**Welcome**

Dear Jane Doe,

NMC Genetics is pleased to provide your **Women’s Health** report based on your unique genomic profile. The report offers you a snap-shot of your genetic response pertaining to your health. The interpretations and recommendations made in your report are based on data curated by our scientific experts from hundreds of clinical studies, clinical trials and Genome Wide Association Studies (GWAS) spanning decades of global research. Your DNA was extracted from your saliva/blood sample and processed in our labs equipped with next generation sequencing and microarray; utilizing globally validated procedures. The information received from your genetic code determines your health. We continuously strive to update our proprietary genomic and clinical databases to improve our tests and recommendations. With insights from this report, your clinicians or Wellness consultant has a guidance map to device a personalized drug and accordingly lifestyle changes to help you achieve optimal health. By seeking professional advice and following the recommendations you can improve your health holistically.

Wishing you good health!

**About Us**

NMC Genetics is a clinical genomics company with a vision to innovate healthcare using genomics and data science.

Our services, delivered from a state-of-the-art genomics laboratory, empower clinicians and health care professionals with precise and actionable results to help improve patient care. NMC Genetics has strong focus and domain expertise in clinical genomics, preventive health, and personalized medicine. Led by a unique team of highly skilled molecular biologists, bioinformaticians and data scientists, NMC Genetics is poised for a big leap into the future of healthcare.

NMC Genetics is a subsidiary of NMC Healthcare LLC. a largest private healthcare company in the UAE and ranks amongst the leading fertility service providers in the world. Over the last forty-three years, NMC has earned the trust of millions, thanks to its personalized care, genuine concern and a sincere commitment to the overall well-being of the patient.

NMC was the first company from Abu Dhabi to list on the London Stock Exchange and is now part of the premium FTSE 100 Index, an elite club of top 100 blue-chip companies by market cap. NMC's strategic acquisitions coupled with its legacy institutions have allowed us to clear the service gap in our healthcare delivery system and offer a continuum of care to patients.

**Legal Disclaimer**

This report is based on your unique DNA results obtained by testing your buccal swabs/blood/saliva

samples in response to a selection of key genes that are associated with the individual health. NMC

Genetics provides genetic assessment services only for investigational purposes and the information

thus given should be interpreted and used exclusively only by qualified medical practitioners, certified physicians, dieticians, nutritionist, sports therapists and others in similar professions. The company does not provide any medical advise and this report does not constitute a medical diagnostic report.

Genetic results are unique but being associated with a futuristic technology, the same must be used only under proper advice. NMC Genetics does not guarantee or in any way confirm any future disease or ailment associated with the genetic data disclosed in this report. For any contraindications you are advised to get supportive tests conducted from appropriate hospitals/laboratories.

The company's role is limited to providing results of genetic tests and providing a broad set of general recommendations. More detailed instructions that may be specific to you are to be made by qualified professional practitioners only. General guidelines provided in our reports are for informational purposes only. They do not constitute professional or medical advice. While assessing your report and providing these recommendations we assume that you are in a general state of good health and do not take into account your past or existing health conditions and or any medication taken by you (either in the past or currently), even if you have provided us with such information. You should consult your medical practitioner before acting on it.

To the fullest extent permitted by law, neither NMC Genetics and nor its officers, employees or representatives will be liable for any claim, proceedings, loss or damage of any kind arising out of or in connection with acting, or not acting, on the assertions or recommendations in the report. This is a comprehensive exclusion of liability that applies to all damage and loss, including, compensatory, direct, indirect or consequential damages, loss of data, income or profit, loss of or damage to property and claims of third parties, howsoever arising, whether in tort (including negligence), contract or otherwise. Nothing in this statement is intended to limit any statutory rights you may have as a consumer or other statutory rights which may not be excluded, nor to exclude or limit our liability to you for death or personal injury resulting from NMC Genetics negligence or that of its officers, employees or other representatives. Nothing in this statement will operate to exclude or limit liability for fraud or fraudulent misrepresentation.

**Women’s Health**

Women have unique health issues. And some of the health issues that affect both men and women can affect women differently. Unique issues include pregnancy, menopause, and conditions of the female organs. Women can have a healthy pregnancy by getting early and regular prenatal care. They should also get recommended breast cancer, cervical cancer, and bone density screenings.

Women and men also have many of the same health problems. But these problems can affect women differently. For example,

* Women are more likely to die following a heart attack than men
* Women are more likely to show signs of depression and anxiety than men
* The effects of sexually transmitted diseases can be more serious in women
* Osteoarthritis affects more women than men
* Women are more likely to have urinary tract problems

**Genetics & Women’s Health**

An individual's health is affected by several factors, including nutrition, exercise, and body weight as well as predispositions to a number of health conditions. Women on the other hand face additional health issues such as, pregnancy, menopause and other gynecological conditions. In order for a woman to achieve optimal health and wellness, it is important for her to understand how her unique genetic profile may be affecting how her body utilizes energy and nutrients, as well as how it responds to certain foods, diets, and exercise regiments. Thus, woman’s genetic makeup can also provide with insights into common health conditions that she may predisposed to, as well as other information that may be helpful during a woman’s lifetime. Since, "Your genes don’t change – they are what they are, and knowing what is in your genes can often help you learn how to take better care of your health

**Introduction**

DNA is the building block of all living organisms. Human DNA consists of about 3 billion bases, and more than 99% of those bases are the same in all people. The order or sequence of these bases is the set of instructions for building and maintaining an organism, similar in a way by which letters of the alphabet appear in a certain order to form words and sentences.

**What is DNA?**

DNA (Deoxyribonucleic), is the hereditary material in humans and almost all other organisms.

Most DNA is located in the cell nucleus (where it is called nuclear DNA), but a small amount of DNA can also be found in the mitochondria (where it is called mitochondrial DNA or mtDNA). The information in DNA is stored as a code made up of four chemical bases: adenine (A), guanine (G), cytosine (C), and thymine (T).

A gene is the basic physical and functional unit of heredity. Genes are made up of DNA. Some genes act as instructions to make molecules called proteins. However, many genes do not code for proteins. In humans, genes vary in size from a few hundred DNA bases to more than 2 million bases. The Human Genome Project estimated that humans have between 20,000 and 25,000 genes. Every person has two copies of each gene, one inherited from each parent.

**What is a gene mutation and how do mutations occur?**

A gene mutation is a permanent alteration in the DNA sequence that makes up a gene, such that the sequence differs from what is found in most people.

Mutations range in size; they can affect anywhere from a single DNA building block (base pair) to a large segment of a chromosome that includes multiple genes.

Gene mutations can be classified in two major ways:

Hereditary (or germline) mutations are inherited from one or both parents and are present throughout a person’s life in virtually every cell in the body.

Acquired (or somatic) mutations occur at some time during a person’s life and are present only in certain cells, not in every cell in the body

**What is Genetic testing?**

Genetic testing is a type of medical test that identifies changes in chromosomes, genes, or proteins. The results of a genetic test can confirm or rule out a suspected genetic condition or help determine a person’s chance of developing or passing on a genetic disorder. Genetic tests can be performed using either saliva, blood, tissue, or other human cells.

**What do the results of Genetic tests mean?**

A positive test result means that the laboratory found a change in a particular gene, chromosome, or protein of interest. Depending on the purpose of the test, this result may confirm a diagnosis, indicate that a person is a carrier of a particular genetic mutation, identify an increased risk of developing a disease in the future, or suggest a need for further testing.

A negative test result means that the laboratory did not find a change in the gene, chromosome, or protein under consideration. This result can indicate that a person is not affected by a particular disorder, is not a carrier of a specific genetic mutation, or does not have an increased risk of developing a certain disease. However, there is still the possibility that any unknown genetic variation can still be a risk factor. A variant of unknown significance (VUS) can also be found in a genetic sequence for which the association with disease risk is unclear.

**How genetic testing impacts your wellbeing**?

Genetic defects can affect our health, although in many cases they don't manifest into a disease, but increases the risk of disease. External factors (such as the environment or lifestyle) influences the manifestation of the disease. For example, If a person is intolerant to lactose, due to a genetic defect, this person is perfectly healthy as long as she does not consume milk or milk products. In many cases health issues appear only in conjunction with certain environmental influences - in this case, consuming products that contain lactose.

Genetic variations called SNPs (pronounced “snips”) or “deletions” or “additions” can affect the way our bodies absorb, metabolize, and utilize nutrients, and determine how effectively we eliminate Xenobiotics (drugs, pollutants) and even potential carcinogens. By understanding the mechanisms by which these genes work and analysing data generated from genome-wide association studies (known as GWAS) and Mendelian randomization, scientists can now understand what impact SNPs may have on disease risk and relationship with certain gene-environmental contexts.

Another example is, if a regulatory gene for iron intake is defective, this can increase the risk of iron assimilation into the body. Your healthcare practitioner can adjust iron intake through natural foods and supplements to mitigate the risk of iron deficiency.

Once researchers understand how specific genotypes can affect how our genes function, this enables development of the most favourable nutritional and lifestyle strategies specific to a person’s genotype.

A healthy lifestyle is, of course, generally preferable, because it can neutralize many genetic predispositions even without knowing underlying risks. However, genetic testing provides you with appropriate information about underlying risk factors and help an individual to implement pro-active health plan with his/her healthcare practitioner to lead a healthy life.

**SOME FACTS:**

In human beings, 99.9% bases are same, remaining 0.1% makes a person unique in terms of:

* Different attributes / characteristics / traits
* How a person looks and what disease risks he or she may have
* Harmless (no change in our normal health)
* Harmful (can develop into diseases like diabetes, cancer, heart disease, Huntington's disease, and hemophilia)
* Latent (These variations found in genes but are not harmful on their own. The change in each gene function only becomes apparent under certain conditions e.g. increase in stress and susceptibility to heart attack)

**About Your Women’s Health Report**

This comprehensive genetic report consolidates up-to-date research on most of the common SNPs that research suggests may have actionable nutritional and lifestyle interventions based on scientific evidence. We use hundreds of studies to bring you the genetic information in the Genetic report.

The reporting format is very consistent and very lucid to understand. The report comprises of following sections in that order.

1. **Summarized results section** : This section comprise of master summary.
2. **Detailed report section**: This section gives the detailed overview of every condition. There is summarized results table, a group of relevant traits, corresponding genetic response and interpretations are listed. Each trait or phenotype has its response is marked as good, bad or average.

This information provides you insight into specific risks such as effect of the marker on women’s diseases. Summary of recommendations in terms do's and dont’s of lifestyle, nutrition, supplementation or exercise are included. This is how the result for a genetic marker associated to an individual trait is graded:

|  |  |  |  |
| --- | --- | --- | --- |
| **Response** | **Risk Level** | **Zone** | **Interpretation** |
| Good | Low/Normal risk |  | Your genetic predisposition to the disease is normal or low. |
| Average | Medium risk |  | Your genetic predisposition to the disease is average. Hence, act as per the recommendations. |
| Bad | High Risk |  | Your genetic predisposition to the disease is high. Hence, act as per the recommendations or consult your healthcare practitioner. |

**Your Summarized Women’s Health Report**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **conditions** | **markers tested** | **gene name** | **your genotype\*** | **your response** |
| **Polycystic ovary syndrome (PCOS)** | rs13429458 | THADA | AC | **Moderate** |
| rs2975760 | CAPN10 | CT |
| **Pregnancy Loss and Abnormal Reproductive Function Risk** | rs1801133 | MTHFR | CC | **Good** |
| rs2232365 | FOXP3 | AA |
| **Peripartum Depression Risk** | rs4680 | COMT | GG | **Good** |
| **Osteoporosis** | rs9594738 | AKAP11 | CC | **Good** |
| rs3736228 | LRP5 | CC |
| rs4988321 | LRP5 | GG |
| rs7524102 | ZBTB40 | CT |
| **Rheumatoid Arthiritis** | rs660895 | HLA-DRB1 | CT | **Moderate** |
| rs6457617 | CT |
| rs13192471 | CT |

**Your Detailed Report**

1. **Polycystic Ovary Syndrome (PCOS):**

Polycystic ovary syndrome (PCOS) is a condition that affects a woman’s hormone levels. Women with PCOS produce higher-than-normal amounts of male hormones. This hormone imbalance causes them to skip menstrual periods and makes it harder for them to get pregnant. PCOS also causes hair growth on the face and body, and baldness. And it can contribute to long-term health problems like diabetes and heart disease. Birth control pills and diabetes drugs can help fix the hormone imbalance and improve symptoms.

**Symptoms:**

* **Irregular periods**. A lack of ovulation prevents the uterine lining from shedding every month. Some women with PCOS get fewer than eight periods a year (10Trusted Source).
* **Heavy bleeding**. The uterine lining builds up for a longer period of time, so the periods you do get can be heavier than normal.
* **Hair growth**. More than 70 percent of women with this condition grow hair on their face and body — including on their back, belly, and chest (11). Excess hair growth is called hirsutism.
* **Acne**. Male hormones can make the skin oilier than usual and cause breakouts on areas like the face, chest, and upper back.
* **Weight gain.** Up to 80 percent of women with PCOS are overweight or obese (11).
* **Male-pattern baldness**. Hair on the scalp gets thinner and fall out.
* **Darkening of the skin**. Dark patches of skin can form in body creases like those on the neck, in the groin, and under the breasts.
* **Headaches**. Hormone changes can trigger headaches in some women.

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| --- | --- | --- | --- | --- | --- |
| **markers tested** | **gene name** | **your genotype\*** | **your response** | **interpretation** | **Recommendation** |
| rs13429458 | THADA | **AC** | **Moderate** | Your genotype is associated with moderate risk of developing PCOS. | **Maintain ideal body weight by exercising regularly and eating a diet enriched with complex carbs, lean proteins, good fats(MUFA & PUFA) and plenty of green leafy vegetables. Avoid sugar, gluten and dairy to minimise the symptoms like acne etc. Avoid processed foods and simple carbs to maintain ideal BMI.** |

**Your Genetic Profile**

**\*some of the genotypes may be imputed**

**Gene Description:**

**CAPN10:** This gene encodes calpain 10. Calpains represent a ubiquitous, well-conserved family of calcium-dependent cysteine proteases. It is associated with type 2 or non-insulin-dependent diabetes mellitus (NIDDM)

**THADA**: This gene encodes THADA armadillo repeat containing. Single nucleotide polymorphisms (SNPs) in this gene may be associated with type 2 diabetes and polycystic ovary syndrome. The encoded protein is likely involved in the death receptor pathway and apoptosis.

1. **Pregnancy Loss and Abnormal Reproductive Function Risk:**

A miscarriage, or spontaneous abortion, is an event that results in the loss of a fetus before 20 weeks of pregnancy. It typically happens during the first trimester, or first three months, of the pregnancy. Miscarriages can happen for a variety of medical reasons, many of which aren’t within a person’s control. But knowing the risk factors, signs, and causes can help you to better understand the event and get any support or treatment you may need.

**Symptoms:**

* heavy spotting
* vaginal bleeding
* discharge of tissue or fluid from your vagina
* severe abdominal pain or cramping
* mild to severe back pain

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| --- | --- | --- | --- | --- | --- |
| **markers tested** | **gene name** | **your genotype\*** | **your response** | **interpretation** | **Recommendation** |
| rs1801133 | MTHFR | **CC** | **Good** | Your genotype is associated with normal risk of pregnancy loss. | **Eat a balanced diet with the right combination of macro and micronutrients. Exercise regularly to stay fit and healthy.** |
| rs2232365 | FOXP3 | **AA** |

**Your Genetic Profile**

**\*some of the genotypes may be imputed**

**Gene Description:**

**MTHFR:** This gene encodes methylenetetrahydrofolate reductase. It catalyses catalyzes the conversion of 5,10-methylenetetrahydrofolate to 5-methyltetrahydrofolate, a co-substrate for homocysteine remethylation to methionine.

**FOXP3:** This gene encodes forkhead box P3. Defects in this gene are the cause of immunodeficiency polyendocrinopathy, enteropathy, X-linked syndrome (IPEX), also known as X-linked autoimmunity-immunodeficiency syndrome.

1. **Peripartum Depression Risk:**

The form of Major depressive disorder (MDD) is diagnosed if MDD occurs during pregnancy or within four weeks after you’ve delivered your baby. It’s estimated that 3 to 6 percent of women will experience this type of Major depressive disorder (MDD) during pregnancy or in the postpartum period. New research shows that about 50 percent of these episodes begin before delivery. The cause of this isn’t known, but medical experts changed the name from postpartum depression to peripartum depression because of this statistic.

**Symptoms:**

* anxiety
* panic attacks
* a loss of appetite
* problems sleeping
* feelings of worthlessness
* restlessness
* paranoia

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| --- | --- | --- | --- | --- | --- |
| **markers tested** | **gene name** | **your genotype\*** | **your response** | **interpretation** | **Recommendation** |
| **rs4680** | **COMT** | **GG** | **Good** | Your genotype is associated with high COMT enzymatic activity, therefore you posses low dopamine levels; thus you have high pain threshold, resulting in less vulnerability to stress. | **During pregnancy eat healthy foods. Refrain from having processed foods, caffeine, smoking and drinking alcohol . Meditate everyday for 15 minutes and take adequate rest twice( once in afternoon for an hour post meals and second at night time for atleast 8 hours).** |

**Your Genetic Profile**

**\*some of the genotypes may be imputed**

**Gene Description:**

**COMT:** This gene is also called catechol-O-methyltransferase - In the process of detoxification COMT helps break down estrogen byproducts.

**4.Osteoporosis**

Osteoporosis is a condition that affects the bones. Its name comes from Latin for “porous bones.” The inside of a healthy bone has small spaces, like a honeycomb. Osteoporosis increases the size of these spaces, causing the bone to lose strength and density. In addition, the outside of the bone grows weaker and thinner. Osteoporosis can occur in people of any age, but it’s more common in older adults, especially women. People with osteoporosis are at a high risk of fractures, or bone breaks, while doing routine activities such as standing or walking. The most commonly affected bones are the ribs, hips, and the bones in the wrists and spine.

**Symptoms:**

The early stages of osteoporosis don’t cause any symptoms or warning signs. In most cases, people with osteoporosis don’t know they have the condition until they have a fracture.

**Some of the earlier ones may include:**

* receding gums
* weakened grip strength
* weak and brittle nails

If you don’t have symptoms but have a family history of osteoporosis, talking to your doctor can help you assess your risk.

**Severe osteoporosis**

* fracture from a fall or even from a strong sneeze or cough.
* back or neck pain, or loss of height.

**Risk factors**

**Age**

The biggest risk factor of osteoporosis is age. Throughout your life, your body breaks down old bone and grows new bone. However, when you’re in your 30s, your body starts breaking down bone faster than it’s able to replace it. This leads to bone that’s less dense and more fragile, and thus more prone to breakage.

**Menopause**

Menopause is another primary risk factor, which occurs in women around the ages of 45 to 55 years. Due to the change in hormone levels associated with it, menopause can cause a woman’s body to lose bone even more quickly. Men continue to lose bone at this age, but at a slower rate than women do. However, by the time they reach the ages of 65 to 70, women and men are usually losing bone at the same rate.

**Other risk factors for osteoporosis include:**

* being female
* being Caucasian or Asian
* having a family history of osteoporosis
* poor nutrition
* physical inactivity
* smoking
* low body weight
* small-boned frame

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **markers tested** | **gene name** | **your genotype\*** | **your response** | **interpretation** | **Recommendation** |
| rs9594738 | AKAP11 | CC | Good | Your genotype result is associated with normal bone mineral density. Hence you are not at risk of osteoporosis. |  |
| rs3736228 | LRP5 | CC |
| rs4988321 | LRP5 | GG |
| rs7524102 | ZBTB40 | CT |

**Your Genetic Profile**

**\*some of the genotypes may be imputed**

**Gene Description**

**AKAP11:**

This gene encodes A-kinase anchoring protein 11. Expressed in heart, brain, lung, liver, kidney, testis and ovary. Weakly expressed in skeletal muscle, pancreas and spleen.

**LRP5:**

This gene encodes LDL receptor related protein 5. It Plays a key role in skeletal homeostasis and many bone density related diseases are caused by mutations in this gene.

**ZBTB40:**

This gene encodes zinc finger and BTB domain containing 40. Plays a role in Bone Mineralization. Abnormal activity leads to Osteoporosis.

1. **Rheumatoid Arthritis**

Rheumatoid arthritis (RA) is an autoimmune disease that occurs when the body's immune system attacks and damages the joints and, sometimes, other organs. Rheumatoid arthritis (RA) is a chronic and potentially debilitating inflammatory disease that causes pain, swelling, stiffness and loss of function in the joints

Rheumatoid arthritis tends to strike women at a younger age than men -- and can hit harder, too.

Some women get the disease at times when their sex hormones are shifting, such as after pregnancy or before menopause. If you're pregnant, your RA may improve, but it might flare again after you have your baby. All of this suggests a link to hormones. If you're breastfeeding, you're less likely to get rheumatoid arthritis. One study shows that women who breastfed for 2 years or more cut their risk of getting the disease in half.

As of October 2020, the overall prevalence of RA was 4.86%, and the prevalence was higher in women than that in men (7.14% vs. 2.56%, p = 0.005)

**Symptoms:**

Common RA symptoms can include:

* fatigue,
* ccasional fever
* morning stiffness
* difficulty moving a joint or several joints
* pain and inflammation in or around a joint and a general sense of malaise.

**Risk factors:**

Although no one knows the precise causes of rheumatoid arthritis, it seems to develop as a result of an interaction of several factors, including genetics, environmental factors and hormones. A virus or bacterium could serve as the environmental trigger in people genetically susceptible to the disease

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **markers tested** | **gene name** | **your genotype\*** | **your response** | **interpretation** | **Recommendation** |
| rs660895 | HLA-DRB1 | CT | Average | Your genotype result is associated with moderate risk of RA. |  |
| rs6457617 | CT |
| rs13192471 | CT |

**Gene Description**

**HLA-DRB1:** This gene encodes major histocompatibility complex, class II, DR beta 1. It plays a central role in the immune system by presenting peptides derived from extracellular proteins.

**Science behind the test**

**Test Methodology**

Genomic DNA is extracted from individual’s Saliva/Tissue/Blood by commercial DNA extraction kits. The genotyping and variant detection is carried out based on illumina Infinium® array protocol. The DNA is then, amplified, fragmented and hybridized to known DNA fragments immobilized in arrays on a Bead- Chip. Millions of such known DNA fragments (50mer probes) containing the target genetic variants are immobilized on the chip. The hybridized chip is then washed to remove non-hybridized DNA fragments. Single-base extension of the oligos on the BeadChip, using the captured DNA as a template, incorporates detectable labels on the BeadChip and determines the genotype call for the sample. The Illumina iScan® or BeadArray Reader scans the BeadChip, using a laser to excite the fluorophore of the single-base extension product on the beads. The scanner records high-resolution images of the light emitted from the fluorophores.

**Analytical Performance**

The genotyping was performed using a custom genotyping array platform (Illumina Inc). This test is a laboratory developed test with high reproducibility > 99% and high call rates > 98% to detect the variants and its performance has been validated in-house. Note that some of the genotypes may be imputed.

**Analysis**

Illumina GenomeStudio® Software is used for efficient genotyping data normalization, genotype calling, clustering, data intensity analysis. Genotypes are called for each sample by their signal intensity (norm R) and Allele Frequency (Norm Theta) relative to canonical cluster positions for a given SNP marker. The reporting software tool is developed in-house by NMC Genetics India Pvt. Ltd. The report is manually reviewed by experts before release.

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