

**CHILDHOOD OVERWEIGHT/OBESITY AND CO MORBIDITIES: AN AYURVEDIC APPROACH****<sup>1</sup>Dr. Ramchandra P. Babar\* <sup>2</sup>Dr. Shravani Gund and <sup>3</sup>Dr. Jayashree Nandgaonkar**<sup>1</sup>PhD Scholar, Deptt of Kaumarbhritya, BVDU's College of Ayurved, Dhanakwadi, Pune, India.<sup>2</sup>MD (Swasthavrutta and Yoga).<sup>3</sup>HOD, Deptt of Kaumarbhritya, BVDU's College of Ayurved, Dhanakwadi, Pune, India.**\*Corresponding Author: Dr. Ramchandra P. Babar**

PhD Scholar, Deptt of Kaumarbhritya, BVDU's College of Ayurved, Dhanakwadi, Pune, India.

Article Received on 09/08/2017

Article Revised on 29/08/2017

Article Accepted on 19/09/2017

**ABSTRACT**

Worldwide estimates of childhood overweight / obesity shows increasing trends and continues each year. Many researches show that the childhood overweight / obesity is epidemic and has impact on every domains of life including the health. The consequences of childhood obesity are extensive and include medical as well as psychosocial co morbidities. The major co morbidities associated with childhood obesity are metabolic risk factors and other systemic disorders. Ayurveda , the ancient science of life also highlighted the overweight / obesity (*staulya*) and its consequences along with the details of causative factors, pathophysiology and line of management with exercise (*vyayam / vihar*), dietary modifications (*Ahar*), medications and some body - purification / detoxification (*panchakarma*) methods. Ayurvedic line of management includes the holistic approach taking in consideration of causative factors (*Ahar-viharaj hetu*), biochemical changes (*Samprapti*), the different stages of the disease (*Agnimandya, Dhatvagnimandya, Ama, Kleda, Srotorodha, Doshaprakop avastha*) and accordingly the accordingly the line of management of the disease (*Ahar, Vihar, Dravyachikitsa, Yuktivyapashraya chikitsa, vayayam, etc*). Overweight / obesity is hard to treat as it needs the multi-systemic approach of managements including dietary and medicinal managements. The Ayurvedic principles of the disease progress & co morbidities should be taken in consideration to control the childhood overweight / obesity to control the complications in further life. This article highlights the co morbidities of childhood overweight/obesity along with its Ayurvedic approach described in ancient ayurvedic literature.

**KEYWORDS:** Childhood overweight and co-morbidities, Sthaulya, Childhood obesity, overweight and Ayurveda.

**INTRODUCTION**

Overweight/obesity in children is becoming more common. Obesity is due to an imbalance between energy consumption and energy expenditure. Overweight/obese children do not have low energy needs. They have high energy needs to support their high body weight. Overweight/obesity is a health concern in itself and also increases the risk of other serious health problems such as high blood pressure, diabetes and psychological distress.

An obese child tends to become an obese adult. There is no evidence that any drug treatment is effective in treating obesity in children. It requires multi angle approach to control the overweight/obesity. Obesity in children may be prevented and treated by increasing physical activity/decreasing physical inactivity (e.g. TV watching) and encouraging a well-balanced and healthy

diet. Lifestyle changes involve making small gradual changes to behaviour.<sup>[1]</sup>

Ancient scholars of Ayurveda describes the overweight/obesity (*sthaulya*) is a disease of bad fat (*Meda Dhatu*). The malformed fat (*meda / kleda*) obstructs the *Vata* so that the *Vayu* get obstructed in *koshtha* (stomach - digestive system) which stimulates the digestive fire (*Agni*) and whatever the diet in the stomach (*koshtha*) get digested and absorbed fast and the patient demands more food. The disease is hard to treat. Due to this disease pathology only bad fat (*meda / kleda*) get formed. As per the basic principles of Ayurveda regarding digestion and metabolism - only bad fat (*meda*) get formed; the other body elements (*Dhatu*s) not formed properly due to the channel obstruction (*Srotorodh*). This obstruction (*Srotorodh*) causes malformed body elements (*Dhatu*s); leading to different co-morbidities which are low quality and duration of life, early old changes (catabolism), difficulty in sexual

activity, fatigue (*Daurbalya*), bad body odour, hyper sweating, and patient always feels hungry & thirsty.<sup>[2]</sup>

Overweight/obesity is not a single system disease. It causes different co-morbidities at different levels by metabolic, systemic and tissue changes. To avoid and control these overweight/obesity co-morbidities multi-systemic approach of management is needed. Ancient scholars of Ayurveda described the causes, pathology, co-morbidities and its managements in detail at different levels. So these different angles of the disease process and its management details are need to be considered while controlling overweight/obesity. Family support is necessary for treatment to succeed. Generally the aim of treatment is to help children to maintain their weight (so that they can grow into it). Most children are not obese because of an underlying medical problem but as a result of their lifestyle. So this article describes the progress of obesity and its co-morbidities at different levels.

### Overweight/Obesity<sup>[3]</sup>

Obesity is an important paediatric public health problem associated with risk of complications in childhood and increased morbidity and mortality throughout adult life. The prevalence of childhood obesity has increased, and the prevention and treatment of childhood obesity has emerged as an important focus of paediatric research and clinical care. Obesity or increased adiposity using the body mass index (BMI); which is an excellent proxy for more direct measurement of body fat.  $BMI = \text{weight in kg} / (\text{height in meters})^2$ . Children >2year old with a BMI >95<sup>th</sup> percentile meet the criterion for obesity, and those with a BMI between 85<sup>th</sup> and 95<sup>th</sup> percentiles fall in the overweight range.

### Overweight/Obesity Co-Morbidities<sup>[3,4,5]</sup>

Complications of paediatric obesity occur during childhood and adolescence and persist into adulthood. An important reason to prevent and treat paediatric obesity is the increased risk for morbidity and mortality later in life. The Harvard Growth Study found that boys who were overweight during adolescence were twice as likely to die from cardiovascular disease as those who had normal weight. More immediate co morbidities include type 2 diabetes, hypertension, hyperlipidemia and non-alcoholic fatty liver disease. Insulin resistance increases with increasing adiposity and independently affects lipid metabolism and cardiovascular health. Non-alcoholic fatty liver disease occurs in 10-25% of obese adolescents and can progress to cirrhosis.

In adults, the combination of central obesity, hypertension, glucose intolerance and hyperlipidemia is the metabolic syndrome. Persons with the metabolic syndrome are at increased risk for cardiovascular morbidity and mortality.

There is increasing evidence that obesity may be associated with chronic inflammation. Adiponectin, a peptide with anti-inflammatory properties, occurs in

reduced levels in obese patients as compared to insulin sensitive, lean persons. Low adiponectin levels correlate with elevated levels of free fatty acids and plasma triglycerides as well as a high BMI, and high adiponectin levels correlate with peripheral insulin sensitivity. Adipocytes secrete peptides and cytokines into the circulation, and pro-inflammatory peptides such as interleukin (IL)-6 and tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) occur in higher levels in obese patients. Specifically, IL-6 stimulates production of C-reactive protein (CRP) in the liver. CRP is a marker of inflammation and might link obesity, coronary disease and subclinical inflammation.

Some complications of obesity are mechanical, including obstructive sleep apnea and orthopaedic complications. Orthopaedic complications include Blount disease and slipped femoral capital epiphysis.

Mental health problems can coexist with obesity, with the possibility of bidirectional effects. These associations are modified by gender, ethnicity and socioeconomic status. Self-esteem may be lower in obese adolescent girls compared to non-obese peers. Some studies have found an association between obesity and adolescent depression. There is considerable interest in the co-occurrence of eating disorders and obesity.

Insulin resistance: a higher amount of insulin is needed to maintain normoglycemia, thus insulin: glucose ratio is elevated. Decrease in insulin leads on to decrease in insulin mediated glucose uptake and results in hyperglycaemia and type diabetes. Acanthosis Nigricans (AN): refers to hyperpigmented velvety skin behind the neck, axilla and groin. AN is associated with obesity, insulin resistance & type 2 diabetes mellitus.

Dyslipidemia: obesity is associated with elevation of plasma triglycerides and VLDL, weight reduction usually normalizes this.

Metabolic syndrome as defined by WHO in adults (1998) is – insulin resistance plus any two of the following

1. Abdominal obesity (waist hip ratio of >0.9, BMI >30)
2. Dyslipidemia (triglyceride >150, HDL<35)
3. Blood Pressure >140/90

Hypertension: systolic BP has positive correlation with BMI and waist-hip ratio. PCOD: insulin regulates ovarian androgens through LH, hence in females hyperinsulinemia is associated with hirsutism, acne and menstrual irregularities. High LH levels may over stimulate the ovaries and possibly the cause of cystic ovaries. An earlier onset of puberty is also likely with exogenous obesity and advanced bone age.

Pickwickian syndrome: hypoventilation and hypercapnia associated with obesity. Non-alcoholic fatty liver diseases and Poor body image hence depression.

Disease	Possible Symptoms
<b>Cardiovascular</b>	
Dyslipidemia	HDL<40, LDL>130, total cholesterol >200
Hypertension	Systolic Blood pressure >95% for sex, age & height
<b>Endocrine</b>	
Type 2 diabetes mellitus	Acanthosis nigrans, polyuria, polydipsia
Metabolic syndrome	Central adiposity, insulin resistance, dyslipidemia, hypertension, glucose intolerance
Polycystic ovary syndrome	Irregular menses, hirsutism, acne, insulin resistance, hyperandrogenemia
<b>Gastrointestinal</b>	
Gallbladder disease	Abdominal pain, vomiting, jaundice
Non-alcoholic fatty liver disease (NAFLD)	Hepatomegaly, abdominal pain, dependent edema, increased transaminases, can progress to fibrosis, cirrhosis.
<b>Neurologic</b>	
Pseudotumor cerebri	Headache, vision changes, papilledema
<b>Orthopaedic</b>	
Blount disease (tibia vara)	Severe bowing of tibia, knee pain, limp.
Musculoskeletal problems	Back pain, joint pain, frequent strains or sprains, limp, hip pain, groin pain, leg bowing.
Slipped capital femoral epiphysis	Hip pain, knee pain, limp, decreased mobility of hip
<b>Psychological</b>	
Behavioural complications	Anxiety, depression, low self-esteem, disordered eating, signs of depression, worsening school performance, social isolation, problem with bullying or being bullied
<b>Pulmonary</b>	
Asthma	Shortness of breath, wheezing, coughing, exercise intolerance
Obstructive sleep apnea	Snoring, apnea, restless sleep, behavioural problems

#### ***Sthaulya karan (Causes of Obesity)***<sup>[6]</sup>

Ingestion of foods which are hard to digest (*guru* or which are more in quantity) will lead to production of large quantity of essence of food which is in the *Ama* state (inadequately digested). This *Ama* (improperly

processed essence) getting mixed with *kapha* residing in *dhatu*s (tissues) makes them weak and causes obesity. Excessive hunger, thirst, sweating, difficulty in breathing, too much of sleep, inability to withstand exertion, lassitude; decrease of life span, strength and vigour, bad smell of the body and stammering (hoarseness of voice) and increase of *medas* (adipose tissue, fat) – all these occur due to excess of nourishment.

The channels (tissue pores, blood vessels, lymphatic ducts etc) become blocked by fat, *Vata* moving especially inside the alimentary tract, causes increase of digestive activity. Because of this, there will be great increase of hunger and thirst, which in turn, burn away the body just as fire and wind burn up a tree which has a big cavity inside it; by the presence of fat, at the (site of) origin of the channels of sweat, increase in secretory activity (moisture) and association of *kapha* – all make for profound increase of sweat.

The fat getting digested in the alimentary tract and causing obstruction in the channels of the *Rasa*, hinders it from going to the other *dhatu*s, and make for increase of *medas dhatu* (fat) only. The remaining portion *Rasa dhatu* being very little in quantity is not enough, to nourish the *Rakta* and other *dhatu*s.

This increase (of fat) is similar to the increase of *vata* and others, “that which has undergone increase first will only undergo further increase” (but not others which have not increased first)” on this analogy there will be disparity between *medas* (fat) and other *dhatu*s. The increased *medas* (fat) will soon produce difficulty in breathing, etc, fever, enlargement of abdomen, rectal fistula, diabetes, loss of movement of the thighs, nodules, abscesses and such other diseases.

#### **Metabolism of Meda (fat) in Sthaulya (overweight/obesity)**<sup>[6]</sup>

*Sthaulya* is the disease of *Medodhatvagni Vikriti*. The good and potent *Dhatvagni* is responsible for the maintenance of healthy *Dhatu*s through proper metabolism at *Dhatu* level. Due to specific *Dhatvagni Vikriti (Mandya)* there will be improper formation and accumulation of respective *Dhatu*s. *Medo Vridhhi* manifesting as *Sthaulya* is one such disorder. *Vagbhata* has described that *Jatharagni*, has its fractions known as *Dhatvagnis* situated at the level of tissues.

Several endocrine hormones determine the metabolic state of our body. These endocrine hormones may come under the preview of *Dhatvagni*. For example, *Medodhatvagni* may include glucocorticoids, insulin, glucagon etc. If glucagon levels are excess, lipolysis occurs which is equivalent to *Medokshaya*. Along with these hormones, all enzymes involved in lipid metabolism may also be regarded as *Medo Dhatvagni*.

When a person indulges in the said *Nidanas* (causative factors) of *Sthaulya* there will vitiation of *Dhatvagni* leading to improper *Rasa Vriddhi* and *Kapha Vriddhi* which are identified by *Angagaurav* (heaviness), *Alasya* (laziness), *Tandra*, *Nidradhikya* (sleepiness) etc. Further; these *Dhatvagni Vikriti* when gets involved with *Meda Dhatu*, there will be production of various clinical features like *Chala - Sphik - Udara - Stana* etc. and in later stages it manifests with *Ashta Doshas of Sthaulya*.

### Co-morbidities of obesity/overweight in Ayurveda<sup>[2]</sup>

Ayurveda scholars describes eight co-morbidities due to the *medorog* / obesity which are low quality and duration of life, early old changes (catabolism), difficulty in sexual activity, fatigue (*Daurbalya*), bad body odour, hyper sweating, patient always feels hungry & thirsty.

1. Decreased life span: due to obstruction of the channels only bad fat get formed and reduction in the quality formation of other body constituents (*Dhatu*s)
2. *Javoparodh*: lack of excitement, early geriatric changes – due to the low quality formation and lack of formation of other *uttarottar dhaus*.
3. *Kricchavyavayata*: low quality formation of *shukra dhatu* (Sperm and other reproductive components) along with obstruction by the bad fat (*meda*).
4. *Daurbalya*: the *dhatu*s (body constituents) get formed in un-equilibrium which lands in fatigue.
5. *Daugandhya*: the sweat (*sweda*) is by-product (*mala*) of the *medo dhatu* (fat). Due to the *dhatvagnimandyata* (hormonal and metabolic changes) the *sam sweda* (low quality / bad kind sweat) get formed; which smells bad. Also the *meda* (bad fat collection) smells bad causing bad body odour.
6. *Swedabadh*: formation of bad quality fat in high amount causes formation of high quantity of sweat. Again due to the looseness of fat (*meda*) the more *kleda* (metabolic changes) get formed causing high sweating.
7. & 8. *Atikshudha* & *Atitrishna*: due to obstruction of the *vayu* the digestive fire in the stomach / digestive system get stimulated and causes the patient hungry and thirsty.

*Meda* undergoing *vriddhi* (increase) produces all the premonitory symptoms of *Prameha* (diabetes), obesity and its complications and other symptoms of increase of *kapha*, *rakta* and *mamsa*.

### Management of Overweight/obesity (*Atisthula chikitsa*)<sup>[7]</sup>

A person is said to be very obese when he has lack of enthusiasm (in physical activities) disproportional to the growth of his body, and has movement of the buttocks, abdomen and breasts. Such a person should be given such foods which mitigate *Vata*, *Kapha* and *Medas* (fat) such as horsegram, small barely, jower, black millet, green gram etc. *Aristas* (medicated liquors), honey water, *mastu* (whey) and *takra* (butter milk) as drinks; drugs which possess the properties of penetrating, hot in

potency, dry and scarifying; those who wish to retain their body thin should also be prescribed worry, sexual intercourse, physical exercise, purificatory therapies (emesis, purgation etc) avoidance of sleep, dry bathing (without anointing oil) and massaging the body (without anointing oil or other fatty materials).

### Vyayam (Exercise)<sup>[8]</sup>

An activity which produces tiredness to the body is known as *Vyayam* (Exercise). Lightness of the body, increased capacity to work, keen appetite, reduction of body fat and parts of the body becoming distinct and firm are the good effects of exercise. Strong persons and those who are accustomed to fatty foods, should do exercise to half their capacity during cold seasons (*Hemant*, *Shishir*) and *Vasant ritu* (Spring) for others and in other seasons it should be still less.

**Udvaratana**: massaging the body mitigates *kapha*, liquefies the fat, makes the body parts firm and is best for the health of the skin.

**Ushnajala (Warm water therapy)**:<sup>[9]</sup> Boiled water cures distension of the abdomen, disorders of *Vata* and *Kapha*, thirst, cough, difficulty in breathing, pain in flanks, accumulation of fat. Hot water stimulates digestion, digest the undigested material, is good for throat, easy to digest and purifies the urinary bladder (urinary tract).

**Takra (Buttermilk)**:<sup>[10]</sup> *Takra* (buttermilk) is easily digestible, astringent and sour, kindles digestion, and mitigates *kapha* and *vata*, cures edema, enlargement of the abdomen.

**Madya (Medicated wines)**:<sup>[11]</sup> Beneficial for obese person, capable of entering minute pores, and cleansing them (*sukshma srotogami*), mitigate *vata* and *kapha*.

For the diseases which are caused by *Santarpan* (excess food intake, over nutrition) there is no treatment other than *Apatarpan* (fasting, less intake of food, under nutrition).<sup>[12]</sup>

### Kapha upakram (treatment for kapha)<sup>[13]</sup>

The treatment for *kapha* (which has undergone increase) are: strong purificatory therapies (emesis and purgation) with drugs possessing dryness, pungent, bitter and astringent taste, use of foods possessing the same properties; use of wines which are strong, old and pleasant; activities such as running, jumping, swimming, keeping awake without sleep, fighting with arm, fighting with weapons, sexual intercourse, physical exercises, dry massage, bath and application of dry powders to the body.

Honey, soups of grains or pulses, emesis, fasting, inhalation of smoke, mouth gargles, avoidance of comfort and regimen prescribed for *vasant ritu* (spring) are all to be observed especially for benefit.

**Pragbhakta aushadhi sevan (medication before food):** the medication to control the overweight; should be given before food for making the body thin.<sup>[14]</sup> Sthaulya (obesity) is langhan yoga vyadhi (can be controlled by dieting/diet modification).<sup>[15]</sup>

**Langhan phalam (benefits of dieting):** feeling of the hunger and thirst together, purity of the heart (mind), and throat (voice), diminution in the severity (virulence) of the disease, improvement of enthusiasm and disappearance of stupor (lassitude) are the benefits of langhana (thinning) therapy.<sup>[16]</sup>

## DISCUSSION

The co-morbidities of the overweight/obesity are associated with the metabolic, hormonal and biochemical changes of the disease progress. The pathology and details of the disease progress described by ancient ayurvedic scholars highlights the multi-systemic and holistic approach for the overweight management.

The management of the disease requires not only the avoidance of causative factors but also the basic concepts of Agni (digestive fire), *Dhatvagni*, *Srotasas* (nutritive channels), *srotasavarodh* (obstruction), *doshanuloman*, etc details.<sup>[7]</sup>

Due to the *srotas* (channels) obstruction the next *dhatu*s are not get formed properly and causes the ayurhas (low quality of life); causing disequilibrium of the body elements leading in to fatigue. *Javoprodh* (lack of stamina/libido) and *Krichhravyvayata* (having problems with sex) reflects the metabolic & hormonal changes.<sup>[2]</sup>

*Daurgandhya* (bad smell), *Swedabadhata* (sweating), *Atikshuda* (high hunger) and *Atitrishna* (high thirst) reflect the metabolic and biochemical changes which are occurred due to overweight/obesity. These are the early changes in obesity. So by knowing such changes; early management plans can be introduced to the obese patients having family history.

*Vyayam* (exercise) promotes the *laghavata* (lightness); as feeling of heaviness is there in obese person which get relieved by exercise. Exercise also reduces the bad fat (*kleda/Aam*) and increases the good quality of sweat which also helps to clear the nutritive channels (*Srotoshodhan*, *Swedasya kledavidhruti*). Application of medicinal plans powder (*Udvaratan*) reduces the bad smell and increases the circulation towards the skin and muscle tissue along with reduction of badly accumulated fat (*Aam/Kleda*). Buttermilk, old medicated wines (*Asav/Arishtha*), lukewarm medicated water penetrates the minute channels of nutrition (*sukshma srotanugami*) and relieves the obstruction caused by bad fat (*Aam/kleda*); resulting in good quality tissue formation. This will result good quality tissue (*Sara dhatu*) formation.<sup>[8,9]</sup>

Obesity/overweight is not controlled by only diet or medication or exercise individually but the combination of three as per the severity of the disease and age, tolerance, feasibility, etc of the patient. Ayurvedic principles of managements considered the details of the co-morbidities and the cell level changes of the disease progress of the disease in detail; so that the management of *sthaulya* (overweight/obesity) include the multi-systemic approach. The management plans such as exercise, buttermilk, old wines, bad fat treatment, and medication by different methods and at different time, etc proves the same.<sup>[7]</sup>

As obesity is hard to control and childhood obesity have dangerous outcomes in adulthood, this holistic approach of the disease progress and management of Ayurveda can be applied for the childhood obesity/overweight.

The co-morbidities described by latest evidences along with the details of disease pathology, complications and line of management described by ancient ayurveda scholars should be considered while treating the overweight child.

In the context of co-morbidities of childhood overweight / obesity, *Dhatvagni-vaishamy* (dysregulation of metabolic paths), *Ama-Nirmiti* (production of unassimilated toxic residue), *Srotorodh* (accumulation of bio-waste), *Dosh-prakop*, *Dhatu-shaithilya* (loss of cohesiveness and quality of *Dhatu*) are important *vyadhi-sankar ghatak* (factors of co-morbid pathology) for the therapeutic targets.

## CONCLUSION

Ayurveda the science of life describes all the co-morbidities of overweight/obesity in detail. As obesity management needs multi-angle approach of management; the multidisciplinary approach of management should be considered to control childhood overweight/obesity. The process of the disease and the details of co-morbidities along with their different management plans at different stages should be taken in consideration while controlling the childhood overweight/obesity.

## REFERENCES

1. Dr Tom Lissauer, Illustrated Textbook of Paediatrics, 3<sup>rd</sup> Edn reprint 2008, Published by Mosby Elsevier. ISBN 978-0-7234-3397-2/chapter12, 201-203.
2. Prof Y.G.Joshi, Kayachikitsa, 4<sup>th</sup> Edn Published by Pune sahitya vitaran, chapter 21/, 2001; 265-270.
3. A Parthasarathy, IAP Textbook of Ped, Jaypee published 6<sup>th</sup> editn 2016; ISBN: 978-93-5250-196-0; chapter 13.3/, 884-890.
4. A Santosh kumar, Manual of Pediatric Practice, Paras Medical Publisher New Delhi, 4<sup>th</sup> Edn ISBN 978-81-8191-423-1. Chapter 15/, 2014; 698-702.

5. Kliegman et al; Nelsons Textbook of Pediatrics, Elsevier publication, New Delhi, reprint India ISBN: B978-81-312-3007-7; chapter 44/, 2012; 179-188.
6. Astang Sangrah of Vagbhata, translated by Prof K.R.Srinath Murthy, Chaukhambha orientalia, Varanasi, 4<sup>th</sup> Edn; sutrasthan chapter24/18-30/, 2001; 424-425.
7. Astang Sangrah of Vagbhata, translated by Prof K.R.Srinath Murthy, Chaukhambha orientalia, Varanasi, 4<sup>th</sup> Edn; sutrasthan chapter24/18-27/, 2001; 42-426.
8. Astang Sangrah of Vagbhata, translated by Prof K.R.Srinath Murthy, Chaukhambha orientalia, Varanasi, 4<sup>th</sup> Edn; Chapter 3 –sutra 3 Dincharya/61-63/, 2001; 43.
9. Astang Sangrah of Vagbhata, translated by Prof K. R. Srinath Murthy, Chaukhambha orientalia, Varanasi, 4<sup>th</sup> Edn; Chapter 6/44-47/, 2001; 91.
10. Astang Sangrah of Vagbhata, translated by Prof K. R. Srinath Murthy, Chaukhambha orientalia, Varanasi, 4<sup>th</sup> Edn; chapter 6/65-66/, 2001; 98.
11. Astang Sangrah of Vagbhata, translated by Prof K.R.Srinath Murthy, Chaukhambha orientalia, Varanasi, 4<sup>th</sup> Edn; chapter6/110-113/, 2001; 108.
12. Astang Sangrah of Vagbhata, translated by Prof K.R.Srinath Murthy, Chaukhambha orientalia, Varanasi, 4<sup>th</sup> Edn; sutrasthan chapter 11/26/, 2001; 252.
13. Astang Sangrah of Vagbhata, translated by Prof K.R.Srinath Murthy, Chaukhambha orientalia, Varanasi, 4<sup>th</sup> Edn; sutrasthan chapter 21/4/, 2001; 385.
14. Astang Sangrah of Vagbhata, translated by Prof K.R.Srinath Murthy, Chaukhambha orientalia, Varanasi, 4<sup>th</sup> Edn; sutrasthan chapter 23/14/, 2001; 416.
15. Astang Sangrah of Vagbhata, translated by Prof K.R.Srinath Murthy, Chaukhambha orientalia, Varanasi, 4<sup>th</sup> Edn; chapter 24/10/, 2001; 422.
16. Astang Sangrah of Vagbhata, translated by Prof K.R.Srinath Murthy, Chaukhambha orientalia, Varanasi, 4<sup>th</sup> Edn; sutrasthan chapter 24/16/, 2001; 424.