The Ayurvedic Approach to Prader-Willi Syndrome: Analysis and Treatment

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Abstract

Prader-Willi Syndrome is a rare multisystemic, genetic disorder that effects 1 in 15,000 people. Treatment for Prader-Willi Syndrome is extensive and lifelong, requiring a team of experts to get optimal results. This paper will discuss Prader-Willi Syndrome in depth, explore and analyze the syndrome from an Ayurvedic perspective, and offer a possible Ayurvedic treatment plan.

Prader-Willi Syndrome

Prader-Willi Syndrome (PWS) is a rare genetic disorder resulting from a mutation in chromosome 15. This syndrome effects the functions of the endocrine, cardiovascular, respiratory, muscular, and skeletal system. PWS also has a significant impact on cognitive and behavioral functioning.

Epidemiology

PWS is found in 1 in every 10,000 to 15,000 individuals, effecting male and females equally[1]. There are many cases in which individuals are misdiagnosed or undiagnosed due to the vast spectrum of physical, behavioral, and medical symptoms. Researchers argue that physicians' lack of familiarity with PWS may be another cause for misdiagnosis[2].

Etiology

The exact cause of PWS is still unknown, but researchers have concluded that it results from a lack of genetic material in chromosome 15. More specifically, there are 1 of 3 genetic mutations that can occur within chromosome 15 that can result in Prader-Willi Syndrome; approximately 75% of PWS cases are a result of paternal 15q11-q13 deletion, approximately 30% of cases a result of maternal uniparental disomy, and approximately 3% of cases are a result of an imprinting defect during embryotic development[3].

Pathology

Physicians look for the phenotypic abnormalities related to Prader-Willi Syndrome. If the child has any of the physical characteristics associated with PWS, their speech and cognitive development are evaluated for the final diagnosis.

The phenotypic, or physical signs associated with the genetic mutation, of Prader-Willi Syndrome, although easily identifiable, are not universal. The most common signs include Hypotonia (weak muscle tone), hypogonadism, small hands with closed web spacing, small frog legged feet, thin lips, large head circumference, thick and sticky saliva, pronounced almond shaped eyes, short stature, pale skin, and early onset of pubic hair, and proneness to obesity[4]. Most physical symptoms are caused by the lack of growth hormone development due to malfunctions of the thyroid and related challenges of the endocrine system[5]. Physicians then further study the patient to pinpoint any abnormalities with developmental and cognitive functioning. Individuals with PWS also exhibit a multitude of cognitive and psychological challenges. Some typical maladaptive behaviors in PWS individuals are as follows; obsessive compulsive behaviors with the obsessions centered on food, pica, sleep disturbances, compulsive food stealing and seeking, hoarding behavior, autism like symptomology, sudden outbursts of rage, decreased libido and an abnormal sex drive. One of the main features of Prader-Willi Syndrome is the constant feeling of hunger the patient feels because of a defect in the hypothalamus which never triggers the feeling of satiation; simply put a PWS individual will never feel full after a meal, regardless of how much they eat[6]. This

quickly develops into the individual having a compulsive behavior relating to food and eating, such as attempting to steal food and revolving daily schedules around meal times[7]. Individuals with PWS have a tendency to exhibit autism like symptoms, and like autism these symptoms appear on a spectrum – some more severe than others[8]. The DSM5, the diagnostic and statistical manual used for psychiatric disorders, lists autism as a neurodevelopmental disorder with symptoms including challenges with social-emotional reciprocity, language and speech deficits, challenges with communication and relationship development, adjusting behaviors in various situations, repetitive behavior patterns, persistent self-stimulatory motor movements, repetitive self-injurious behavior, dependence on routine, fixated interests and obsessions, hyperactivity to sensory input or hypoactivity to sensory input[9].

Comorbidities

Infants with PWS, besides presenting the aforementioned phenotypic symptoms, will show signs of Neonatal Failure to Thrive (FtT). FtT symptoms include poor appetite, little to no desire to feed, vomiting, infrequent and scanty urination, inability to properly defecate, and difficulty gaining weight. Without proper care and management these infants will fail to make it to 2-years old[10]. Proper care for infants experiencing failure to thrive involve an insertion of a feeding tube, usually around the navel, where liquids and nutritional supplements can be fed directly to the stomach. Regularly scheduled blood tests are also recommended so that the physician can carefully monitor the development of the infant[11]. In some cases, a regular intravenous drip is used to assure that the infant is being well hydrated.

Pica, an eating disorder in which an individual will persistently consume non-nutritive and often inedible substances[12], is a common comorbidity with PWS and may be developed in part due to the food obsessed behaviors and hypothalamic malfunctions[13].

While many individuals with Prader-Willi Syndrome will receive a medical diagnosis of Autism Spectrum Disorder, it is not necessary that these individuals will be autistic. A diagnosis allows families to receive state provided services for individuals with special needs, therefore aiding in the care and management of PWS. Individuals with PWS also have sleep related issues, most commonly narcolepsy – excessive daytime sleepiness[14] and difficulties breathing while sleeping due to weakness in the lungs[15]. In some cases, sleep apnea is present.

Due to their ability to gain weight quickly and food related obsession, individuals with Prader-Willi Syndrome are likely to develop weight related disorders[16]. This includes diabetes mellitus, obesity, atherosclerosis, and other related disorders. Weight related disorders in PWS patients are even more than in a non-syndromic individual, significantly decreasing their lifespan.

Allopathic Treatment

Currently, Allopathic medicine has little to offer in terms of treatments for Prader-Willi Syndrome. Most drugs and recommended treatments are geared toward alleviating symptoms of the disorder, and treatment plans must be carefully designed by a team of experts as per each individuals' needs[17]. Another factor that makes PWS difficult to treat is that it is a multisystemic illness and finding a health care provider that can assess and treat all the factors of PWS can be difficult[18]. It is important that the patients' diet, behavior, cognitive development, and physical development are managed closely and collectively.

Management of Diet

Individuals with PWS are prone to struggling with weight related complications. Their metabolism is much slower than that of an average individual and are prone to rapid weight gain and obesity. Furthermore, the excessive weight gain can lead to additional problems with the respiratory, cardiac, and muscular-skeletal system resulting in premature mortality[19]. Healthcare providers will customize a caloric and dietary plan for PWS individuals. As a general guideline, individuals are restricted to 1,200 calories a day and meals should have a higher protein content and limited carbohydrates and complex sugars[20]. This ensures that the PWS individual is getting the nutrition needed and controlling the amount of sugar intake in the body, as these individuals are prone to diabetes mellitus. Dietary management for Neonate Failure to Thrive infants with Prader-Willi Syndrome will require the use of a feeding tube and regular scheduled hospital visits and blood tests[21]. This is to ensure that the child will live past its infancy and begin to develop properly. For at least 8 months of the child's life, the feeding tube will supply nutrients directly into the stomach where they can be broken down and distributed throughout the body. The duration of time will depend on each individual and how quickly they respond to the treatment. Once the infant develops at a more appropriate rate, then a proper diet plan is set into place. These plans are then modified and reworked every six months to a year[22].

Behavior and Cognitive Management

Individuals with Prader-Willi Syndrome struggle with a multitude of behavioral and cognitive challenges. Behavior management will require the caretaker(s) of an individual with Prader-Willi Syndrome to constantly monitor and adjust behaviors related to temper tantrum, autistic traits, and compulsive behavior. It is crucial to first identify the triggers for temper tantrum outburst and to work on removing or adjusting undesirable stimuli from the area; however, many children will have violent fits of rage with their temper tantrums without the presence of an antecedent[23]. Usually, these behaviors increase around the time of puberty, because of the significant hormonal and physical changes occurring within the endocrine and reproductive system. Currently, researchers are still looking for the ideal way to deal with and control temper tantrums and aggressions in individuals with Prader-Willi Syndrome; seeing as each case is so individualized, it is recommended that individuals seek guidance and counseling from a

behavior specialist[24]. Individuals with PWS are also often prescribed medications often used for treatment of Attention Deficit/Hyperactivity Disorder such as clonidine and dextroamphetamines to help manage the learning and communication challenges[25].

Most, if not all, individuals with Prader-Willi Syndrome are also diagnosed with Autism Spectrum Disorder (ASD). These individuals have neurodevelopmental symptoms similar to autism and once they are officially diagnosed with ASD more treatment options become available[26]. In America, individuals with autism are granted access to behavioral therapists, speech therapists, occupational, and physical therapists. This team of individuals can also help individuals with PWS learn how to communicate appropriately and also help them develop gross and fine motor skills that they would have otherwise had to live without[27]. An autism diagnosis is often times a crucial part of the treatment of Prader-Willi Syndrome.

Managing and Improving Phenotypic Traits

There are many physical and phenotypic symptoms that make Prader-Willi syndrome identifiable. Features like the thin lips and predominantly almond shaped eyes are near impossible to change, but there are medications and therapies that help combat some of the less permanent symptoms. Hormone replacement therapy (HRT) is the most common medical regime used to treat children with PWS. The introduction of additional hormones helps individuals, especially children, grow taller than would be otherwise expected as well as experiencing a more normalized puberty[28]. Hormones also play a role in managing or alleviating hypogonadism and balancing irregular libido as well as helping build endurance when individuals with Prader-Willi Syndrome engage in endurance based exercises[29].

Individuals with Prader-Willi Syndrome benefit from physical therapy and occupational therapy. Due to the weak web spacing on the hands and the abnormalities of the feet, individuals with Prader-Willi Syndrome have a difficult time using both their fine and gross motor skills. Physical therapy strengthens and promotes the use of gross motor skills[30]. Therapists will focus on adding flexibility and balance to the body, and as the individual ages the treatments and exercises get more intense. Physical therapy is mainly used to combat hypotonia, but has been known to boost endocrine function, and prevent against diabetes mellitus and obesity[31]. Occupational therapy helps with strengthening the web spacing on the hands so that, as the individual progresses, they are able to grip, pull, pinch, and tug at items much easier[32]. Both occupational and physical therapy are important to the treatment of Prader-Willi Syndrome and studies have shown that there is improvement when an individual is also on a HRT regime[33].

Ayurvedic Interpretation

Nidana

Prader-Willi Syndrome is a genetic disorder, therefor it can be attributed toward past karma. The classical texts, such as Charaka Samhita and Brihat Samhita offer no insight into this disorder[34]. It could be that

children born with Prader-Willi Syndrome around the time of the classical texts being written, did not survive past infancy. An analysis of the symptoms indicates that Prader-Willi is a tridoshic disorder.

Samprapti

Patient is born with *arochaka* symptoms and enters the world with low ojas and low agni. The symptoms seen in the infant are tridoshic and difficult to treat but once the child is nurtured and grows out of the infancy phase of their life, the rest of the disorder begins to manifest.

Kapha dosha in the body takes over *medovaha, raktavaha, manovaha, majjavaha, mamsavaha,* and *annavaha srota.* Vata dosha travels throughout the body effecting *raktavaha, purishivaha, artavaha, shukravaha, manovaha, mamsavaha, raktavaha,* and *mutravaha srota.* Throughout the life of the PWS individual, Kapha and Vata will increase and decrease. Symptoms may change and vary within the person as frequently as monthly[35], indicating that this syndrome is heavily controlled by Vata. Without proper care and management, Pitta dosha overflows and takes over *annavaha, mannovaha,* and *majjavaha srota.*

Chikitsa

Individuals with Prader-Willi Syndrome are born with a karmic, tridoshic disorder therefore there is no cure. However treatment plans can put into place so that patients can live a full life. If an individual is diagnosed and treated as a child it increases the success of the treatments, therefore a practitioner should take great lengths to ensure that they are working with a strong team of specialists. A neonatal specialist is ideal for placing and monitoring the feeding tube in the infant while an Ayurveda practitioner should focus on treating the *Vanaspatya Tamasa* nature of the infant[36]. The mother and the child should also engage in self-care practices. A daily warm oil using ghee or olive oil massage, for both the mother and baby; this treatment helps strengthen the relationship, reduce stress, and allow the baby to heal. Calming herbs like lavender (*Lavendula Spica)* will make a good addition to these daily oil massages[37]. Once the child grows to become a toddler, the practitioner can move on to a more intense treatment plan.

Diet

Proper diet for individuals with Prader-Willi Syndrome will be the key to alleviating associated ailments. Children aged 6 to 13 should consume no more than 1,200 calories while trying to eliminate unnecessary complex carbohydrates, processed foods, and foods high in sugar[38]. Practitioners should reevaluate the patient after the age of 13 to determine if the amount of calories should remain at 1,200 or increased. This will be highly dependent on the individual's progress and needs. PWS individuals should stick to a saatvic diet, following routine and scheduled meal times eating the heaviest meal during the afternoon. Basmati rice, oats, and whole grains are the ideal grains, dairy should be whole milk, organic and as fresh as possible, fresh homemade yogurt is also good. Fats should be wholesome and easy to digest, like olive oil and ghee. Any amount of fruits and vegetables can be consumed, but the patient should be observed closely because some foods can increase flatulence. Nuts should not be eaten in large quantities but small

quantities of almonds, pine nuts, and walnuts are appropriate. Proteins, ideally, should come from plant based sources or even through fresh dairy products, meats should be avoided. However if the patient chooses to include meat in their diet, it should be limited to 1 to 2 times a week, and should be taken as a broth or soup[39]. Food should be moderately seasoned with spices and herbs such as cardamom, fennel, ginger, and turmeric.

Lifestyle Practices

Exercise is very important for these patients, and treatment should emphasize an exercise plan. Practitioners should work with physical therapists and occupational therapists so that the physical treatment is holistic. Individuals with Prader-Willi Syndrome would benefit from starting the morning with light yoga stretches preformed at or before sunrise[40]. Due to the gross and fine motor restrictions found in a number of these patients, help from a caretaker may be required. The caretaker should promote as much independence as possible, but should be available in case help is needed. This will also help establish a close and intimate bond with patient and caretaker. Light walking and moderate exercise are recommended throughout the day to promote movement and strengthening of the muscles. Morning oil massages and nightly warm baths are also beneficial to help relax the mind and aid in digestion[41]. Sensory therapies can also help boost cognitive functioning. Aromatherapy blends with calamus *(Acorus calamus),* lavender *(lavendula spica),* rosemary *(Rosmarinus officinalis),* and sandalwood *(Santalum album)*[42]. Breathing in these fragrances help clear up the channels in the mind, increase focus and perception, as well as adding warming qualities to the mind.

Herbal Treatment

Since there is no cure for Prader-Willi Syndrome, all herbal remedies for this syndrome should be given with the intention of alleviating symptoms and improving the individual's quality of life. Calamus (*Acorus calamus)* root is highly beneficial for balancing all symptoms of Prader-Willi Syndrome because the properties are multisystemic. Calamus can also help with the psychological and neurological symptoms of PWS because of its slight hallucinogenic properties[43]. However, Calamus is currently banned in the United States for internal consumption and when permitted to be sold, as topical ointment or oil, is required to be labeled "legal ecstasy." There is a high toxicity rate with this herb and pregnant women should heed caution because it is a documented emmenagogue and abortificant[44]. The medical charts found below list out common chief complaints associated with Prader-Willi Syndrome along with related herbal treatments. Practitioners should keep detailed notes of their PWS patients and cater the herbal formulations according to the symptoms that are more persistent. An herbal formula including Ashwaghanda (*Withania somnifera*), Licorice root (*Glycyrrhiza glabra*), and Shatavari (*Asparagus racemosus*) would have a positive effect without averse side effects on any individual with PWS.

Stage	Evidence	Dosha	Subdosha	Dhatu	Srota	Herb categories	Herb examples
rmd	Constipation and gas	Vata	Apana	Rasa	Purishivah a	carminatives	Ginger Root Cinnamon
rmd	Abnormalitie s in the formation of hands and feet	Vata	Apana	Asthi	Ashtivaha	Muscular and osteo tonics	Ashwagandha Bala
rmd	Weakness in the lungs	Vata	udana	rasa	pranavaha	Respiratory tonics	Licorice shatavari
rmd	narcolepsy	Vata	prana		manovaha	Nervine stimulant	Brahmi[45] St. John's Wort

Stage	Evidence	Dosha	Subdosha	Dhatu	Srota	Herb categories	Herb examples
rmd	Sluggish digerstion /elimination	Kapha	Kledaka	Rasa	annavaha	dipanas	Ginger Black pepper
rmd	constipation	Kapha			purishivah a	purgatives	Senna aloe
rmd	Low sex drive; hypogonadis m; delayed development of reproductive organs	Kapha		shukra	shukravaha	Reproductive tonics	Shatavari Rose
rmd	Developmental delay and autism	kapha	tarpaka		mannovaha	Mental tonics	Calamus Cardamom

Stage	Evidence	Dosha	Subdosha	Dhatu	Srota	Herb categories	Herb examples
rmd	Constant feeling of hunger	Pitta	Pachaka	rasa	annavaha	Cool demulcents	Celery root (juice)[46] Shatavari
rmd	Anger and temper tantrums	Pitta	Sadhaka				manovaha
rmd	Muscular weakness dues to missed information in neurotransmitters.	pitta		mamsa	mamasavaha	Muscle tonics	Licorice Gaducci

[1] (Angulo, Butler, & Cataletto, 2015, p. 1; Bellon-Harn, 2005, p. 460)
[2] (Bellon-Harn, 2005, p. 461)
[33] (Angulo, Butler, & Cataletto, 2015, p. 1)
[4] (Bellon-Harn, 2005, pp. 461-462) (Angulo, Butler, & Cataletto, 2015, pp. 8-10) (Nativio, 2002 , pp. 299-301)
[5] (Angulo, Butler, & Cataletto, 2015, pp. 8-9)
[6] (Nativio, 2002 , p. 300; Angulo, Butler, & Cataletto, 2015, pp. 4-5)
[7] (Bellon-Harn, 2005, p. 462) (Young, et al., 2006, p. 19)
[8] (Bellon-Harn, 2005, p. 463)
[9] (Jeste, Lieberman, Fassler, & Peele, 2013, pp. 50-51)
[10] (Ceballos-Osorio, Hong-McAtee , Reuter-Rice, & Giannetta, 2013, pp. 2-4)
[11] (Ceballos-Osorio, Hong-McAtee , Reuter-Rice, & Giannetta, 2013, pp. 2-4)
[12] (Jeste, Lieberman, Fassler, & Peele, 2013, pp. 329-331)
[13] (Young, et al., 2006, pp. 19-20)
[14] (Jeste, Lieberman, Fassler, & Peele, 2013, p. 367)
[15] (Angulo, Butler, & Cataletto, 2015, pp. 6-7)
[16] (Lima, et al., 2016)
[17] (Bellon-Harn, 2005, pp. 466-469)
[18] (Nativio, 2002 , p. 301)
[19] (Lima, et al., 2016, pp. 189-190)
[20] (Lima, et al., 2016, pp. 190-192)
[21] (Bellon-Harn, 2005, p. 468) (Ceballos-Osorio, Hong-McAtee , Reuter-Rice, & Giannetta, 2013, p. 59)
[22] (Young, et al., 2006, p. 22) (Lima, et al., 2016, p. 191)
[23] (Tunnicliffe, Woodcock, Bull, Penhallow, & Penhallow, 2014, p. 141)
[24] (Tunnicliffe, Woodcock, Bull, Penhallow, & Penhallow, 2014, pp. 143-145)
[25] (Jeste, Lieberman, Fassler, & Peele, 2013) (Bellon-Harn, 2005, p. 468)

[26] (Bellon-Harn, 2005, p. 469)
[27] (Tunnicliffe, Woodcock, Bull, Penhallow, & Penhallow, 2014, p. 146) (Nativio, 2002 , p. 301)
[28] (Rubin, et al., 2015, p. 393; Nativio, 2002 , p. 301)
[29] (Rubin, et al., 2015, pp. 393-394)
[30] (Rubin, et al., 2015, p. 393)
[31] (Rubin, et al., 2015, p. 394)
[32] (Rubin, et al., 2015, p. 394)
[33] (Rubin, et al., 2015, p. 395)
[34] (translated by Sastri & Ramakrishna Bhat, revised and translated 2013)
[35] (Bellon-Harn, 2005, p. 463)
[36] (translated by Sastri & Ramakrishna Bhat, revised and translated 2013)
[37] (Khory & Katrak, 1903)
[38] (Lima, et al., 2016)
[39] (Halpern, 2012, p. 271)
[40] (translated by Sastri & Ramakrishna Bhat, revised and translated 2013)
[41] (translated by Sastri & Ramakrishna Bhat, revised and translated 2013)
[42] (Khory & Katrak, 1903)
[43] (Khory & Katrak, 1903)
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[45] (Khory & Katrak, 1903)
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