



## Mini Review

# A Perspective on the Effect of Nutrients and Physical Exercise on the Premenstrual Syndrome

Josephine Lourdu\*

Research Scholar, Rayalaseema University, India

\*Corresponding author: Josephine Lourdu, Research Scholar, Rayalaseema University, India

**Citation:** Lourdu J (2020) A Perspective on the Effect of Nutrients and Physical Exercise on the Premenstrual Syndrome. Adv Prev Med Health Care 2: 1019. DOI: 10.29011/2688-996X.001019

**Received Date:** 24 March, 2020; **Accepted Date:** 07 April, 2020; **Published Date:** 13 April, 2020

### Abstract

Premenstrual Syndrome (PMS) is manifested through many negative physical and psychological symptoms because of the abnormal ovarian hormonal activity like estrogen and progesterone. Majority of menstruating women are experiencing this trauma and some women experience more severely making them vulnerable. Enhanced ovarian hormonal activity may not be avoided, but the PMS symptoms can be controlled and reduced through lifestyle modifications following the epigenetic science. Exercise induced muscle myokines can help in regulating the hormonal axes of the bioenvironment through cross talk and enhanced cell signalling. Muscle myokines may also influence the genetic expression of several genes that are associated with the ovarian hormonal axes. Along with the regular exercise, scientific intake of nutrients basing on the exercise requirement would bring more vigorous changes in the cell signalling mechanism and genetic expression. Nutrigenomic effects on the gene expression through the minerals like magnesium zinc, calcium etc, vitamins and phytochemicals as factors and cofactors is well recognised through empirical evidences. Simultaneous wellness lifestyle with exercise, nutrients and stress management strategies would make women to either prevent or reduce the PMS symptom

**Keywords:** Muscle myokines; Nutrigenetics; Ovarian hormones; Premenstrual syndrome; Wellness lifestyle

### Introduction and Premise for The Perspective

Among the many commonest health problems for women, the Premenstrual Syndrome (PMS) is significantly affective and debilitating problem that affects majority of women in menstruating age. Several studies are indicating that more than seventy percent of the menstruating woman face this problem and the consequent effects are multiple and simultaneous. This premenstrual syndrome occurs during the initial luteal phase of the menstruation cycle, during which time the woman experiences abnormal increases in the circulating Estrogen and progesterone hormones. Though it is difficult to identify the PMS to abnormal increase in the presence of these hormones, there seems a logical explanation based on the functions of these hormones. These two hormones affect the functioning of neurotransmitters like Serotonin and Gama Aminobutyric Acid (GABA) causing changes in several psychological statuses of individuals. The hormone and neurotransmitter Serotonin cause changes in mood and may regulate the behaviour of individuals whereas the neurotransmitter GABA

influences the anxiety levels of the individuals [1-3]. Conflicting scientific evidences about the role of Estrogen and Progesterone in the control of the neurotransmitters makes the aetiology of PMS more complicated and uncertain. Abnormal hormonal fluctuations during the pre-menstruation phase, especially of progesterone could be the cause for the PMS. Abnormal increase in progesterone hormone and consequent increase in the progesterone metabolites might cause for the reduction in sedative effect in brain causing anxiety symptoms among women. Abnormal fluctuations of hormonal presence during the initial luteal phase could be attributed the symptoms of the PMS among the menstruating women. The varying intensity and varied degree of manifestation of symptoms among different women may be due to their sensitivity to the disturbances in hormonal secretions. Some women may experience severe intensity of symptoms whereas some may experience less intensity of symptoms [4-6].

PMS results in myriad of psychological and physical problems that might cause inconvenience in lifestyle of the woman. The psychological symptoms like mood swing leading to depressed state, anxious attitude, excitability and irritability, difficulty in concentration, unexplained mental fatigue etc.

These symptoms may be due to the suppression of Serotonin and suppression of progesterone metabolites as already explained. Physiological disturbances due to hyper hormonal imbalances could also cause several physical problems like nausea feeling, headache, bloated feeling, severe headache, metabolic swings causing weight gain symptoms, constipation, diarrhoea, joint aches, insomnia, physical fatigue, change in hunger and propensity to eat excessive carbohydrate especially sweet related propensity etc. This preference for carbohydrate by women experiencing the PMS could be to increase the serotonin levels by providing additional supplies of tryptophan, which is a precursor for serotonin [7,8]. Chronic PMS women could gain weight due to increased intake of food and especially the excessive amounts of carbohydrates in their diet. Though the number of symptoms and severity of symptoms may vary from woman to woman, some women may experience these symptoms in a severe manner affecting their life very much in terms of their participation in social events, participation in sporting events etc. Few women may experience these symptoms in severe intensity causing very much inconvenience in their routine life. Significant reduction in terms of productivity of women experiencing severe symptoms was observed by many researchers. If the symptoms are more and with more intensity, then the disorder is recognised as Pre-Menstrual Dysphoric Disorder (PMDD). But, the studies indicated that only few women, probably around three percent to five percent of menstruating women might experience the PMDD and could face severe lifestyle hitches due to this debilitating problem [9-12].

### **Interplay of Genetics and Epigenetics for PMS**

Enhanced scientific knowledge in genetics and epigenetics of various physical problems and diseases brings out new ways and means of controlling and preventing the same. Even the PMS may be recognised as a disorder that may be attributed to genetics and lifestyle functioning of women. Possibility of existence of differential hormonal metabolism in different women due to their genetic predisposition. Genetics of adipose tissue of women may predispose the obesity levels and hunger intensity. The scientific evidences indicate that the chronic PMS sufferer may become obese due to the increased propensity to consume more carbohydrate and become more obese. Otherwise also that an obese woman tends to experience disturbances in the serotonin metabolism could be affected by PMS. It may be difficult to crystallise the cause of the PMS and Obesity and vice versa. Genomics evidences indicated that the presence or absence of a particular gene or group of genes may be a prerequisite for a particular metabolic cascade to complete to fulfil the bioenvironment of individual. Synthesis of hormones, circulation of hormones, cell signalling proteins, cell signalling cytokines, muscle signalling myokines and actions of these chemical substances in the bioenvironment are all due to the genetic impact of the individual [13,14]. Over expression or under expression of a gene or gene group could lead to changes in the

metabolic cascades of individuals leading to reduced functional health or enhanced functional health. It is again a very astonishing that these substances called hormones, enzymes, cytokines, myokines and other molecules act as factors or cofactors for gene expression by becoming part of cell signalling pathways in several complex metabolic cascades that are conducted simultaneously in the body. The genetic predisposition for certain types of physical debilities may also be controlled through the under expression of the genes through the lifestyle modifications, which is the subject matter of the science of epigenetics. Aberrations in the serotonin and GABA metabolism which may be attributed as the cause of PMS among women, could also be attributed to the genetic predisposition, though the epigenetic endeavours may bring positive results. Epigenetic endeavours may be physical exercise, consuming scientific nutrition which provide essential nutrients and being stress free. It is essential to incorporate the epigenetic effects of exercise, nutrition and stress management to prevent and to control the effects of PMS among women. Scientifically formulated exercise sessions, essential nutrient intake and stress coping to be undertaken simultaneously to prevent and/or to mitigate the effects of PMS and PMDD [15,16].

### **Exercise Epigenetics for Prevention and Control of PMS**

The discovery of exercise factor which may be called as Myokine, the health prevention scenario changed drastically in terms of clarity of how the exercise benefits the individuals in promoting functional health both physically and mentally. Myotome consisting of muscle fibres, tendons and other connective tissues like fascia etc. is the source of the secretion of chemical substances which conduct cross talk among different organ tissues of the body and would promote the metabolic cascades for enhanced functional health of the tissues. Myotome releases several dozens of cytokine like substances called myokines during the muscular contraction of physical exercise. These myokines once released from the muscle enter into circulation and reaches the target tissues where they work as factors or cofactors of various cell signalling cascades in turn influencing several genes for proper expression. It is important and astonishing to note that the muscle myotome secretes both anti-inflammatory and pro-inflammatory chemical substances apart from secreting anti-oxidative chemical substances. But the intensity of the release of these myokines and types of myokines depend mainly on the type of exercise and also the intensity and duration of exercise performed. Medium to higher intensity exercise certainly promotes the secretion of myokines that foster the functional health in tissues and organs of the body. These myokines could influence the hormonal actions by acting as promoter cytokines or as cofactors of the cell signalling molecules. For example, muscle secreted Interleukin-6 (IL-6) which generally recognised as pro inflammatory cytokine in general context of metabolism, but it has a strong influence on the leptin and adiponectin, the adipokines which are mainly

responsible for adipose tissue metabolism, fat oxidation and glucose uptake. The IL-6 is a potent myokines that may bring significant changes in the white adipose tissue metabolism leading to availability of tryptophan, which is necessary for serotonin metabolism. The myokines Irisin is another significantly effective myokines that shows significant effect on the fat and glucose metabolism thereby controlling the insulin signalling. Chronic secretion of Irisin by muscle due to regular exercise training would make the white adipose tissue into Brown adipose tissue thereby changing the metabolic cascades of the adipokines secreted by the adipose tissue, which is very essential in the prevention and control of the PMS among women. Brain Derived Neurotrophic Factor (BDNF) is another significant myokine released by muscle during exercise, which is a significant chemical messenger that promotes the neurobiology and neuronal metabolism. Regular exercising individuals are seen producing the BDNF in significant quantities that would regulate the neuro-biological environment bringing excellent signalling to promote brain functioning. This has a significant role in controlling the serotonin metabolism in the brain and would cause for the significant reduction in the anxiety levels of the individuals. There are many other myokines like Interleukin-8, Interleukin-15, PGC1 $\infty$  etc which interplay with the IL-6 and Irisin in influencing the metabolic cascades and cell signalling cascades of adipose tissue and its related adipokines that might result in the prevention or mitigation in the rigors of the PMS [17,18].

### **Nutrigenomics in Control of PMS**

The knowledge on the effect of various nutrients on the genetic expression has taken a different stride in recent times, establishing certain revelations that several nutrients would work as factors or as cofactors in the cell signalling and also in the genetic expression. Micronutrients like minerals and vitamins play vital part in the gene expression cascades and downstream cell signalling also. Even the phytochemicals are seen as potent inducers of several antioxidative signalling cascades leading to increased antioxidative capacity to individuals. For example, the intricate connections among the magnesium, calcium and vitamin D are really complex and interdependent. These three micronutrients show significant influence on the human health with respect to energy metabolism, bone metabolism and antioxidative cell signalling. Magnesium (Mg<sup>2+</sup>) is an essential mineral in the signalling of the ATPase during the energy metabolism. In fact, magnesium presence is required for ATP. Mg<sup>2+</sup> also is a key ion that regulates the calcium channels of the neurotransmitters and would stabilise the neurobiology. Calcium and Vitamin D are co regulators and vitamin D is essential for the absorption of calcium in the gut. Vitamin D controls the Reactive Oxygen Species (ROS) signalling and Calcium signalling. Hence, vitamin D which is responsible for both calcium absorption and phosphate metabolism, protects the bone health and also the mitochondrial enzymatic functioning

thereby securing the energy metabolism. Availability of energy substrates is not the only prerequisite for energy metabolism, the presence of excellent working of calcium phosphate signalling too is essential. Vitamin D targets several genes through the Vitamin D Receptor (VDR) signalling and human monocytes and their differential cells are identified as effector cells through various genetic markers of genes. Vitamin D targets the genes which are responsible for Tumour Necrosis Factor suppression, negative T cell regulation, neutrophil activation and improving the immune function. Deficient Vitamin D metabolism and consequent calcium metabolism dysfunction could lead for several disturbances including energy deficient state and unexplained fatigue. Energy metabolism disturbances could lead for aberrant changes in hormonal signalling leading either to increased or decreased hormonal activity [19,20].

### **Preventive Perspective On PMS**

The abnormal increase in estrogen and progesterone levels during the initial luteal phase could be the major cause of the PMS leading to the experience of several negative physical and psychological symptoms. The scientific logic for this abnormal enhanced state of hormones is to compensate the effects of ovulation effects. Sudden increase in these ovarian hormones and regulation of these hormones during the later stage of menstruation is all very natural to take care of the ovulation process and the effects of ovulation. The consequent physical and psychological disturbances could bring these PMS symptoms among women. Though the process of release of ovarian hormones is quite natural, it is good to be accommodative to these changes by proper epigenetic preparations like regular exercise, proper nutrient intake and maintaining composed state of mind or being happy and complacent avoiding the stressful situations. Empirical scientific evidences indicate that the regular exercise would bring excellent adaptations in hormonal regulations, neural plasticity leading to brain composure through various muscle myokine interactions. Regularly exercising women can experience enhanced energy metabolic cascades leading to enhanced cell signalling function of the body and enhanced functional health. Exercise induced myokines are recognised as powerful inducers of cell signalling of several hormonal axes in the body. Regular and proper intake of nutrients basing on the exercise requirement would foster better functional environment in the tissue metabolism as several minerals, vitamins and phytochemicals are recognised as cell signalling factors or as cofactors that would help in proper and optimal expression of several genes associated with several protein bodies like immunoglobulins, hormones, enzymes etc. The support system that is comprehensive consisting of regular exercise with proper nutrient intake would make the PMS vulnerability to very limited and the women experiencing more intense PMS symptoms can certainly mitigate the negative effects of PMS [21,22].

## Conclusion

Premenstrual syndrome, which is manifested through the negative physical and psychological symptoms may be due to the abnormally enhanced hormonal functioning during the menstruation cycle. Though the hormonal functioning may not be controlled, the PMS experiencing women can control and reduce the negative effects of the PMS through regular exercising, consuming appropriate nutrients based on the exercise regime and controlling the stress biology through stress management techniques.

## References

1. Bianco V, Cestari AM, Casati D, Cipriani S, Radici G, et al. (2014) Premenstrual syndrome and beyond: lifestyle, nutrition and personal facts. *Minerva Ginecol* 66: 365-375.
2. Chocano-Bedoya PO, Manson JE, Hankinson SE, Johnson SR, Chasan-Taber L, et al. (2013) Intake of selected minerals and risk of premenstrual syndrome. *Am J Epidemiol* 177: 1118-1127.
3. Delezie J, Handschin C (2018). Endocrine crosstalk between skeletal muscle and the brain. *Front Neurol* 9: 698.
4. Dennerstein L, Lehert P (2010) The effect of premenstrual symptoms on activities of daily life. 94: 1059-64.
5. Farahmand M, Ramezani Tehrani F, Khalili D, Amin G, Negarandeh R (2017) Factors associated with the severity of premenstrual syndrome among Iranian College students. *J Obstet Gynaecol Resc* 43: 1726-1731.
6. Gomasasca M, Banfi G, Lombardi G (2020) Myokines: the endocrine coupling of skeletal muscle and bone. *Adv Clin Chem* 94:155-218.
7. Hashim MS, Obaideen AA, Jahrami HA, Radwan H (2019) Premenstrual Syndrome is associated with dietary and lifestyle behaviours among university students: A cross-sectional study from Sharjah, UAE. *Nutrients* 11: 1939.
8. Houghton SC, Manson JE, Whitcomb BW (2018) Carbohydrate and fiber intake and the risk of premenstrual syndrome. *Eur J Clin Nutr* 72: 861-870.
9. Leal LG, Lopes MA, Batista ML Jr (2018). Physical exercise induced myokines and muscle-adipose tissue cross talk: a review of current knowledge and the implications for health and metabolic diseases. *Front Physiol* 9: 1307.
10. Louzada RAN, Bouviere J, Matta LP, Werneck de Castro JPS (2020) Redox signalling in widespread health benefits of exercise. *Antioxid Redox Signal*.
11. Ferguson LR, De Caterina R, Görman U, Allayee H, Kohlmeier M, et al. (2016) Guide and Position of the International Society of Nutrigenetics/Nutrigenomics on Personalised Nutrition: Part 1 - Fields of Precision Nutrition. *J Nutrigenet Nutrigenomics*. 9: 12-27.
12. Macsue Jacques, Danielle Hiam, Jeffrey Crai (2019). Epigenetic changes in healthy human skeletal muscle following exercise – a systematic review. *Epigenetics* 14: 633-648.
13. McGee SL, Hargreaves M (2010) Epigenetics and Exercise. *Trends Endocrinol Metab*. 30: 636-645.
14. Fenech M, El-Sohemy A, Cahill L, Ferguson LR, French TA, et al. (2011) Nutrigenetics and Nutrigenomics: Viewpoints on the Current Status and Applications in Nutrition Research and Practice. *J Nutrigenet Nutrigenomics* 4: 69-89.
15. Nan ci S Guest, Justine Horne (2019) Nutrigenomics: Personalised nutrition for athletic performance. *Front Nutr* 6: 8.
16. Vaghela N, Mishra D, Sheth M, Dani VB (2019) To compare the effects of aerobic exercise and Yoga on premenstrual syndrome. *J Educ Health Promot* 24: 8.
17. Pedersen L, Hojman P (2012) Muscle to organ cross talk mediated by myokines. *Adipocyte* 1: 164-167.
18. Sareh Abdollahifard, Afifeh Rahmanian Koshkaki (2014). The effects of Vitamin B1 on ameliorating the premenstrual syndrome symptoms. *Glob J Health Sci* 6: 144-153.
19. Rescigno T, Micolucci L, Tecce MF, Capasso A (2017) Bioactive nutrients and nutrigenomics in age related diseases. *Molecules* 22.
20. Vidhu V Thaker (2017) Genetic and epigenetic causes of Obesity. *Adolesc Med State Art Rev* 28: 379-405.
21. Winer SA and Rapkin AJ (2006) Premenstrual disorders: prevalence, etiology and impact. *J Reprod Med* 51: 339-347.
22. Zainab Samadi, Farzaneh Tagian and Mahboubeh Valiani (2013) The effects of 8 weeks of regular aerobic exercise on the symptoms of premenstrual syndrome in non-athlete girls. *Iran J Nurs Midwifery Res* 18: 14-19.