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EFFECT OF GARLIC POWDER CONSUMPTION ON BODY COMPOSITION OF POSTMENOPAUSAL WOMEN IN BANGALORE

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Abstract

Postmenopausal women are usually troubled by increasing weight and waist circumference caused by obesity and androidal fat redistribution. The deleterious health consequences of obesity and visceral fat deposition after middle age encompass a variety of problems. Results from experimental studies have shown that garlic (*Allium sativum* L.) can reduce body weight and body fat mass. However, the effect of garlic on body fat mass and weight in the human population, which is addressed in this study, is still obscure. **Objective** : Aim of the study was to find out the effect of garlic on the body composition of postmenopausal women in Bangalore **Method:** In this clinical trial 180 respondents willing to participate in intervention programme, who met inclusion criteria, were divided into three groups, control (n=60), Exp-I (garlic eaters n=60) and Exp-II (non-garlic eaters n=60). 500 mg of dry garlic powder capsules two per day were given to the respondents for 12 weeks. Body composition was measured by bioelectrical impedance before and after the study. **Results**: Mean age of the respondents was found to be (53. 6±0.89)years. Higher percent of the study population were in obese category (80%) with mean BMI (30.14 ± 2.8), W/H (0.834 ± 0.07), Body fat (41.7± 3.83%), Muscle mass (23.82± 2.82%), Visceral fat level (11.66±1.82). Significant reduction in body fat (-2.93%) and visceral fat levels (-1.66) and increase in muscle mass (+1.53%) was observed in post test compare to pretest of experimental groups (p-value <0.001), irrespective of garlic eater and non-garlic eaters. However, changes in body composition of control group was found to be non-significant. **Conclusion:** It can be concluded that prevalence of Obesity, Central obesity is high among postmenopausal women. Significant improvement in the body composition observed with garlic intervention.

Keywords:

Postmenopausal women,
visceral fat,
body fat,
Obesity,
Garlic.

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1. Introduction

Postmenopausal women are usually troubled by increasing weight and waist circumference caused by obesity and androidal fat redistribution. This is mostly attributed to estrogen depletion though other factors such as chronological aging and decline in physical activity play a significant role. The deleterious health consequences of obesity and visceral fat deposition after middle age encompass a variety of problems; from dyslipidemia and metabolic syndrome to increased risk of cardiovascular disease (CVD), osteoporosis,

malignancies and mortality. With the increase in life expectancy resulting in women living one half to one third of their lives after menopause, Various strategies including lifestyle modifications (caloric restriction, physical increasing), anti-obesity medication, and bariatric surgery are used for weight loss. Nonetheless, sometimes weight loss is not achievable without using dietary supplements. Garlic (*Allium sativum* L.) has been used as food and medicinal plant in many countries and cultures for thousands of years. Garlic contains many organosulfur compounds that its biological activities are attributed to them. Evidence from cellular and animal studies suggested that garlic can exert anti-obesity properties. However, the anti-obesity effect of garlic in the human population is still obscure. This clinical trial was performed to determine the effect of garlic supplementation on body composition among healthy postmenopausal women .

2. Research Method

In this clinical trial 180 respondents willing to participate in intervention programme, who met inclusion criteria, were divided into three groups, control (n=60), Exp-I (garlic eaters n=60) and Exp-II (non-garlic eaters n=60) depicted in figure-1. All women with a cardiovascular, renal, liver, and other endocrine or metabolic disorders that might affect lipid metabolism were excluded from the study. None of them were on hormonal contraception, or taking medications which are known to interfere with lipid metabolism at the time of participation. Informed consent was taken from the study population. Women were evaluated in the morning after 12-14 hours fast. The investigator performed all evaluations. In the evaluation the investigator used a pre coded questionnaire including a full clinical history, socio-economic and personal information, dietary habits, a complete history of weight variations during the subject life. Anthropometric measurements were obtained. Height (in cm.) and weight (in kg.) were recorded and body mass index was calculated. waist (in cm), hip (in cm) were recorded and waist hip ratio was calculated. 500 mg of dry garlic powder capsules two per day were given to the respondents for 12 weeks along with individual dietary counseling. Dry garlic poweder capsules were prepared using standard procedures and anlysed using standard methods depicted in figure-2. Body composition was measured by bioelectrical impedance before and after the study shown in figure-3. Results were expressed as mean +SD or as percentage, as suitable. The significance of comparisons was tested using chi-square, t-test test as appropriate.

3. Results and Analysis

The data in table-1 depicts the profile of subjects based on their personal and related characteristics. The results portraits that majority of the respondents were in the age group between 53-55 years in control and experimental group. Majority of the study population were Hindus, followed by Muslims and Christians in control group, whereas experimental -1 (garlic eaters), Maximum percentage were Muslims followed by Christian and in experimental -II (non-garlic eaters) all are from Hindu community. Most of the respondents were married, graduates and employed in all the groups. The results subjected to analysis indicate that the percentage response between sample groups with respect to age, education, occupation, marital status were found to be non-significant, except for religion which was found to be highly significant. Since respondents require for experimental group II are non- garlic eaters which are mainly from Hindu sub -community where use of raw garlic is limited for ritual propose.

Nutrient intake of the respondents

The table -2 depicts the Macronutrient intake of the experimental groups in the pre and post test. The results revealed that the Energy, Total fat intake in pre test was higher than the recommended values which was statistically significant, whereas intake of Proteins was lower. In post test intake of macronutrients was as per the recommendations in all the groups, which was statistically non-significant.

Anthropometric status

Table-3 indicates the group wise mean pre and post test BMI of the respondents. The result indicates that the post test BMI values were found to be comparatively decreased than pre test BMI values among non-garlic eater(Exp-II) and garlic eater group(Exp-I) than control group. The statistical result established the high significant difference between pre and post test among non-garlic and garlic eater group ($p<0.01$) and non significance in control group. The change in BMI values in the experimental group post test can be attributed to the intervention programme.

In the current study, majority of the respondents were in obese grade -I category in pretest in all groups, after intervention higher percent among them (32 to 43%) lost weight and came in pre- obese category from experimental groups, the results also revealed to be highly significant at 5% level for experimental group irrespective of garlic eater and non-garlic eater, whereas in the control group the results showed reduction in weight of Obese respondents but the statistical results revealed to be non-significant.

A garlic-derived organosulfur, 1,2-vinyldithiin, has been reported to reduce lipid accumulation by decreasing the expression of C/EBPα, PPARγ2, and LPL and the activity of PPARγ in human adipocytes (Keophiphath M, et al., 2009). This could be the reason for more reduction in BMI in experimental group

compare to Control group which was on calorie control diet. This indicates diet along with garlic supplement has significant effect on reducing weight.

A 2012 study examined the effects of garlic and exercise on cardiovascular disease (CVD) risk for 30 Korean women. Researchers were particularly interested in how garlic may affect weight. Their findings showed that the group of women who received 12 weeks of treatment with garlic (along with a regimen of regular exercise) experienced significant reductions in both body weight and body fat. (Dae Yun Seo, et al., 2012).

The pre and post waist, hip measurements and waist/hip ratio of the respondents is presented in the table-5. The post test results indicate a mean reduction in the waist and hip circumference 3-3.5 cm in the experimental group and 1-1.5cm in the control group. The reduction in the circumference of waist and hip was highly significant in experimental group (t=7.44** -12.41**) and the reduction in control group was non-significant ($t=1.97^{NS}$-1.84^{NS}) . The mean difference in the waist/hip ratio was higher in the experimental groups as compared to the control group and the difference was found to be highly significant at 1 % level.

There are important limitations in using BMI as a measure of obesity because BMI does not discriminate fat from lean mass or abdominal from gluteofemoral fat, both of which have different health implications (James R. Cerhan, et al., 2014). Abdominal obesity, also known as beer belly or clinically as central obesity, is excessive abdominal fat around the stomach and abdomen has built up to the extent that it is likely to have a negative impact on health. There is a strong correlation between central obesity and cardiovascular disease (James R. Cerhan, et al., 2014).

The pre and post body composition analysis of the respondents is presented in table- 6. The findings in the table show that there was a significant reduction observed in body fat percentage and visceral fat levels in post test compare to pretest of experimental groups irrespective of garlic eater and non-garlic eaters whereas reduction in control group was found to be non-significant. However, increase in muscle mass percentage was observed in post test compare to pretest in the experimental groups and the statistical analysis reveals the existence of highly significant difference in experimental groups irrespective of garlic eaters and non-garlic eaters and non-significance in control group.

IDF (2010) Manual reported that, Muscle mass indicates the weight of muscle in the body, Muscle play an important role as they act as an engine in consuming energy. As muscle mass increases, there is an increase in energy consumption helping to reduce excess body fat levels and lose weight in a healthy way. In the current study it was an interesting results with body fat percentage which showed an decrease in the post test along with an increase level of muscle mass.

Visceral fat is the fat that is in the internal abdominal cavity, surrounding the vital organs in the trunk (abdominal) area. (Wang, et al., 2004) study reported that even the distribution of fat changes and is more likely to shift to the trunk area specially with menopause. Ensuring to have healthy levels of visceral fat, may reduce the risk of certain diseases such as heart disease, high blood pressure.

Rating from 1 to 9, indicates to have healthy level of visceral fat. Rating from 10 to 59, indicates to have an excess level of visceral fat. (Wang, et al., 2004)

The present study is in accordance with the above study wherein there was reduction in visceral fat level of the respondents from experimental groups. This may be a preventing factor for the occurrence of other degenerative diseases such as diabetes, cardiovascular disorder and hypertension among the respondents in their later life.

Similar results seen in a clinical trial, 110 subjects, the intervention group received two garlic tablets (containing 400 mg of garlic powder) daily while the control group received placebo tablets. Results revealed that in the intervention group, significant reductions were observed in body weight and body fat mass ($P < 0.05$), conducted by (Davood Soleimani, et al., 2016).

The anti-obesity action associated with garlic may refer to its thermogenic properties. In support to this suggestion, it has been reported that garlic and its derivatives increased the oxygen consumption. Several points should be considered as strengths of the results obtained such as low calorie diet, equal macro and micronutrient distribution between two groups, high compliance rate among the respondents in completing the study, and adequate sample size and study duration. Indicates balance diet along with garlic supplement has greater impact on body weight and composition.

4. Conclusion

It can be concluded that prevalence of Obesity, Central obesity is high among postmenopausal women. This study demonstrated that a 12-week garlic supplementation could decrease body fat mass and visceral fat level and increase in muscle mass among postmenopausal women . Therefore, garlic may reduce the amount of fat in the body. Further studies with stronger design, longer periods are necessary.

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TABLES

Tables

Table -1: Personal Characteristics of Respondents (n=180)

Characteristics	Category	Respondents						χ^2 Test
		Control (n=60)		Exp-I (n=60)		Exp-II (n=60)		
		N	%	N	%	N	%	
Age	51-52.9	10	16.7	15	25	10	16.7	2.86^{NS}
	53-54.9	48	80	41	68.3	46	76.7	
	55-56.9	2	3.3	4	6.7	4	6.6	
Religion	Hindu	27	45	0	0	60	100	120.72*
	Muslim	20	33.3	34	56.7	0	0.0	
	Christian	13	21.7	26	43.3	0	0.0	
Education	Primary	1	1.7	4	6.7	0	0.0	11.73^{NS}
	High sec/PUC	5	8.3	8	13.3	2	3.3	
	Graduate	39	65.0	33	55.0	35	58.3	
	Post graduate	15	25.0	15	25.0	23	38.3	
Current occupation	Not working	8	13.3	15	25.0	6	10.0	12.50^{NS}
	Office assistant	24	40.0	20	33.3	27	45.0	
	Teacher	23	38.3	22	36.7	16	26.7	
	Any other	5	8.3	3	5.0	11	18.3	
Marital Status	Married	48	80.0	45	75.0	59	98.3	15.25^{NS}
	Unmarried	6	10.0	9	15.0	0	0.0	
	Widow	3	5.0	2	3.3	1	1.7	
	Divorcee	3	5.0	4	6.7	0	0.0	

^{NS}:Non-Significant ***: Significant at 5% level**

Note: Exp-I group (garlic eaters) & Exp-II group (non-garlic eaters)

Table:- 2 Macronutrient intake of the respondents (n=180)

Groups	Energy (Kcals)					't' Test	
	Pre test		Post test		Recommended	Post test to Recommended	Pre test to post test
	Mean	SD	Mean	SD			
Control	1857.7	74.2	1756.2	28.5	1751.3	1.95^{NS}	6.04*
Exp-I	1859.6	81.3	1748.9	28.1	1737.4	1.40^{NS}	5.54*
Exp-II	1861.5	64.3	1750.3	32.8	1744.8	1.51^{NS}	3.22*
	Proteins (gms)						
Control	55.8	3.2	78.2	6.4	78.8	1.17^{NS}	7.84*
Exp-I	55.6	1.2	75.8	7.4	76.3	1.16^{NS}	6.44*
Exp-II	55.7	0.9	73.5	5.0	74.1	1.19^{NS}	6.85*
	Fats (g)- Total Fat (gms)						
Control	57.4	6.0	39.3	1.9	38.9	1.36^{NS}	8.29*
Exp-I	57.1	6.6	38.9	0.9	39.6	1.93^{NS}	8.36*
Exp-II	58.5	6.5	39.1	1.1	38.7	1.58^{NS}	3.18*

^{NS}:Non-Significant ***: Significant at 5% level**

Table: 3 -Group wise Body Mass Index (BMI) Of the Respondents

Groups	Sample	Body Mass Index						Paired 't' Test
		Pre test		Post test		Difference		
		Mean	SD	Mean	SD	Mean	SD	
Control	**60**	29.64	2.8	29.43	2.6	0.21	2.2	**0.717NS (p=0.476)**
Exp-I	**60**	30.0	3.2	29.0	2.9	0.97	2.4	**3.032* (P=0.004)**
Exp-II	**60**	30.8	2.4	29.1	2.3	1.66	0.37	**33.86** (P=0.000)**
F-Test		2.65NS		5.68*				

NS:Non-Significant *: Significant at 5% level **: Significant at 1% level (59df,p-value <0.001)

Table:4 BMI Classification of the Respondents (n=180)

Groups	Sample (n)	Body Mass Index (BMI)								χ^2 Test
		Pre test(%)				Post test(%)				
		Over wt	Pre Obese	Obese-I	Obese-II	Over wt	Pre Obese	Obese-I	Obese-II	
Control	60	3.3	15.0	80.0	1.7	1.7	26.7	71.7	0.0	1.482^{NS}
Exp-I	60	3.3	16.7	73.3	6.3	5.0	53.3	41.7	0.0	5.467*
Exp-II	60	1.7	6.7	86.7	5.0	5.0	51.7	43.3	0.0	10.90*

NS:Non-Significant *: Significant at 5% level

Table: - 5 Waist Hip Ratio of the respondents (n=180)

Aspects	Groups	Sample	Measurement						Paired 't' Test
			Pre test		Post test		Difference		
			Mean	SD	Mean	SD	Mean	SD	
Waist (cms)	Control	60	95.76	8.19	94.80	8.11	0.95	0.08	1.97^{NS}
	Exp-I	60	99.55	9.92	96.56	9.62	2.98	0.29	7.77 **
	Exp-II	60	100.18	10.4	96.67	10.05	3.50	0.36	7.44**
Hip (cms)	Control	60	114.90	7.04	113.3	6.67	1.55	1.11	1.84^{NS}
	Exp-I	60	114.10	7.14	111.24	6.97	2.85	0.17	12.3**
	Exp-II	60	115.26	7.19	111.80	6.98	3.45	0.21	12.41**
Waist /hip Ratio	Control	60	0.833	0.053	0.830	0.052	0.003	0.008	0.01^{NS}
	Exp-I	60	0.882	0.078	0.800	0.079	0.082	0.009	4.63**
	Exp-II	60	0.871	0.081	0.810	0.081	0.061	0.007	6.71**

NS:Non-Significant **: Significant at 1% level (59df,p-value <0.001)

Table: 6 Body composition of the Respondents (n=180)

Groups	Sample	Body fat (%)						Paired 't' Test
		Pre test		Post test		Difference		
		Mean	SD	Mean	SD	Mean	SD	
Control	**60**	39.41	4.0	38.7	3.4	0.71	1.1	**1.46^{NS}**
Exp-I	**60**	43.73	3.9	40.00	4.4	1.73	1.38	**9.67****
Exp-II	**60**	42.03	3.6	39.10	3.3	2.93	1.26	**8.02****
		Muscle mass (%)						
Control	**60**	23.95	3.49	24.13	3.39	0.31	0.05	**1.28^{NS}**
Exp-I	**60**	23.73	2.53	24.85	2.29	1.11	1.18	**7.32****
Exp-II	**60**	23.78	2.45	25.31	2.03	1.53	1.15	**10.2****
		Visceral Fat level						
Control	**60**	11.62	1.71	11.31	1.17	0.31	1.01	**1.14^{NS}**
Exp-I	**60**	11.48	2.07	10.06	1.32	1.41	1.18	**9.27****
Exp-II	**60**	11.9	1.7	10.23	1.16	1.66	1.03	**12.4****

^{NS}:Non-Significant ****: Significant at 1% level (59df,p-value <0.001)**

FIGURE CAPTIONS

Fig-1 Methodology Phase-I

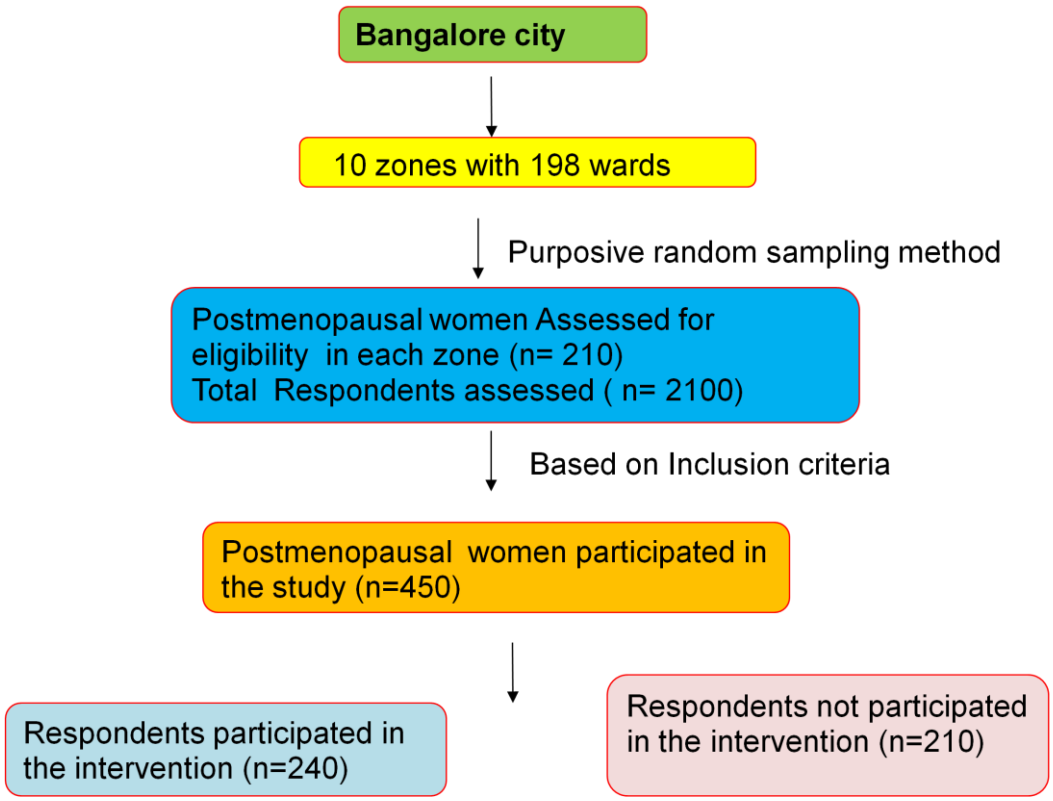


Figure-2 Development of dry garlic powder

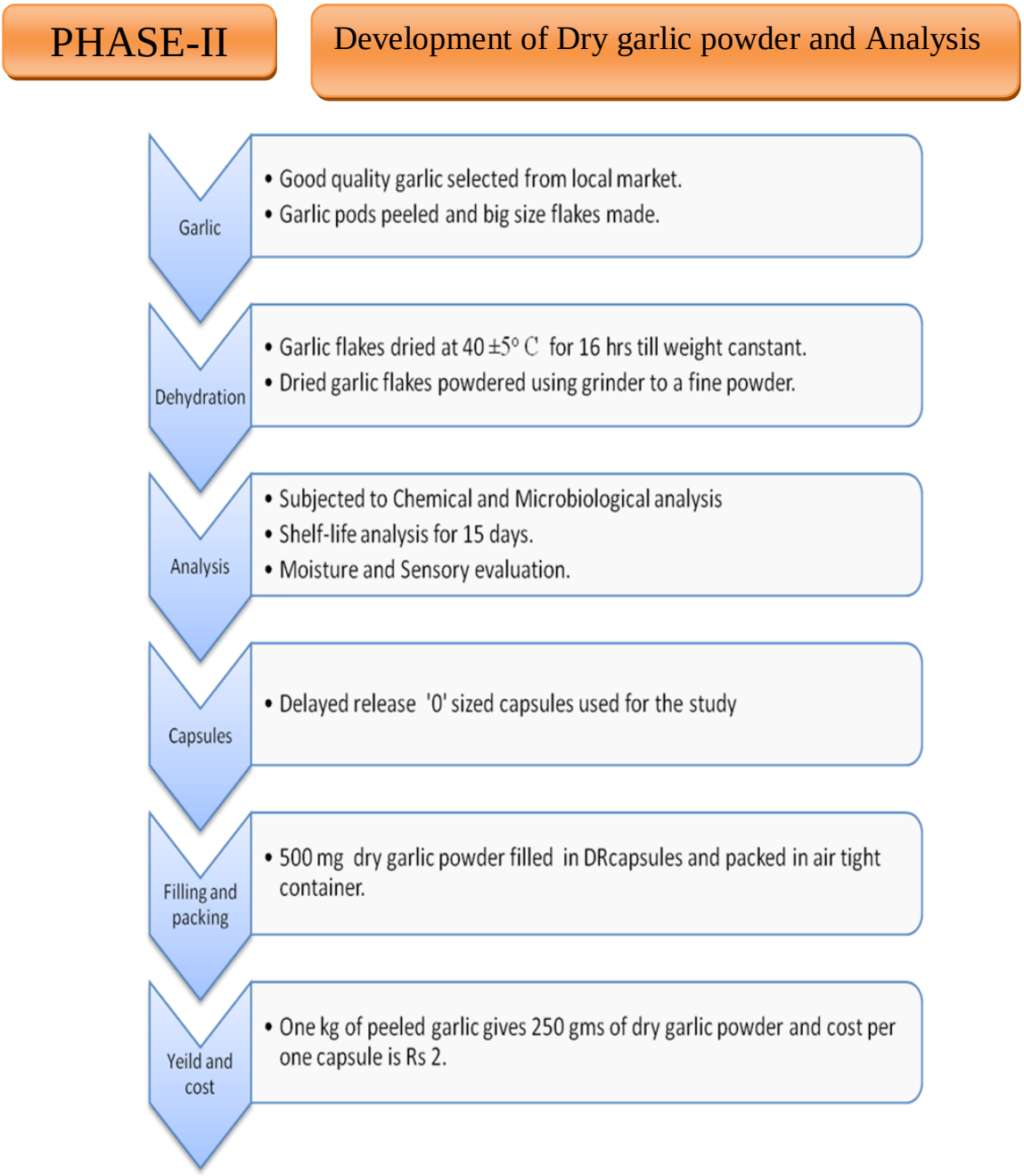
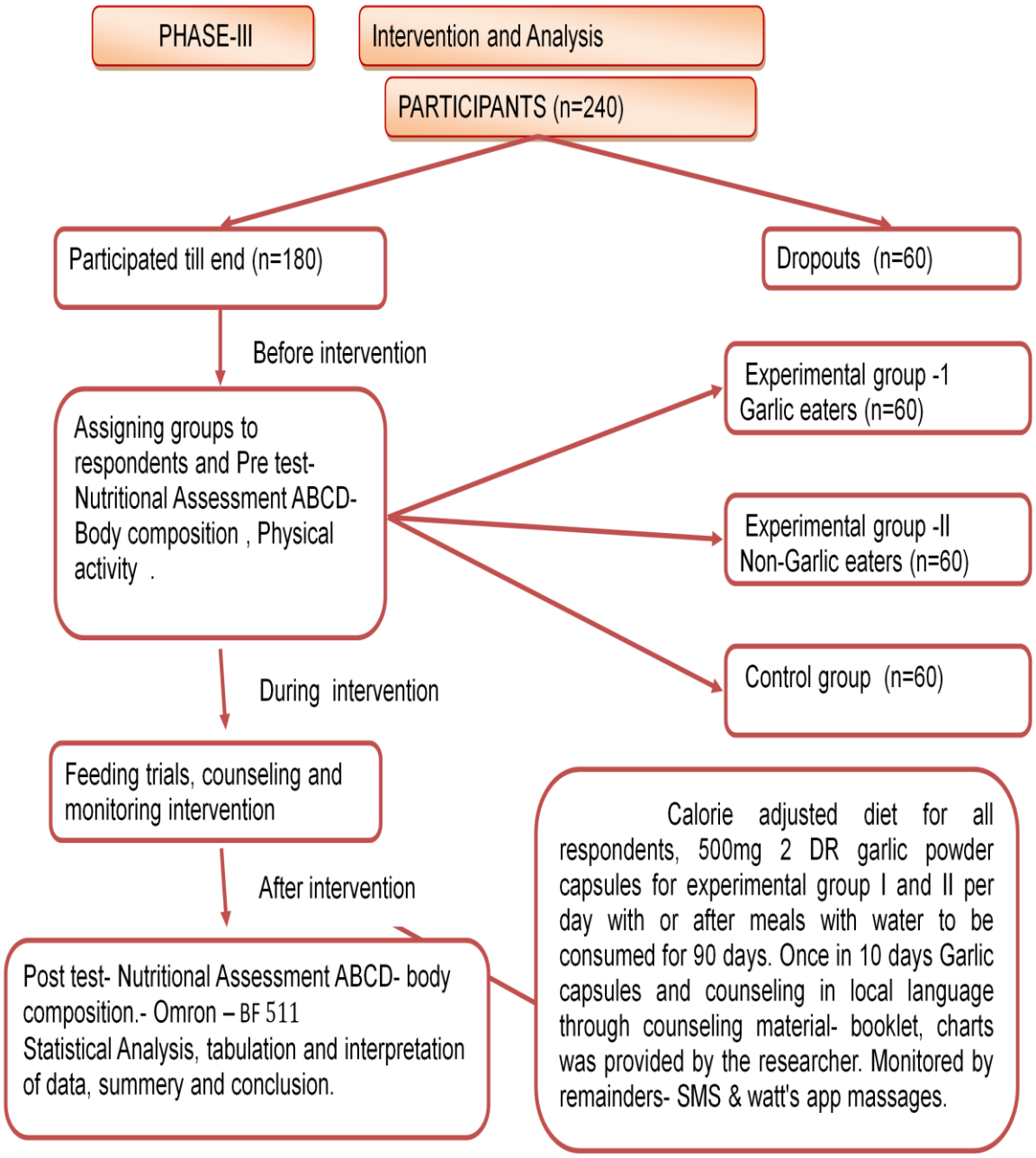


Fig-3 Intervention and Analysis


PHASE-III
Intervention and Analysis
PARTICIPANTS (n=240)
Participated till end (n=180)
Dropouts (n=60)
Before intervention
Assigning groups to respondents and Pre test- Nutritional Assessment ABCD- Body composition , Physical activity .
Experimental group -1 Garlic eaters (n=60)
Experimental group -II Non-Garlic eaters (n=60)
Control group (n=60)
During intervention
Feeding trials, counseling and monitoring intervention
After intervention
Post test- Nutritional Assessment ABCD- body composition.- Omron – BF 511
Statistical Analysis, tabulation and interpretation of data, summery and conclusion.
Calorie adjusted diet for all respondents, 500mg 2 DR garlic powder capsules for experimental group I and II per day with or after meals with water to be consumed for 90 days. Once in 10 days Garlic capsules and counseling in local language through counseling material- booklet, charts was provided by the researcher. Monitored by remainders- SMS & watt's app massages.