



Are You Depressed?

Or are you just on birth control...

By Olive Cowan

Sixty-five percent of women of reproductive age in the United States take birth control pills. It is likely therefore, that if you are an American woman reading this article, you have used some form of birth control in your lifetime. Societal standards have deemed women responsible for carrying the burden of birth control. However, the first clinical trials for birth control were actually conducted on men; they consisted of two injections of two different hormones and were found to be 96% effective. However, the trials were terminated when men reported side effects such as acne and mood swings (2). Researchers replaced women as the subjects because it seemed easier to block the release of one egg a month as opposed to millions of sperm. In the U.S., hormonal contraceptives such as IUD or combination pills are most commonly used for women — because who wouldn't opt for 99% efficacy?

Across cultures, the implications of birth control vary immensely. Many religions advocate against birth control or abortion because they believe one should not alter the innately biological processes of reproduction. In underdeveloped countries, it can even be difficult to gain access to birth control. Additionally, birth control can be viewed negatively because of its association with sex, and subsequently female pleasure (another taboo topic in many societies). However, hormonal contraceptives are not just used to prevent pregnancy; many women are prescribed birth control to treat common reproductive disorders that affect the ovaries such as polycystic ovarian syndrome (PCOS) and endometriosis. When I was 16, I was diagnosed with PCOS and prescribed birth control as a medication to treat it. I was

relieved to know that there was a medication that could help, but overwhelmed by the list of side effects associated with taking birth control.

If you have used hormonal contraceptives before, you have probably experienced a moment of shock when you learn all the possible side effects and risks.. Even though they tend to be rare, side effects range from common/minor effects such as changes in bleeding, headaches, weight fluctuation, facial acne, nausea or cramping, to serious/rare side effects such as blood clots, ovarian cancer, or vaginal infections. They are rare, and if caught early they can be treated. The important factor is knowing side effects are a possibility so that if you experience them, you can recognize them and tell your doctor. Another side effect listed under the rare section is depression/mood changes. However 2.2 out of 100 women who are taking hormonal birth control developed depression compared to 1.7 out of 100 women who did not use hormonal birth control (29). Indicating that if you are taking hormonal birth control, you are potentially at a higher risk for developing depression or other mood disorders. Additionally, this number is likely underestimated

because many individuals do not report their mood changes as a side effect of birth control, instead they view them as independent issues. After I started birth control, I was one of the unlucky few who experienced these mood related side effects. For a while, I too believed they were independent, but now I'm not so sure. A few months ago I stumbled upon an article titled "Can hormonal birth control trigger depression?", and what I learned was shocking. If you have ever experienced something similar, or relate to what I have already said, I suggest you continue reading. Before we begin, a solid understanding of menstruation, hormones and birth control is necessary to understand the implications of the aforementioned article.

What is Menstruation?

Menstruation begins when a woman goes through puberty. Her hormone levels fluctuate and she becomes fertile. The menstrual cycle has a few stages, first, menstruation where the uterus releases its inner tissue lining through a "period". In the Follicular phase, the uterine lining begins to build



EFFECTS OF BIRTH CONTROL ON YOUR BODY

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Mood

Birth control can offer relief for cyclical mood symptoms in some women, others find it amplifies anxiety and depression. For some women, birth control can accompany new onset of mood symptoms and may increase the risk of suicide.

Hair

Some women experience hair loss on their head when starting birth control and others may find decrease growth of unwanted hair.

Thyroid

The pill depletes nutrients the thyroid requires to produce hormones and increases thyroid binding globulin, a protein that prevents thyroid hormone from being used by the body.

Breast

Breasts may become tender and enlarged after beginning birth control. Birth control may also improve cyclical breast changes.

Liver

The pill specifically alters the liver on a structural and genetic level. There is an increased risk of both benign liver tumors and liver cancer.

Gallbladder

Women with a history of gallstones on birth control may experience faster stone formation.

Blood Pressure

Birth control can lead to elevated blood pressure. Be sure to have your blood pressure checked regularly to screen for this.

Weight Changes

For some women, birth control can cause fluctuations in weight, weight gain and weight loss.

Pregnancy Prevention

Some forms of hormonal birth control are up to 99% effective with perfect use.

Period Relief

Birth control can help reduce heavy periods and cramps in some women.

Diabetes Risk

Current use of the pill has been shown to lead to insulin resistance and blood sugar dysregulation. In postmenopausal women who have ever used the pill there is an increased risk of developing diabetes.

Blood Clots

There is an increased risk of developing a blood clot while on birth control. If you're a smoker, have a genetic predisposition, have heart or liver disease, have migraines with an aura or are overweight you may be at increased risk. According to the CDC, being over age 35 is also considered a risk factor.

Brain

Birth control alters brain structure, function, mate selection, and can increase the production of neurotoxins in the brain.

Migraines & Headaches

While birth control can provide hormonal headache relief, migraines and headaches can start or become worse while on birth control.

Skin

Estrogen and progesterin can resolve acne for some women, in others it can get worse.

Stress

Women on birth control have been found to have disruption in their HPA axis and an altered stress response.

Cancer

Birth control can reduce the risk of some cancers like ovarian, uterine, and colorectal cancers. It has been shown to increase the risk of brain, liver, and breast cancer.

Heart Attack

Certain pill formulations can increase the risk of a cardiovascular event. In women with pre-existing conditions, this risk may be higher.

Gut

Birth control increases intestinal hyperpermeability (leaky gut), disruption of the microbiome, allows for overgrowth of yeast, and is associated with an increased risk in developing autoimmune disease of the gut in people with a genetic predisposition.

Nutrient Deficiencies

The pill is specifically shown in multiple studies to cause depletions in many vitamins, minerals and antioxidants.

Vaginal Infections

Increase in yeast infections can occur for some women using birth control.

Libido

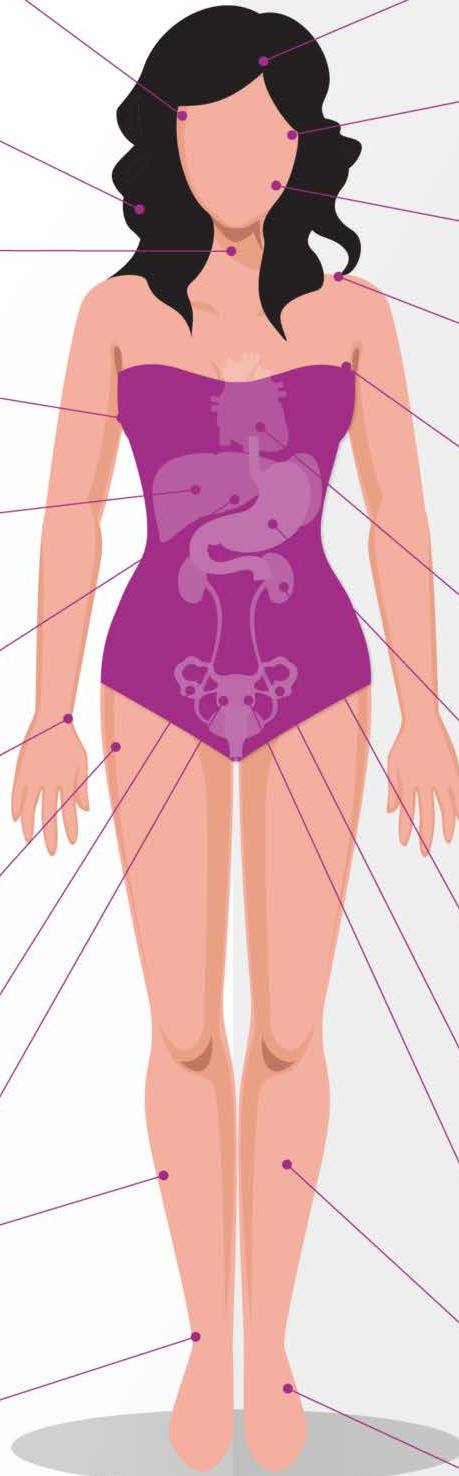
Women on birth control often report low or absent libido. Birth control can also lead to vaginal dryness and pain with sex.

Bone Health

Hormonal birth control may impair bone density in teenage women and may not have the "bone protecting" effect once thought.

Autoimmune Disease

Hormonal birth control is associated with an increased risk of developing crohn's disease, multiple sclerosis, lupus, interstitial cystitis and ulcerative colitis.



up again to prepare to release an egg from the ovaries in the Ovulation phase. The Luteal phase completes the menstrual cycle by building up the uterine lining and preparing for menstruation again. During the 30-day cycle of menstruation, hormone levels fluctuate dramatically (17).

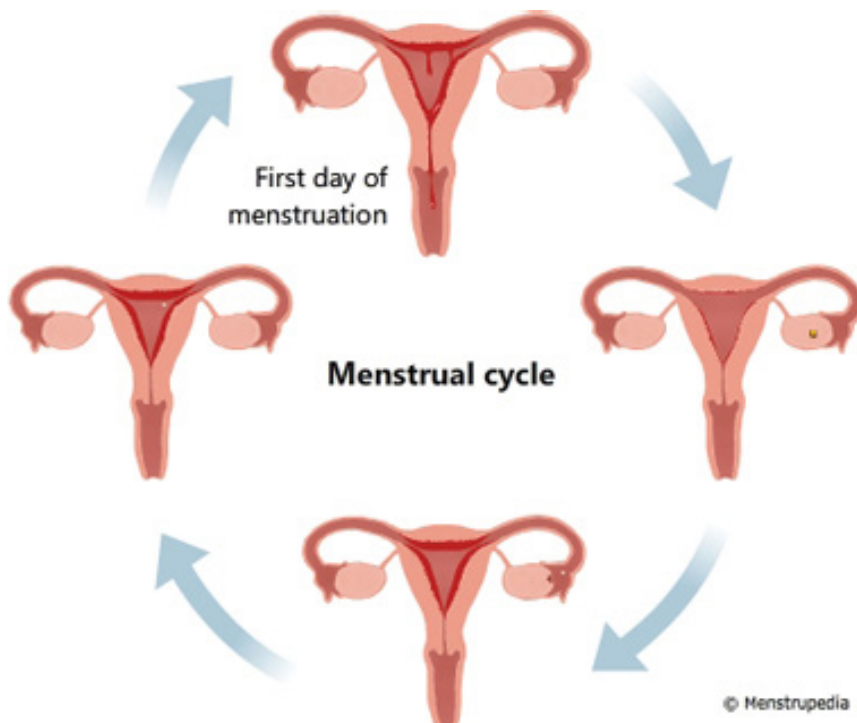
Hormones and Birth Control

Hormones are responsible for regulating a number of different biological processes mostly within the endocrine system (a network of glands that dictate the functioning of cells and organs). The endocrine system is made up of regions of the brain (hypothalamus, pineal and pituitary gland), thyroid/parathyroid gland, adrenal gland, pancreas, ovaries, and/or testes (20). This system is responsible for essential biological processes such as homeostasis, metabolism, phys-

ical/mental growth, energy, fear, and reproduction. The endocrine system interacts with the HPA axis (hypothalamic-pituitary-adrenal axis), a network of communication and feedback within the hypothalamus, pituitary gland and adrenal gland that dictates our body's stress response. The pituitary and pineal glands release stress hormones called cortisol, which signal to the hypothalamus and other brain regions to go into fight or flight mode. Hormone fluctuations can have effects throughout the whole body because hormones interact with many different physiological processes. You might be wondering what this has to do with periods and birth control; birth control manipulates this pathway by altering levels of the female sex hormone (estrogen) to interrupt the menstrual cycle.

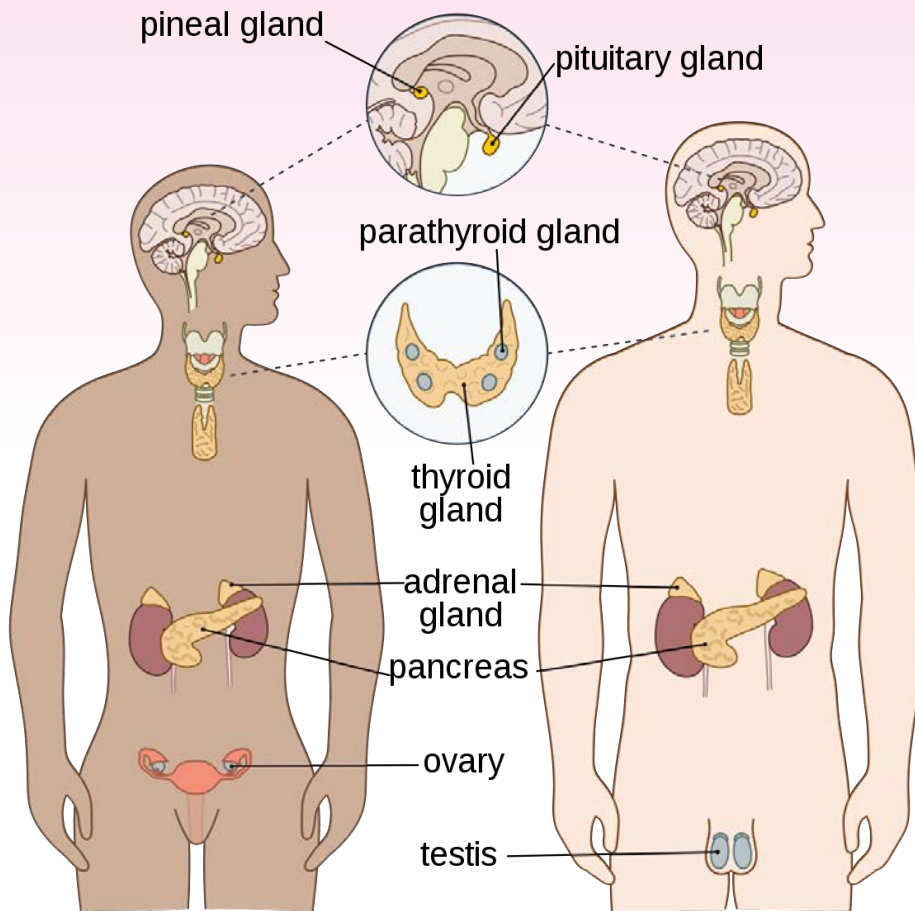
Estrogen has three major endogenous forms: estriol, estradiol and estrone (17). β -estradiol is the most abundant form of estrogen produced naturally in the body (3). Scientists spent years

researching these hormones in order to generate synthetic versions that act in a similar manner. The primary goals for using synthetic hormones were hormone therapy and hormonal contraceptives. Supplemental synthetic estrogens increase estrogen levels which can stop periods, and prevent ovulation. Increased estrogen levels signal via the endocrine system to the brain and the ovaries that the body is pregnant (even though it isn't actually). When the body thinks it is pregnant, it does not ovulate (release eggs) and therefore cannot become pregnant. Hormonal contraceptives can be administered in several ways. Some work through a daily pill which releases hormones into the bloodstream. Hormones can also be administered through an intrauterine device (IUD). This is placed in the uterus and slowly releases small doses of hormones over time to the localized area. These hormones do not interact with the brain or the bloodstream, however similar changes still occur in the uterus. The hormones in the IUD cause the tissue lining of the uterus to become thinner which results in lighter/less frequent periods. The IUD prevents pregnancy by triggering swelling and mucus generation in the uterus so that it is inhospitable to sperm (34). These hormonal contraceptives are composed of synthetic hormones such as ethinylestradiol (the most commonly used hormone in oral contraceptives) or levonorgestrel (a synthetic hormone similar to progesterone used in an IUD) (10, 34).



Treating Other Disorders

Hormone therapy is often used to treat disorders that impact the endocrine system. These



disorders impact processes such as reproduction, growth/development, mood, and hormone regulation. Endometriosis is an endocrine disorder that affects the growth/development of the uterus by overproducing endometrial/uterine tissues that begin to grow on the outside of other organs. When the uterine lining is shed during a period, it can cause small lacerations on other organs which can be very painful and lead to infertility (19). Polycystic ovarian syndrome (PCOS) is another endocrine disorder that affects the uterus. It is caused by the overproduction of androgens (a male sex hormone found in low concentrations in women) that leads to cysts (small fluid filled sacs) on the ovaries. The hormone imbalance can prevent some women from menstruating. Menstruating with PCOS can be very painful and also poses

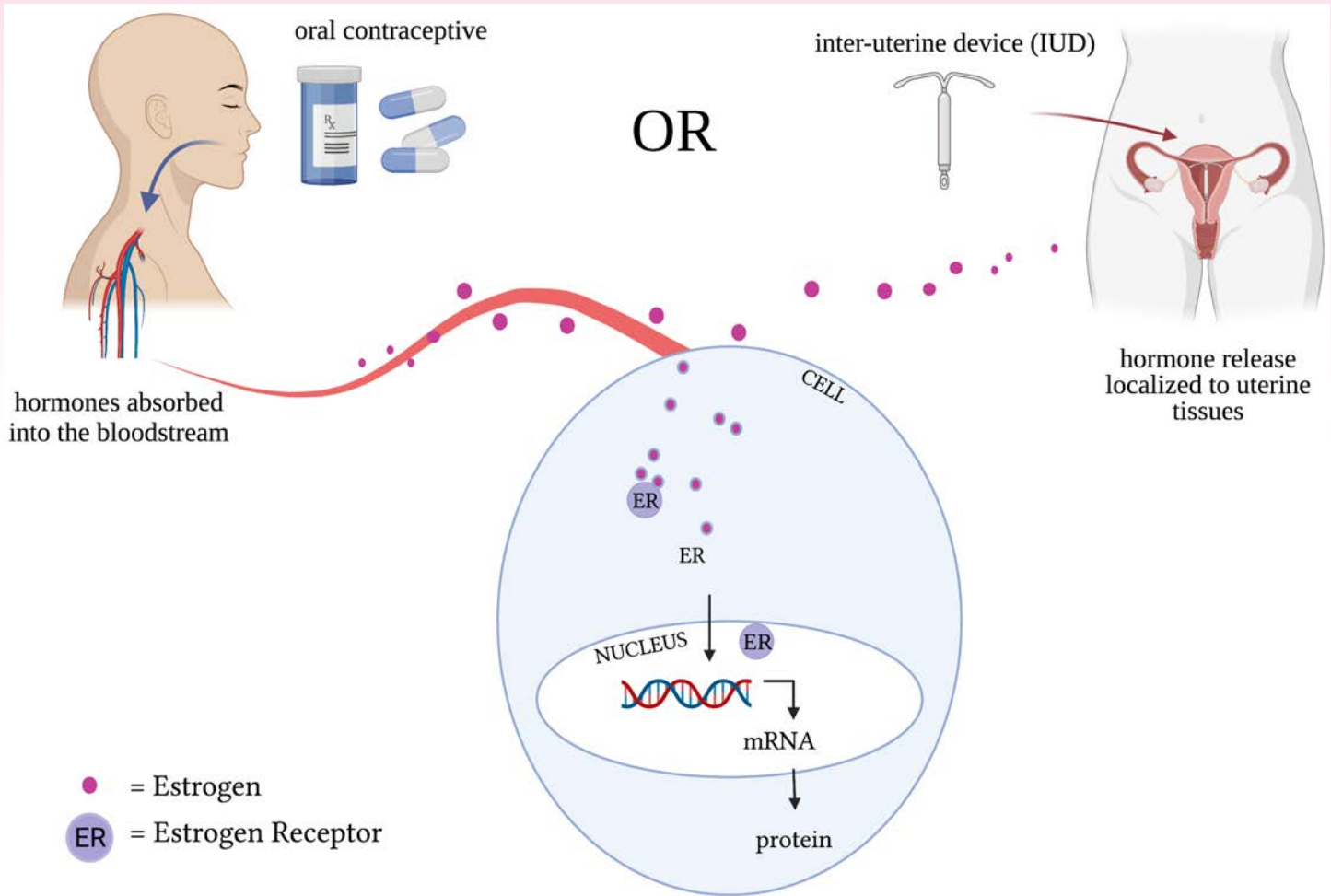
health risks by increasing your risk of having a cyst burst (19). Hormonal birth control as a form of treatment has a positive impact on the severity of both PCOS and endometriosis symptoms. Supplementation of synthetic progesterone and/or estrogen decreases menstruation by thinning the uterine lining which makes periods less painful and decreases the risk for lesions or burst cysts (36). Medications used to treat endocrine disorders such as hormonal contraceptives have widespread effects due to the diffuse nature of the endocrine system.

The Emotional Side of Things

While the physiological side effects of birth control have been widely studied, the emo-

tional effects have not been given much attention. As mentioned previously, between 4 and 10 percent of women experience emotional changes after taking oral contraceptives (15). These effects range from mood swings to diagnosis of mood disorders, and are impacted by the type of hormonal contraceptive, age of first exposure, and duration of use. Different brands of hormonal birth control have different concentrations and ratios of progesterone and estrogen, which makes choosing a birth control very hard. A general rule of thumb is to use the lowest dose possible to remain effective because higher doses increase the risk of serious side effects (30). Additionally, progesterone-only forms of hormonal contraceptives have a higher association with depression (29). Women who are first exposed to birth control during adolescence as opposed to adulthood are 1.7 to 3 times more likely to develop depression or other mood disorders later in life (2). Researchers speculate that the significant brain changes that occur during adolescence are altered by the ways in which supplemental sex hormones interact with the brain and other parts of the endocrine system. If the body gets used to receiving estrogen from birth control it may not learn to produce it on its own. In a similar manner, prolonged use of birth control can have similar neurological effects.

Some brain regions have stronger associations with the overall mood and depression due to their interaction with estrogen. Estrogen receptors can be found in the digestive system, bone tissue, reproductive system and nervous system (6). They are also highly concentrated in areas of the brain associated with mood regulation such as the hippocampus, hypothalamus, raphe nucleus, and cerebellum. ERs are



specific estrogen receptors used by synthetic and natural forms of estrogen. Estrogen receptors are nuclear receptors, a special kind of receptor that is able to interact with DNA and regulate gene transcription. Transcription impacts a wide range of biological processes such as reproductive organ development, bone density, and brain functioning (27). Alterations in brain functioning due to transcriptional changes is a potential route in which depressive symptoms can emerge. Fluctuations in estrogen levels caused by the menstrual cycle have been shown to cause structural changes in the brain such as decreased overall volume, in addition to decreased volume in specific regions associated with depression/mood such as the hippocampus, amygdala, temporal and parietal regions (24).

Another possible mech-

anism by which estrogen can impact mood is through estrogen receptors abundance in areas of the brain responsible for serotonin regulation and usage. Serotonin is a neurotransmitter associated with mood regulation. When serotonin levels are low, individuals experience symptoms of anxiety or depression. It is not clear how serotonin levels get depleted, but scientists have speculated that early life stressors, persistent trauma, or lack of gut microbiota can all impact serotonin levels (13, 38).

You May be Moody Or It Could be Your Birth Control

Women are often ridiculed for being moody or asked "are you on your period?" when

they are irritable. This is a normal response to hormone fluctuation and should not be criticized by others. The drastic changes in hormones during the menstrual cycle can cause moodiness or irritability which can be worsened by life changes or new stressors. Supplemental hormones in birth control can often intensify these effects and in some cases lead to different mood disorders. When doctors prescribe birth control, they rarely go into detail about the potential severity of mood effects.

The statistics on prevalence of mood related side effects and hormonal birth control are shocking. 47% of women who began taking birth control terminated their use within the first six months due to adverse effects. These women tend to switch forms of birth control or discontinue use permanently (26). Due to the

recent evidence supporting an association between mood disorders and use of hormonal birth control, scientists have begun researching ways in which this could occur.

The route is not completely clear, however based on the information discussed above, there are a few mechanisms by which these mood changes are possible. Estrogen may interact directly with the endocrine system and produce effects in areas of the body such as the brain and reproductive organs. It is possible that the supplemental synthetic hormones disrupt proper cognitive functioning and lead to mood changes. Another possible mechanism is through gene transcription caused by the estrogen receptors. Scientists do not know which genes the hormones turn on or off. It's possible based on the fact that estrogen receptors are highly concentrated in regions of

the brain that produce serotonin, that the synthetic hormones turn off genes that produce serotonin, and decrease serotonin levels.

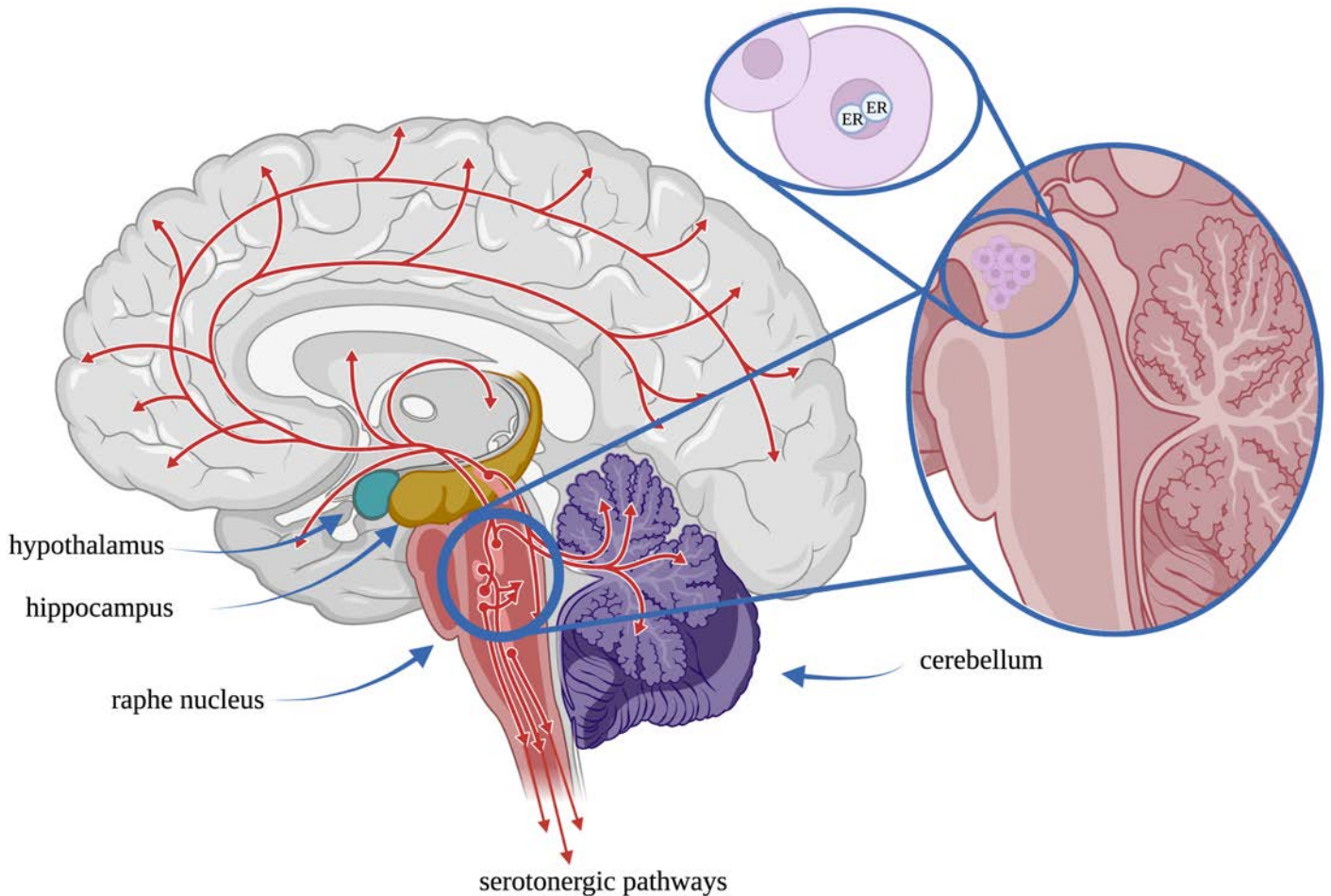
Back to The Article That Started it All

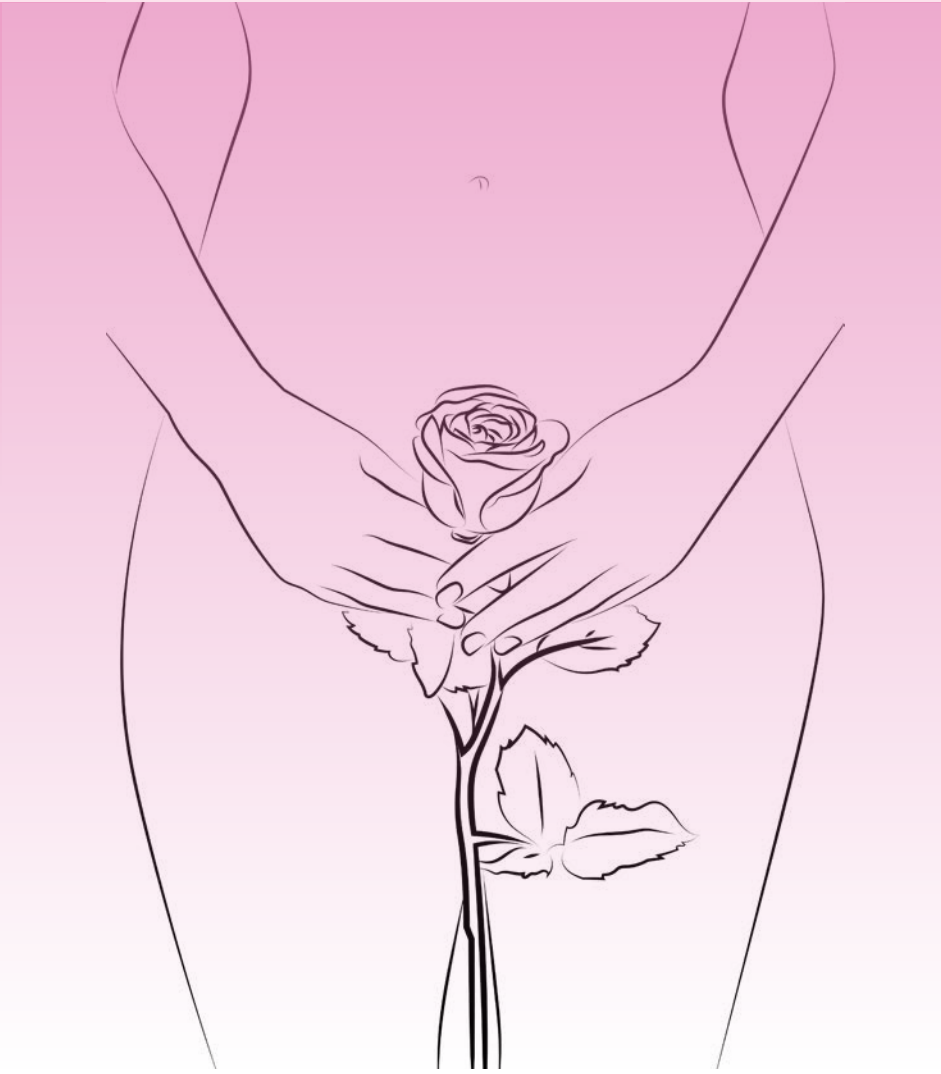
Now that you understand the background information about hormones, birth control, and their effects on mood, we can begin to explore why this is applicable to you and a large portion of the population. After reading "Can hormonal birth control trigger depression?" I googled some key words and the results of my search were astounding. I knew that moodiness or irritability were among the other potential side effects on the generous list. However, I was unaware of how direct the correlation between depression

and hormonal birth control is.

A study tracking women taking birth control found that 47% of women taking an oral contraceptive discontinued it, and 14% changed to a different type of pill within the first 6 months of starting (26). One of the leading causes of these changes was their awareness of worsening mental/emotional wellbeing. Various experiments have shown that women taking hormonal birth control pills experience higher scores of depressed mood, mood swings, and fatigue than individuals receiving a placebo treatment (14).

Even when the hormone release is localized to the uterus, such as an IUD, women have reported experiencing depressed mood or anxiety. A population study in females with an IUD detected a decrease in psychological well being, an increase in anxiety





about health, and an increase in alcohol dependence (32). This particular study ran statistical analyses to determine if the contraceptives, or a different variable, were contributing to the issue. The correlational analysis determined that the use of hormonal contraceptives was contributing most heavily to the psychological effects. Another population study done in Denmark revealed that adolescents with IUD's were more likely to subsequently be prescribed antidepressants than adolescents who did not take birth control (28). These women were 50% more likely to be diagnosed with depression within six months of starting birth control than individuals who were not taking any hormonal contraceptives. These same researchers did another study, using a simi-

lar sample, but this time looking at women with IUD's risk of attempted or completed suicide. Shockingly, they found that these women, about 21 years old with no previous psychiatric diagnosis, antidepressant use or hormonal contraceptive use before the age of 15, were two times more likely to attempt suicide than those who did not use hormonal contraceptives during these years [28]. Unfortunately, the risk of completed suicide was even higher; women using hormonal contraceptives were three times more likely to commit suicide.

Remember the HPA axis? It's responsible for our stress response. Patients with depression have been shown to have a blunting effect, in which patients have a diminished stress response

and impaired stress recovery (5). A diminished response indicates an inability to cope and deal with stress, one of the principal contributors to mental disorders. This blunting effect commonly found in disorders such as anxiety and depression is also seen in women on the birth control pill.

Necessary Societal Changes

These statistics are disturbing and indicate that significant changes need to be made in regards to the way in which women are informed about mood effects and the use of hormonal birth control in general. Mood effects are not usually discussed in detail as a side effect of birth control use. In order to decrease the prevalence of mood effects, doctors need to inform women taking birth control of the increased risk for mood effects. This way, they can look out for them and make the association between mood changes and birth control rather than viewing them as independent issues. Potential interventions could be changing dosages or forms of birth control to decrease the mood effects. Some individuals may be more sensitive to oral contraceptives because they are absorbed into the bloodstream, but not as sensitive to an IUD which releases hormones to a localized region of the uterus. Determining which method is safest for you is imperative to your emotional wellbeing.

The Bright Side

While these statistics are grim and you are probably feeling like getting your IUD taken out or stopping your birth control, that isn't the first step and there are other options. While there is a

risk for developing depression or mood disorders, not all women do. Some women benefit greatly from hormone therapies. Women using hormones to treat endometriosis or PCOS experience significant reductions in pain and dangerous physical impacts. Additionally, some studies show that hormone therapies can actually have positive impacts on mood for women with severe premenstrual syndrome (PMS) or post menopause (7).

If you are worried that your birth control may be contributing to a depressed or anxious mood, you can talk to your doctor to discuss maybe switching the concentration of your hormones, or changing to a different form of birth control. These small changes can make a big difference. Factors such as personal/familial past

medical history of mental illness or mood related side effects from hormonal contraceptives can have a significant impact on your sensitivity to synthetic hormones (15, 12). In addition, the use of progesterone only pills or multiphasic pills (hormone dose increases over the course of your cycle rather than remaining constant) can increase your likelihood of the development of negative mood effects (31). Lastly, starting birth control at a young age increases your risk; the less developed your mind is, the more likely you are to experience these mood related side effects (28). Therefore, it may be best to consider starting hormonal birth control as late as possible.

In light of these concerns for women's mental health, scientists have gone back to the lab in search of non-hormonal birth

control options. The FDA has approved a number of different products, however none are as effective as their hormonal counterparts. One of the most promising new options is a non hormonal gel used before sex called Phexxi. It works by altering the vaginal pH to be inhospitable to sperm. This birth control was shown to be 93% effective in clinical trials, making it relatively competitive with other forms of hormonal birth control. This birth control is now on the market, but it requires a prescription from a doctor to ensure it is a safe option for you. However, this is made easy with telehealth appointments on phexxi.com. Some doctors recommend progesterin-only birth controls to alleviate the emotional side effects; however, literature has shown similar negative emotional effects with these pills (31). The overall trend is ambiguous and requires more research to make any conclusions.

Additionally, researchers are working hard to generate an effective birth control pill for men. One drug called "11 β methyl nor-testosterone dodecyl carbonate" has moved into phase one of its clinical trial (28). It works by suppressing testosterone and another male sex hormone essential for sperm production. It is unclear if these will be viable options, but if they are safe and effective, this medication may prevent many women from suffering mood related side effects. Regardless of the scientific limitations, there are societal stigmas surrounding men and infertility which makes implementing male birth control difficult. Reproduction is biological and innate; any deficiencies in this domain are frowned upon. There needs to be both societal and scientific growth in order for change to occur and the norms of birth control to shift.

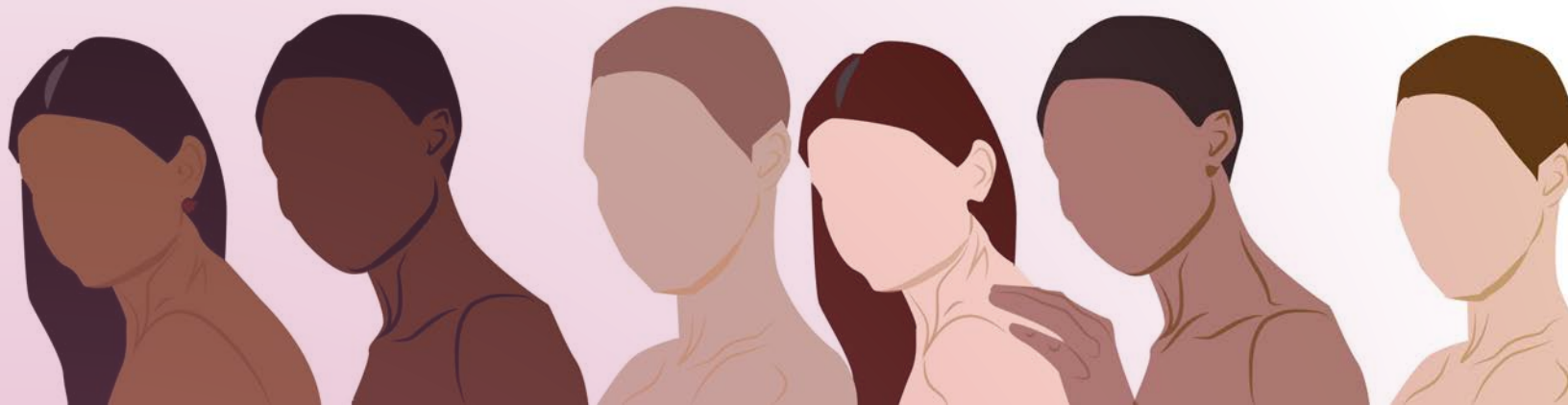






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