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Effects of Bilwadi Panchamula and Suryanamaskara Asana in the secondary prevention of Obesity (Athisthaulya)

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The prevalence of obesity is increasing at an alarming rate worldwide. World Health Organization has revealed that in 2022, 1 in 8 people in the world were living with obesity. In Sri Lanka, the prevalence of overweight and obesity is high among adults. This study aimed to assess the obesity prevalence among the patients who seeks Ayureveda treatments and the efficacy of Bilawadhi Panchamula and Suryanamaskara asana in the secondary prevention of Obesity (Athisthaulya). The clinical study was based on prospective randomized comparative study carried out among the 90 patients in two groups with duration of one year. Group A was given only the Bilwadhi Panchamula decoction with bee honey for twice a day. Group B was given Bilwadhi Panchamula decoction along with Suryanamasakara practicing. In clinical study administration of Bilwadhi Panchamula decoction, the mean Weight, Body mass index, Waist circumference, and Total cholesterol were reduced by statistically highly significant ($p<0.001$) mid upper arm circumference was statistically insignificant. But administration of Bilwadhi Panchamula along with Suryanamaskara was statistically highly significant in the reduction of weight, Body mass index, and waist circumference in mid-upper arm circumference, and Total cholesterol. The overall effects of therapy indicate that markedly improved 26.67% of Group B while 15.55% of Group A from the BMI in the normal range. Also indicates that moderately improved in 42.22% of Group B while 33.34% of Group A was giving the improvement of BMI in reducing the percentage of Obesity patients.

Keywords: Athisthaulya, Bilwadhi Panchamula, Suryanamasakaraya

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Introduction

With the history of more than 3000yrs of Ayurveda has mentioned "*Athisthaulya*" in *Charaka Samhitha* under the chapter "*Ashtaunindeetiya*". It has mentioned that there are eight types of undesirable persons depending on the physical constitution. "*Athisthaulya* person" is the one of those types.**[1]** According to *Acharaya Charaka* described this *Athisthaulya* reference to *Nanathmaja Vikara* of *Kapha*. It is described as that the person who over obese due to excessive increases of fat and muscles, having pendulous buttocks, abdomen and breast and suffers from deficient metabolism and energy was called as *Sthaulya* which is a synonym for *Athisthaulya.* A same etiopathology of *Athisthaulya* condition in the modern medicine called as Obesity. Today obesity has become a health threat not only to Sri Lanka but also other countries in the world. It has identified that the prevalence of overweight and obesity is increasing at an alarming rate in developed and developing countries. Further it has revealed that globally, there are more than 1 billion overweight adults and 300 million of them are obese.**[2]** WHO has estimated that in 2016, more than 1.9 billion adults, 18 years and older were overweight. Among them over 650 million were obese world widely. Overall, about 13% of the world's adult population was obese. Researchers have predicted that overweight and obese were fifth leading risks for global deaths which cause 2.8 million deaths at least for each year.**[3]** It has proved that the percentages of Sri Lankan adults having overweight, obesity, and abdominal obesity as 25.2%, 9.2%, and 26.2%, respectively.**[4]** There is high prevalence of overweight and obesity, particularly, abdominal obesity among adults in Sri Lanka in middle-income country.**[5]**

It was estimated in 2016 prevalence of obesity among female & male which is ages 18+ respectively 7.3% & 2.9%. Obesity has become one of most prevalent health concerns among all populations & age groups worldwide, resulting increase in mortality & morbidity related to coronary heart diseases, diabetes type 2, metabolic syndrome, stroke & cancers.**[4,5]** Day by day number of who are victim to obesity is becoming increased by occurring at any age & either sex than or equal to 25 is define as overweight & whose BMI is greater than or equal to 30 is define as obesity.

The prevalence of overweight and obesity is commonly assessed by using body mass index (BMI) which is the mostly accepted classification of the WHO. BMI defined as the weight in kilograms. Some study has suggested that there is a positive association between dietary diversity with several socio- demographic characteristic and obesity among Sri Lankan adults.**[6]** Literature review revealed that the alteration in dietary habit and less physical activities are key causes for obesity.**[7]**

In the modern view obesity has defined as an abnormal growth of the adipose tissue due to an enlargement of the fat cell size or increase in fat cell number or combination of both.**[8]** The degree of adiposity has been assessed by skin fold thickness of the various areas of the body together with height, weight and age. Depending on the fat phenotype and the fat distribution it has four types named as General obesity, Android obesity, Gynoid obesity and visceral obesity. The chief goal of obesity treatment is to maintain healthy weight. But unfortunately, with the busiest sedentary lifestyles avoid weight reduction by dieting and physical exercises. According to recent studies has identified that many medications has been used to manage obesity over years. But most of them were stopped using due to their adverse effects.**[9]** In the past there are so many natural plants have been used in healthcare or as dietary supplements. As consequences there were many studies have conducted related to the use of herbal plants such as *Fecus vesiculosus, Camellia Synthesis,* & *Green tea* etc… in the management of obesity. *Bilwadi Panchamula* is one of the decoctions that mentioned in the *Charaka Samhitha* in the management of *Athisthaulya*.**[10]**

Sun is the only god which provides good health to the human. Sun salutation which is *Suryanamaskara* is the one of drugless therapy that helps to maintain healthiness of the body. Some studies have proved that *Suryanamaskara* provides vigor and vitality and keeps the body healthy and fit.**[11]** Not only that but also research confirms that the obese persons can significantly reduce their weight with help of *Suryanamaskara* exercise.**[12]**

Nowadays obesity has emerged as a major health problem and risk factors for various diseases and also become a clinical and health burden of the country. Prevention and treatment of *Athisthaulya* should be public health priority today.

Therefore, present study was carried out to determine efficacy of *Bilwadi Panchamula* decoction & *Suryanamaskaraya* in management of *Athisthaulya.*

Hypothesis

H0 - Decoction of *Bilwadi Panchamula* with *Suryanamaskara* is not an effective treatment for reducing obesity compared to the decoction of *Bilwadi Panchamula* alone.

Ha - Decoction of *Bilwadi Panchamula* with *Suryanamaskara* is an effective treatment for reducing obesity compared to the decoction of *Bilwadi Panchamula* alone.

Objectives

To compare the efficacy of *Bilwadi Panchamula* decoction *and Suryanamaskara* in the secondary prevention of Obesity (*Athisthaulya*).

Materials and Methods

A prospective randomized comparative clinical trial conducted at National Ayurveda Teaching Hospital, Colombo 08, Sri Lanka. This study was carried out during a one-year period. The study population consisted of the patients who came to the *Swathavritta* clinic at Ayurvedic Teaching Hospital. A simple random sampling technique was used. Each sample was selected from each group using a random number generator applied to BMI criteria which is25 < BMI <34.99. (Overweight and Obesity class 1) (Source: WHO 2003 mentioned in K.PARK 23rd edition**[8]** According to inclusion, exclusion, and diagnostic criteria, patients were selected randomly and were divided into 2 groups and named as Group A and Group B.

Inclusion criteria

- Patients with a BMI of more than 25 & less than 34.99. (Overweight and obesity class 1)**[14]**
- Age group 30 - 60 years.**[13]**
- Those who can perform *Yoga Asana*

Exclusion criteria

- Pregnant mothers
- Who are with a BMI less than 25 and more than 34.99 will be excluded.
- Patients had disorders of the thyroid gland such as Hypothyroidism, carcinoma, and congenital deformities.
- Patients suffered from other chronic illnesses, cardiac diseases, Hypertension, severe insulin resistance, diabetes, and organ-secreting neoplasm, etc.

Drug has selected to according to mentioned in "*Charaka Samhitha*" and "*Susrutha Samhitha*" the decoction of *Bilwadi panchamula* is used with Bee honey as a drug in the reduction of obesity.**[15]**

Table 1: Ingredients of the Drug

Sanskrit Name	Scientific Name	Part used
Bilwa	Aegle marmelos	Root
Agnimantha	Premna serrotifolia	Root
Syanaka	Oroxylum indicum	Root
Kashmari	Gmelina arborea	Root
Patala	Fernandoa adenophylla	Root

Bee honey used which is manufactured by the Ayurveda drug cooperation under the recommended standards. Drug authentication was done from the pharmaceutical Botany Division, Bandaranayaka Memorial Research Institute Nawinna, Maharagama, Sri Lanka. Drug has prepared according to *Kuwatha Paribhasha.* Patients were given treatments for four weeks with 1-month follow-up. Patients were given specific instructions on diet and lifestyle modifications. During the treatments to diagnosis purposes Pre and post Total cholesterol level has tested. Selected patients with overweight and obesity from the Swasthavritta clinic, were randomly divided into two groups. One group consists of 45 patients named as Group A and the other Group B. Group A patients were given *Bilwadi Panchamula* decoction with bee honey 2 times per day continuously for 1 month and did the investigations. In group B, patients were given *Bilwadi Panchamula* decoction with bee honey 2 times per day continuously following *Suryanamaskaraya*. The practicing of *Suryanamaskara* was given to this group and advised to practice asana twice a day in the morning and evening at least 6 times with the relaxations. Both groups patients were given treatments for four weeks with 1-month follow-up. After 30 days of following treatment and practice measurements and investigations were measured & compared & results were statistically analyzed.

Results

Results are which describe the outcome of the clinical study. The total number of the participated patients in the study was 90.

Table 2: Shows the Socio-demographic characteristics of the patients.

Socio-demographic characteristics		N (%)
Gender	Female	90 (100%)
Marital status	Married	82 (91.11%)
	Unmarried	8(8.89%)
Religious	Buddhist	66 (73.3%)
	Muslim	5 (5.6%)
	Hindu	11(12.2%)
	Catholic	8 (8.9%)
Residence	Urban	58 (64.4%)
	Suburban	21(23.33%)
	Rural	11(12.27%)
Education level	No	2(2.22%)
	Primary	10 (11.11%)
	Ordinary level	48 (53.3%)
	Advance level	24 (26.7%)
	Degree	6(6.67%)
Occupation	No	10 (11.11%)
	Self-employer	20 (22.22%)
	Officer	33 (36.67%)
	Labor	27 (30.00%)
Age Group	30-40	19 (21.1%)
	41-50	47(52.2%)
	51-60	24 (26.7%)

All of patients were female due to inability to prepare decoctions male patients were dropped out of study. Majority of them were age group between 41-50 years (52.2%). The mean ages of them were 46.30 ± 7.58. The majority of them were married (91.11%), Buddhist (73.3%), Educational level is Ordinary level (53.3%), worked as officers (36.67%), and lived in urban areas (64.4%).

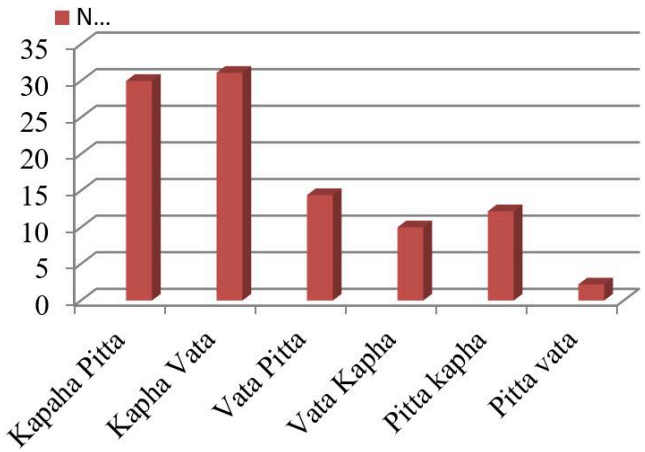

Figure 1: Shows the distribution of *Dehaprakurti* types of the patients.

According to sample patients with *Kapha Vata Deh-aprakurti* were prominent among obese patients.

Effect of *Bilwadhi Panchamula* decoction on *Athisthaulya*

Table 3: Shows the effect of *Bilwadhi Panchamula* decoction on objective parameters of *Athisthaulya* (with a 95% confidence interval)

Objective parameter	Mean		SD		SEM		t value	P value
	BT	AT	BT	AT	BT	AT		
Weight	73.96	71.62	10.531	10.435	1.570	1.585	9.324	< 0.001
Body Mass Index	32.28	31.27	8.737	8.559	1.302	1.275	9.771	< 0.001
Waist circumference	106.49	104.24	10.841	11.403	1.616	1.700	7.861	< 0.001
Mid-upper arm circumference	33.82	34.22	3.670	12.364	0.547	1.843	-0.229	> 0.05

When comparing and analyzing the pre-data and post-data, here it was observed that the mean values of participants were significantly reduced and the significant findings of the p-valve are less than 0.001 ($p<0.001$). The mean value of weight in patients was reduced from 73.96 ± 10.531 to 71.62± 10.435 ($p<0.001$). The mean value of BMI of patients was reduced from 32.28 ± 8.737 to 31.27 ± 8.559 ($p<0.001$).

The mean value of waist circumference in patients was reduced from 106.49 ± 10.841 to 104.24 ± 11.403 ($p<0.001$). But the mean value of mid upper arm circumference is not reduced as such the p-value is 0.820 which is not less than the p-value of 0.05. It is observed that above mentioned mean values of objective parameters from the pre-test to the post-test have been decreased except for the value of mid-upper arm circumference.

The statistical value of the objective parameters of *Athisthaulya* is greater than the critical value and the p-value is less than 0.001 which is statistically highly significant in most variables of obesity except the mid-upper arm circumference.

Table 4: Shows the effect of *Bilwadi Panchamula* decoction on the chemical parameter of *Athisthaulya* (Total cholesterol)

Bio-chemical Parameter	Mean		SD		SEM		t value	P value
	BT	AT	BT	AT	BT	AT		
Total Cholesterol	170.89	167.09	12.953	13.216	1.931	1.970	10.711	< 0.001

When comparing the data pre and post-test of total cholesterol it is observed that the mean value of total cholesterol is reduced from 170.89 ±12.953 to 167.09 ± 13.216 ($p<0.001$) which is statistically significant.

Table 5: Shows the effect of *Bilwadi Panchamula* decoction on the subjective parameters of *Athisthaulya*.

Subjective parameter	Mean		SD		SEM		t value	P value
	BT	AT	BT	AT	BT	AT		
Pendulous hanging of Buttocks (Spik Chalata)	2.20	1.27	0.757	0.720	0.113	0.107	24.819	< 0.001
Movement of breast (Sthana Chalata)	1.96	1.13	0.952	0.815	0.142	0.121	10.316	< 0.001
Movement of the abdomen (Udara Chalata)	1.93	1.18	0.963	0.806	0.144	0.120	7.857	< 0.001
Movement of cheeks	2.02	1.16	0.866	0.824	0.129	0.123	12.714	< 0.001
Movement of Thigh	1.91	1.20	0.973	0.786	0.145	0.117	7.620	< 0.001
Dyspnoea on excursion (Ayasena Swasa)	0.96	0.51	0.824	0.695	0.123	0.104	4.781	< 0.001
Exercises (Daurbalya/ Alpa Vyayama)	1.29	0.49	0.795	0.371	0.233	0.170	7.520	<0.001
Sweating (Swedadhikya)	1.29	0.49	0.895	0.471	0.133	0.070	8.552	< 0.001
Nidradhikya	0.96	0.51	0.995	0.571	0.233	0.170	3.538	< 0.001
Thirst (Ati Pipasa)	0.78	0.22	0.823	0.471	0.123	0.470	4.748	< 0.001
Burning sensation (Daha)	0.24	0.04	0.358	0.149	0.53	0.220	4.532	< 0.001
Shortness of Breath (Kshudra Swasa)	0.22	0.13	0.387	0.344	0.058	0.051	0.813	< 0.001
Pain in knee joints (Janu Sandhi Shoola)	1.42	0.91	0.941	0.996	0.140	0.148	3.944	< 0,001

It has shown that improvement of mean value of *Sphik Chalata* from (2.20 to 1.27), *Sthana Chalata* from (1.96 to 1.13), *Udara Chalata* from (1.93 to 1.18), movements of cheek from (2.02 to 1.16), Movement of Thigh from (1.91 t0 1.20), *Ayasena Swasa* from (0.96 to 0.51), *Alpa Vyayama* from (1.29 to 0.49), *Swedadhikya* from (1.29 to 0.49), *Nidradhikya* from (0.96 to 0.51), *Ati Pipasa* from (0.78 to 0.22), *Daha* from (0.24 to 0.04), *Kshudra Swasa* from (0.22 to 0.13 and *Janusandhi Shoola* from (1.42 to 0.91) was statistically highly significant ($p < 0.001$)

Effect of *Bilwadhi Panchamula* with practicing of *Suryanamasakara* on *Athisthaulya*

Table 6: Shows the effect of *Bilwadhi Panchamula* decoction with practicing *Suryanamakara* on the objective parameters of *Athisthaulya* (with a 95% confidence interval)

Objective parameter	Mean		SD		SEM		t value	P value
	BT	AT	BT	AT	BT	AT		
Weight	72.62	67.22	8.710	8.868	1.708	1.739	46.321	< 0.001
Body Mass Index	31.23	27.80	3.578	3.601	0.701	0.706	40.625	< 0.001
Waist circumference	103.20	99.20	6.364	6.005	1.248	1.178	29.685	< 0.001
Mid-upper arm circumference	34.07	30.87	3.892	3.718	0.763	0.729	25.000	< 0.001

When comparing and analyzing the pre-data and post-data, here it was observed that the mean values of participants were significantly reduced and the significant findings of the p-valve are less than 0.001 ($p<0.001$).

The mean value of weight in patients was reduced from 72.62 $\pm$ 8.710 to 67.22 $\pm$ 8.868 ($p<0.001$). The mean value of BMI of patients was reduced from 31.23 $\pm$ 3.578 to 27.80 $\pm$ 0.701 ($p<0.001$).

The mean value of waist circumference in patients was reduced from 103.20 $\pm$ 6.364 to 99.20 $\pm$ 6.005 ($p<0.001$). The mean value of mid-upper arm circumference also reduced from 34.07 $\pm$ 3.892 to 30.87 $\pm$ 3.718 ($p<0.001$).

It is observed that above mentioned mean values of objective parameters from the pre-test to the post-test have been decreased. The statistical value is greater than the critical value and the p-value is less than 0.001 which is statistically highly significant in the variables of obesity.

Table 7: Shows the effect of *Bilwadhi Panchamula* decoction with practicing *Suryanamaskaraya* on the Biochemical parameter of *Athisthaulya.*

Bio-chemical parameter	Mean		SD		SEM		t value	P value
	BT	AT	BT	AT	BT	AT		
Total Cholesterol	167.09	154.38	7.503	6.699	1.472	1.314	13.100	< 0.001

When comparing the data pre and post-test of total cholesterol it is observed that the mean value of total cholesterol is reduced from 167.09 $\pm$7.503 to 154.38 $\pm$ 6.699 ($p<0.001$) which is statistically significant.

Here it has shown that the improvement of the mean value of *Sphik Chalata* from (1.58 to 0.51), *Sthana Chalata* from (1.58 to 0.49), *Udara Chalata* from (1.58 to 0.49), movements of cheek from (1.58 to 0.54), movement of the thigh from (1.47 to 0.49), *Ayasena Swasa* from (0.89 to 0.20), *Alpa Vyayama* from (1.07 to 0.22), *Swedadhikya* from (1.05 to 0.22), *Nidradhikya* from (0.75 to 0.20), *ati Pipasa* from (0.98 to 0.16), *daha* from (0.27 to 0.23), *Kshudra Swasa* from (0.20 to 0.15) and *Janusandhi Shoola* from (1.18 to 0.53).

Also, t values were higher than the critical value and these objective parameters of *Athisthaulya were* statistically highly significant ($p < 0.001$)

Table 8: Shows the effect of *Bilwadhi Panchamula* decoction and practicing *Suryanamaskaraya* on subjective parameters of *Athisthaulya*.

Subjective parameter	Mean		SD		SEM		t value	P value
	BT	AT	BT	AT	BT	AT		
Pendulous hanging of Buttocks (Spik Chalata)	1.58	0.51	0.732	0.504	0.143	0.099	14.307	<0.001
Movement of breast (Sthana Chalata)	1.58	0.49	0.749	0.504	0.147	0.099	14.307	<0.001
Movement of the abdomen (Udara Chalata)	1.58	0.49	0.732	0.504	0.143	0.099	14.307	<0.001
Movement of cheeks	1.58	0.49	0.749	0.508	0.147	0.100	14.307	<0.001
Movement of Thigh	1.47	0.49	0.846	0.508	0.166	0.100	8.712	<0.001
Dyspnoea on excursion (Ayasena Swasa)	0.89	0.20	0.816	0.402	0.160	0.079	14.307	<0.001
Exercises (Daurbalya/ Alpa Vyayama)	1.07	0.22	0.901	0.420	0.220	0.160	8.402	<0.001
Sweating (Swedadhikya)	1.05	0.22	0.801	0.368	0.157	0.072	8.844	<0.001
Nidradhikya	0.75	0.20	0.995	0.571	0.233	0.170	8.812	<0.001
Thirst (Ati Pipasa)	0.98	0.16	0.749	0.272	0.47	0.053	4.748	<0.001
Burning sensation (Daha)	0.27	0.23	0.358	0.149	0.53	0.220	4.532	<0.001
Shortness of Breath (Kshudra Swasa)	0.20	0.15	0.387	0.344	0.058	0.051	0.813	<0.001
Pain in knee joints (Janu Sandhi Shoola)	1.18	0.53	0.941	0.996	0.187	0.127	8.323	<0.001

Table 9: Shows the comparative effect of Test Therapies *Bilwadhi Panchamula* decoction using in group A and *Bilwadi Panchamula* decoction using with practicing *Suryanamaskaraya* in Group –B on overall improvement Objective parameters of *Athisthaulya* (By Levene's test)

Objective parameter	Group	N	Mean score		Mean difference	% Relief	SD +	SE +	t value	Sig.	P value
			BT	AT							
Weight	A	45	73.96	71.62	4.400	5.94	10.644	1.587	2.147	0.035	< 0.05
	B	45	71.62	67.22	4.400	6.14	8.702	1.297	2.147	0.035	< 0.05
Body Mass Index	A	45	32.28	31.27	3.470	10.74	8.567	1.277	2.481	0.015	< 0.05
	B	45	31.23	27.80	3.470	11.11	3.832	0.571	2.481	0.015	< 0.05
Waist circumference	A	45	106.49	104.24	5.044	4.73	10.963	1.634	2.636	0.010	< 0.05
	B	45	103.20	99.20	5.044	4,89	6.676	0.995	2.636	0.010	< 0.05
Mid upper arm circumference	A	45	33.82	34.22	3.356	9.92	12.364	1.843	1.749	0.084	> 0.05
	B	45	34.07	30.87	3.356	9.85	3.571	0.532	1.749	0.086	> 0.05

Group A - *Bilwadi Panchamula* decoction only

Group B - Both *Bilwadi Panchamula* & *Suryanamas-kara*

When comparing & analyzing post data of Group A and Group B it was observed that mean values of participants were significantly reduced and significant findings of p-valve are less than 0.05 ($p<0.05$). Mean value of weight in patients of Group A reduced from 71.62 to mean value of Group B 67.22 with mean difference of 4.400 (<0.05). Mean value of BMI of patients in Group A reduced from 31.27 to mean value of Group B 27.80 with mean difference of 3.470 ($p<0.05$). Mean value of waist circumference in Group A reduced from 104.24 to mean value of Group B 99.20 with mean difference of 5.044 ($p<0.05$). Mean value of mid-upper arm circumference in Group A reduced from 34.22 to mean value of Group B 30.87 with mean difference of 3.356 (> 0.05).

The statistical values of objective parameters in *Athisthaulya* were greater than the critical value and the p-value is less than 0.05 which is statistically highly significant except for the value of mid-upper arm circumference. Mid-upper arm circumference was statistically insignificant ($p> 0.05$).

Group A - *Bilwadi Panchamula* decoction only

Group B - Both *Bilwadi Panchamula* and *Suryanamas-kara*

The mean value of total cholesterol of patients in Group A reduced from 167.09 to the mean value of Group B 154.38 with a mean difference of 12.711($p<0.001$).

The statistical value of the bio-medical parameter in *Athisthaulya* was greater than the critical value and the p-value is less than 0.001 which is statistically highly significant.

Table 10: Shows the comparative effect of Test Therapies *Bilwadhi Panchamula* decoction using in Group A and *Bilwadi Panchamula* decoction using with practicing *Suryanamaskaraya* in Group - B on overall improvement Bio-chemical parameters of *Athisthaulya.* (By Levene's test with 95% confidential interval)

Biochemical parameter	Group	N	Mean score		Mean diff.	% Relief	SD +	SE +	t value	Sig.	P value
			BT	AT							
Total Cholesterol	A	45	170.89	167.09	12.711	7.43	13.216	1.970	5.393	0.000	< 0.001
	B	45	167.09	154.38	12.711	7.60	8.679	1.294	5.393	0.000	< 0.001

Table 11: Shows the comparative effect of Test Therapies *Bilwadhi Panchamula* decoction in Group A and *Bilwadi Panchamula* decoction using practicing *Suryanamaskaraya* in Group –B on overall improvement subjective parameters of *Athisthaulya.* (By Levene's test with 95% confidential interval)

Subjective parameter	Group	N	Mean		Mean Diff.	% Relief	SD+	SE +	t value	Sig.	P value
			BT	AT							
Pendulous hanging of Buttocks (Spik Chalata)	A	45	2.20	1.27	0.756	34.37	0.720	0.107	5.762	0.000	<0.001
	B	45	1.58	0.51	0.756	47.48	0.506	0.075	5.762	0.000	<0.001
Movement of breast (Sthana Chalata)	A	45	1.96	1.13	0.756	38.57	0.815	0.121	4.509	0.000	<0.001
	B	45	1.58	0.49	0.756	47.84	0.506	0.075	4.509	0.000	<0.001
Movement of the abdomen (Udara Chalata)	A	45	1.93	1.18	0.689	35.67	0.806	0.120	4.858	0.000	<0.001
	B	45	1.58	0.49	0.689	43.67	0.506	0.075	4.858	0.000	<0.001
Movement of cheeks	A	45	2.02	1.16	0.667	33.02	0.824	0.123	4.624	0.000	<0.001
	B	45	1.58	0.49	0.667	42.21	0.506	0.075	4.624	0.000	<0.001
Movement of Thigh	A	45	1.91	1.20	0.711	37.23	0.786	0.117	5.103	0.000	<0.001
	B	45	1.47	0.49	0.711	48.37	0.506	0.075	5.103	0.000	<0.001
Dyspnoea on excursion (Ayasena Swasa)	A	45	0.96	0.51	0.311	32.39	0.695	0.104	2.596	0.011	<0.05
	B	45	0.89	0.20	0.311	34.94	0.405	0.060	2.596	0.011	<0.05
Exercises (Daurbalya/ Alpa Vyayama)	A	45	1.29	0.49	0.267	20.69	0.626	0.093	2.372	0.020	<0.05
	B	45	1.07	0.22	0.267	24.95	0.420	0.063	2.372	0.020	<0.05
Sweating (Swedadhikya)	A	45	1.29	0.49	0.267	20.70	0.626	0.093	2.372	0.020	<0.05
	B	45	1.05	0.22	0.267	25.42	0.420	0.063	2.372	0.020	<0.05
Nidradhikya	A	45	0.96	0.51	0.311	32.39	0.695	0.104	2.596	0.011	<0.05
	B	45	0.75	0.20	0.311	41.47	0.405	0.060	2.596	0.011	< 0.05
Thirst (Ati Pipasa)	A	45	0.78	0.22	0.067	8.58	0.471	0.070	0.749	0.456	> 0.05
	B	45	0.98	0.16	0.067	6.83	0.367	0.055	0.749	0.456	>0.05
Burning sensation (Daha)	A	45	0.24	0.02	0.022	8.14	0.149	0.022	0.582	0.562	>0.05
	B	45	0.27	0.04	0.022	8.14	0.208	0.031	0.582	0.562	>0.05
Shortness of Breath (Kshudra Swasa)	A	45	0.22	0.23	0.156	70.97	0.344	0.104	0.051	2.602	<0.05
	B	45	0.20	0.15	0.156	78	0.001	0.060	0.001	2.602	<0.05
Pain in knee joints (Janu Sandhi Shoola)	A	45	1.42	0.91	0.378	26.61	0.996	0.148	2.120	0.011	<0.05
	B	45	1.18	0.53	0.378	32.03	0.661	0.098	2.120	0.013	<0.05

Group A - *Bilwadi Panchamula* decoction only

Group B - Both *Bilwadi Panchamula* and *Suryanamas-kara*

When comparing and analyzed post data of Group A and Group B it was observed that improvement of mean value of *Sphik Chalata* reduced from (1.27 to 0.51), mean value of *Sthana Chalata* reduced from (1.96 to 1.58), mean value of *Udara Chalata* reduced from (1.93 to 1.58),

The mean value of movements of cheek reduced from (2.02 to 1.58), the mean value of movement of thigh reduced from (1.91 to 1.47). It has given relief in *Spik Chalata* 47.48%, *Sthana Chalata* 47.84%, *Udara Chalata* 43.67%, movements of cheeks 42.21% and movement of thigh 48.37% as observed. In which *Spik Chalata, Stana Chalata, Udara Chalata,* movement of cheeks, and movements of thigh were statistically highly significant ($p < 0.001$).

Also, mean value of *Ayasena Swasa* reduced from (0.52 to 0.20), mean value of *Daurbalya* has reduced from (0.49 to 0.22), mean value of *Swedhadhikya* reduced from (0.49 to 0.22), mean value of *Nidradhikya* reduced from (0.51 to 0.20), *Kshudra Swasa* from (0.23 to 0.15) and mean value of *Janu Sandhi Shoola* has reduced from (0.91to 0.53). It has given relief in *Ayasena Swasa* 34.94%, *Daurbalya* 24.95%, *Swedhadhikya* 25.42%, *Nidradhikaya* 41.47%, *Kshudra Swasa 78%* and *Janu Sandhi Shoola* 32.03% have observed. In *Ayasena Swasa, Daurbalya, Swedhadhikya* and *Nidradhikya, Kshudra Swasa* and *Janu Sandhi Shoola* were statistically significant ($p < 0.05$).

But the mean value of the post data in *Ati Pipasa* and *Daha* were not improved as such and it was statistically insignificant (p value > 0.05).

Table 12: Shows the Comparative effect of both therapies in Group- A (n=45) and Group B (n=45)

Effect of Therapy	Group A (N=45)		Group B (N=45)	
	BT	AT	BT	AT
Normal BMI	0	7 (15.55)	0	12 (26.67)
Overweight	19 (42.22)	23 (51.11)	16 (35.55)	14 (31.11)
Obese	26 (57.77)	15 (33.34)	29 (64.44)	19 (42.22)
Total	45 (%)	45 (%)	45 (%)	45 (%)

Group A - *Bilwadi Panchamula* decoction only

Group B - Both *Bilwadi Panchamula* and *Suryana-maskara*

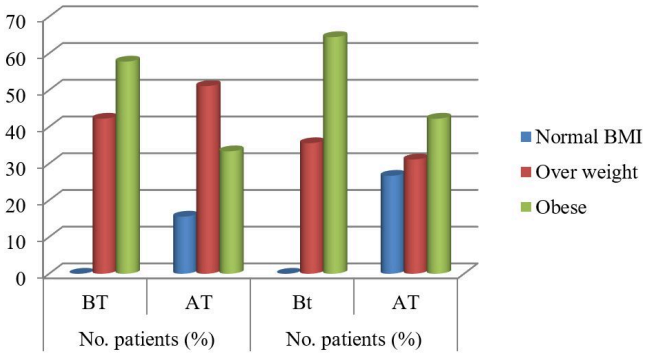

Figure 2: Shows the changes in the overall improvement in BMI in Group A and Group B.

The overall effects of therapy indicate that markedly improved 26.67% of Group B while 15.55% of Group A improved from the BMI in the normal range. Also indicates that moderately improved in 42.22% of Group B while 33.34% of Group A was giving the improvement of BMI in reducing the percentage of Obesity patients.

Discussion

Effect of *Bilwadi Panchamula* decoction on *Athisthaulya*

Shodhana and *Shamana* are the therapies that have been recommended for *Athisthaulya* in Ayurvedic texts. The *Dravya*, which are with *Katu, Tikta*, and *Kashaya Rasa* and also with *Ushna Ruksha Guna* help to the remove *Kapaha* and *Meda*. The roots of these drugs in *Bilwadi Panchamula* have the action of *Tridosagna*, *Kapaha Vata Samana Deepana Guna*, and *Makshika* (Bee honey) also with *Tridosaghna* and *Kapha Pitta Shamaka.*

Phytochemicals that are contained in these roots such as Flavonoids, Alkaloids, and tannins also effect on reduction of adipose tissue which is the main physiological factor of *Athisthaulya*. Because of these actions of the drug, it has increased *Agni* and reduced *Kapha* and *Meda* to reduce weight, Body mass index, and waist circumference remarkably except in the mid-upper arm circumference.

A similar study has given different results on mid-upper arm circumference due to the duration of the intervention being much longer than this study.**[16]**

Most of the symptoms occur due to the *Athisthaulya* which is *Chalata* of *Spik*, *Uadara*, and *Stana*, movement of cheeks and thigh, *Ayasena Swwasa, Daurbalya*, *Swedhadhikaya, Nidradhikya, Ati Pipasa, Kshudra Swasa* and *Janu Sandhi Shoola* has improved by the *Bilwadhi Panchamula* decoction. Also, the total triglyceride level was remarkably reduced.

All these objective parameters, subjective parameters, and biochemical parameters are statistically highly significant ($p<0.001$) except mid-upper arm circumference ($p >0.05$).

Effect of *Bilwadi Panchamula* decoction along with practicing *Suryanamasakara* on *Athisthaulya*

Suryanamaskaraya regulates the endocrine system of the body by stimulating the pancreas, thyroid, and pituitary gland.**[17]** As a result, it was observed that when practicing *Suryanamaskar* along with *Bilwadi Panchamula* decoction has a statistically highly significant effect on weight, Body mass index, waist circumference, mid-upper arm circumference, and total cholesterol level ($p< 0.001$).

A similar study done by Rameswar Pal, Sobika Rao at el, 2024 and a study done by Dr.Sarvesh Kumar, Dr.Kirti R et al. have found less improvement than this study when only practicing *Suryanamaskara* for obesity patients (p<0.006).**[18,19]**

In this study, it has observed that there is a highly significant effect on subjective parameters such as *Sphik Chalata*, *Sthana Chalata*, *Udara Chalata,* movement of thigh and cheeks, *Ayasena Swasa*, *Alpa Vyayama*, *Swedadhikya*, *Nidradhikya*, *Ati Pipasa*, *Daha*, *Kshudra Swasa* and *Janusandhi Shoola* (p < 0.001).

In this study, intergroup comparison of effects of test- -therapies *Bilwadi Panchamula* decoction in Group A and *Bilwadi Panchamula decoction* along with *Suryanamasakara* in Group B on overall improvement in objective parameters of *Athisthaulya* showed that there is a significant difference in between these two therapies (p<0.05) except mid-upper arm circumference (p> 0.05).

Likewise, the biochemical effect of total cholesterol between the two groups' observation showed highly significant improvement (p<0.001) by giving relief from 7.6% in group B. Intergroup comparisons of subjective parameters in Group A and Group B as *Sphik Chalata, Sthana Chalata*, *Udara Chalata,* movements of cheek, and movement of thigh were found that statistically highly significant (p< 0.001) by giving relief in 47.48%, 47.84%, 43.67%, 42.21% and 42.21% respectively in group B.

Comparison of subjective parameters such as *Ayasena Swasa*, *Daurbalya, Swedadhikya, Nidradhikya,* and *Janu Sandhi Shoola* found statistically significant differences between these two therapies (p <0.05).

In group B, it has given relief of *Ayasens Swasa, Alpa Vyayama, Swedadhikya, Nidradhikya, Kshudra Swasa* and *Jani Sandhi Shoola* in 34.94%, 24.95%, 25.42%. 41.47%, 78%, and 32.03% respectively. However, in complaints of *Ati Pipasa* and *Daha* was found no significant difference between these two therapies (p> 0.05).

On comparing the effect of the two therapies it can be concluded that *Bilwadhi Panchamula* decoction along with practicing *Suryanamasakara* provides significantly better relief than the therapy of *Bilwadi Panchamula* decoction only in most of the signs and symptoms of *Athisthaulya*.

Conclusion

Analyzing the data of the obesity prevalence study it has proved that the obesity prevalence is high among the age group between 51-60 years. Also, the obesity prevalence was high among the female respondents, educational level ordinary level, teachers and housewives, and those who were living in suburban areas. It has revealed that there is a relationship between BMI with age group, educational level, and residential area.

After analyzing the observations and results, it has been found that the administration of *Bilwadhi Panchamula* is effective in *Athisthaulya* or obesity. The mean Weight, Body mass index, Waist circumference, and Total cholesterol were reduced which was statistically highly significant (p<0.001) mid upper arm circumference was statistically insignificant. The improvement in subjective parameters of *Athisthaulya* as *Spik Chalata, Stana Chalata, Udara Chalata*, movement of cheeks and thighs, *Ayasena Swasa, Alpa Vyayama, Sweda Adhikya, Nidra Adhikya, Ati Pipasa Daha, Kshudra Swasa* and *Janu Sandhi Shoola* were statistically highly significant.

Also, administration of *Bilwadhi Panchamula* along with *Suryanamaskara* was statistically highly significant in reducing weight, Body mass index, and waist circumference in mid-upper arm circumference. As well as improvement of subjective parameters of *Athisthaulya* as *Spik Chalata, Stana Chalata, Udara Chalata*, movement of cheeks and thighs, *Ayasena Swasa, Alpa Vyayama, Sweda Adhikya, Nidra Adhikya, Ati Pipasa Daha, Kshudra Swasa* and *Janu Sandhi Shoola* were statistically highly significant.

When comparing the effect of administration of *Bilwadhi Panchamula* only and *Bilwadi panchamula* along with *Suryanamaskara* the *Bilwadi Panchamula* along with *Suryanamaskara* was highly significant in the reduction of weight, Body mass index, weight circumference, and total cholesterol level except for mid-upper arm circumference (p<0.001), It was highly significant in *Spik Chalata, Stana Chalata, Udara Chalata*, movement of cheeks and thighs, and it was significant in the reduction of *Ayasena Swasa, Alpa Vyayama, Sweda Adhikya, Nidra Adhikya, Kshudra Swas and Janu Sandhi Shoola .* But in *Ati Pipasa* and *Daha,* it was statistically insignificant.

After analyzing all observations and results, it can be concluded that the one-month regular use of *Bilwadhi Panchamula* decoction along with *Suryanamaskara* had better effect as compared to the use of *Bilwadhi Panchamula* decoction only.

Recommendation

Following recommendations at the ministry level including in policy-making

1. Urgent Public health interventions are needed to control the obesity prevalence at an early stage.
2. Yoga practice should start in school as two periods at least per week
3. Promote Yoga practice in Government offices as morning session for a ½ hour as a daily routine part in their working set up.
4. As well as promote *Yoga* among private workers as a daily routine in their working setup

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