentas, however, that is not always the case. Sometimes, via ultrasound or other testing, clues can help detect zygosity such as different sex or different blood type. But often, in the absence of such distinctions, a DNA test is the most accurate way to verify that twins are dizygotic (Prindle Fierro 2021a).

During a normal cycle of ovulation, a single egg (or oocyte) is released from a woman's ovaries. If the egg is fertilized by sperm from a man during sexual intercourse, the resulting zygote travels to the woman's uterus, dividing and duplicating through the process of mitosis, where it will implant and grow into an embryo and eventually a foetus.

Sometimes, more than one egg is released during ovulation. If two eggs are fertilized during sexual intercourse and both successfully implant in the uterus, the result is a multiple pregnancy. If more than two eggs are released, fertilized, and implant, the result is multizygotic multiples, higher-order multiples such as triplets (3), quadruplets (4), quintuplets (5), sextuplets (6), septuplets (7), octuplets (8), or even more, although no multiples beyond octuplets have ever been known to survive.

Hormones control the process of ovulation. Usually, they signal the body to release one egg in a cycle, but sometimes they trigger the release of two or more eggs. Some of the factors that may have an effect on hormones and influence this process are:

- Discontinuing the use of birth control pills or irregular usage of birth control pills
- Breastfeeding
- Using fertility drugs such as Clomid

Obesity, defined as women with a BMI over 30, as extra fat stores produce increased levels of oestrogen (Prindle Fierro 2021b).

Some other factors are thought to generate hyper-ovulation in women and cause twins, such as:

- *Genetics*: Some women may just hyper-ovulate regularly and there is actually a gene that causes them to do so. Although both men and women carry the gene, only women ovulate, so a woman with the gene who hyper-ovulates may have fraternal twins. A man with the gene wouldn't be more likely to have twins, but he may pass the trait to his daughter, and maybe she'd be a candidate to have twins.
- *Family History*: Women who have conceived and borne several children already may be more likely to have twins. While the previous pregnancies don't cause hyper-ovulation or cause twins, it's possible that the mother's womb is just more hospitable to sustaining a twin pregnancy.
- *Maternal Age*: As you grow older, you're more likely to hyper-ovulate. Perhaps it's the body's accelerated attempt to reproduce before time runs out. Women over the age of 30 are more likely to have twins, and the rate increases even more after the age of 35.
- *Height*: Taller women have a higher-than-average rate of twin pregnancies. The reasons aren't particularly specific, but perhaps it's because increased height is associated with better nutrition, or the additional height provides more room in the womb, making multiple pregnancies more likely to thrive.
- *Race*: Women of African descent produce a higher number of twins than women of Asian descent.
- *Diet*: High rates of twins have been found in cultures where the diet is rich in a type of yams that contain phytoestrogen. One example is the Yoruba tribe in Nigeria, which has the highest rate of twins of any population in the world.

The causes of identical twinning are much vaguer. No clear explanation is offered by science. No specific theory has been confirmed as to why a fertilized egg splits and develops into two embryos. Data about monozygotic twins in populations indicates that the rate generally remains stable across

populations and time periods.

As technology improves, scientists are getting closer to finding answers. One 2007 study used specialized computer software to capture photos of embryos developing and found that the embryo basically collapses, splitting the progenitor cells in half and dividing them into two sets of genetic material that form as two separate foetuses. While the discovery was important, it still didn't pinpoint the reason for the split or explain exactly why identical twins happen. No genetic link has been identified. Some theories have been proposed but not confirmed. These include:

- An enzyme in sperm
- A mutation in the cells of the blastocyst
- Age of the egg after ovulation

Identical twins are generally considered to be random and unexplained. The mystery is part of their magic and mystique. The increased utilization of fertility treatments has definitely resulted in an increase in twin births. Fertility-enhancing drugs and injections contribute to hyper ovulation and can cause dizygotic twins. Artificial insemination (IUI treatment) does not necessarily increase the rate of twins but is usually accompanied by a routine of fertility-enhancing drugs that do.

IVF treatment (in vitro fertilization) may also cause fraternal twins. This treatment involves transferring embryo(s), or fertilized eggs, to the mother's womb. Often two or more embryos are transferred to increase the chances of a successful outcome, sometimes resulting in multiples.

Generally, fertility treatments are not considered a cause of identical twins. However, the rate of monozygotic twinning is slightly higher among pregnancies produced by reproductive assistance, particularly in IVF situations where an embryo is fertilized outside the womb and transferred to the mother. However, as with natural conceptions of monozygotic twins, the reasons aren't expressly understood (Prindle Fierro 2020).

Conclusion

The understanding of twin's typology, genetics, developmental stages, chromosomal aberrations, hormonal influences, genealogy, maternal age, stature, race, diet, treatments and different theories will in turn lead us to domain of genes and environment where its difficult to trace their influence in twinning, with surety. Although we can predict the outcome of offspring sexes depending upon the type of twins (Monozygotic or Dizygotic), the exceptions still remain to question our understanding.

References

Gurevich, R. (2021a).“How Monozygotic Twins Develop?” Medically reviewed by Anita Sadaty, MD RN Updated on June 14, 2021.

Gurevich, R (2021b) “How Monozygotic Twins Develop?” Updated on June 14, 2021. Medically reviewed by Anita Sadaty, MD.

News, *Human Interest Thursday*, April 27, 2017.

Prindle Fierro, P. (2020). “Causes of Identical and Fraternal Twins” Medically reviewed by Brian Levine, MD, MS, FACOG, August 31, 2020.

Prindle Fierro, P. (2021a). “Explanation of Dizygotic twins”, Updated on June 14, 2021, Medically reviewed by Meredith Shur, MD.

Prindle Fierro, P. (2021b).“Causes of Identical and Fraternal Twins”, Medically reviewed by Brian Levine, MD, MS, FACOG, June 14, 2021.

Sahu, M. and Josyula G. P. (2016). “ Twin Studies: A Unique Epidemiological Tool”, *Indian J Community Med*. 2016 Jul-Sep; 41(3): 177–182.

Sharma, K. (1997), “The twinning rates and epidemiological characteristics of births in southeast Uttar Pradesh, India.” *PMID*: 9298158 <DOI: 10.1017/s000156600000074x>