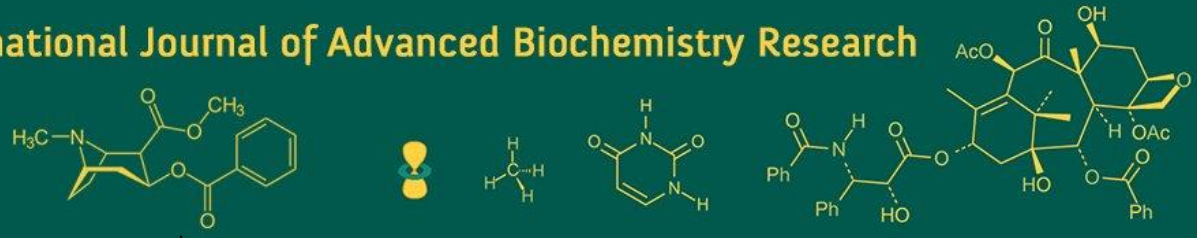
International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; 8(8): 427-431
www.biochemjournal.com
Received: 21-05-2024
Accepted: 26-06-2024

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Effect of vitamin C supplementation on anthropometric measurement and lipid profile indices in obese female

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DOI: https://doi.org/10.33545/26174693.2024.v8.i8f.1768

Abstract
Obesity is a central health issue due to its epidemic prevalence and its association with type 2 diabetes and other comorbidities. Obesity is not just being overweight. Obesity is a complex, multifractional disorder characterized by an excess of adipose tissue to an extent that health may be adversely affected with hypertension, hypertriglyceridemia, cardiovascular disorder, kidney disorders and diabetes The present study was aimed to analyse the effect of vitamin C intake on anthropometric measurements, lipid profile and atherogenic indices in obese and non obese individuals and to find out the correlation between study variables Antioxidant activity level of guava and amla were 168 and 203. Hence these fruits were selected for supplementation to obese women. Information on socio-economic status, dietary habits, health status and knowledge of the groups regarding the use of vitamin C rich foods were collected from 30 subjects by using the designed questionnaire. Thirty obese women were divided into two groups of fifteen each. Obese women of group one served as control while group two served as the experimental group receiving 100 g of guava and 100 g of amla were given on alternative days for a period of 100 days. The initial bio-chemical parameters like serum cholesterol, triglyceride, HDL, LDL and VLDL of the selected subjects were 209.133, 155.8, 44.66, 131.73 and 31.53 mg/dl respectively. After supplementation of guava and amla the level of serum cholesterol, triglyceride, HDL, LDL and VLDL were 205.86, 147.86, 48.93, 126.86 and 32.46 mg/dl respectively. Long term administration of vitamin C may be helpful for dieticians and clinicians in advising high intake of vitamin C through the diet like amla and guava.

Keywords: Obesity, vitamin c supplementations, anthropometric measurements and lipid profile

Introduction
In recent year obesity has become a public health problem of considerable importance in India and all over the world. In many countries more than half of the population is overweight and levels of obesity are rising rapidly. Recent estimates suggest around 250 million worldwide are obese (Yadav *et al*., 2011) [12]. Obesity is not a disease in itself but it is at the roots of many diseases like high blood pressure, heart trouble, diabetes, kidney trouble, gout and joint pains, stroke, skin diseases and of which some increase the rate of mortality. The more a person's weight, the greater is the risk of his early death (Richman *et al*.,2014) [8]. Obesity with excessive macronutrient intake or over nutrition as its fundamental cause is referred to as a primary obesity while obesity due to other causes is regarded as secondary obesity. The majority of obesity cases are primary and arise from excessive food intake associated with reduced energy expenditure (Mathews *et al*., 2011) [7].
Lalitha *et al.,* (2014) [6] conducted a study on the role of antioxidant vitamins and enzymes in the prevention of exercise induced muscle damage. This study revealed that a growing amount of evidence indicates that free radicals play an important role as mediators of skeletal muscle damage and inflammation after strenuous exercise. Human studies had shown that dietary supplementation with antioxidant vitamins had favorable effects on lipid peroxidation after exercise. In this way the increased oxidative stress induced by exercise was compromised by increased antioxidant activity, preventing lipid peroxidation.

Materials and Methods

Selection of the study area and Selection of respondents

Madurai Agricultural University Campus was selected for conducting the survey on the basis of convenience sampling. The respondents were selected from these quarters in Tamil Nadu Agricultural University Madurai Campus. The respondents were selected from the Madurai Agri Campus Quarters. 30 obese women in the age group of 25-55 years were randomly selected. 15 members were selected for control group and another 15 members were experimental group for this study.

Data collection and feeding trial

The interview schedule was used to collect the information regarding type of family, family size, number of children, educational status, income, lifestyle, health complications and related disease, dietary habits, frequency of food consumption, life style of the respondents, health problems and diseases of the respondents.

100 g of guava and 100 g amla was given an alternate days to the experimental group. For a period of 100 days. The nutritional composition of guava and amla is given below.

Table 1: Nutrient content of vitamin-C rich fruits

S. No	Nutrients	Fruits	
		Guava	Amla
1.	Moisture (g)	81.7	81.8
2.	Energy (k.cal)	51	58
3.	Vitamin C (mg)	212	600
4.	Fibre (g)	5.2	3.4
5.	Calcium (mg)	50	50

Anthropometric measurements

The anthropometric indices used in these analyses were the height, weight and body mass index and waist-hip ratio.

Chemical and biochemical assessment

Antioxidant activity of guava and amla were determined by the method Lipid profile of selected subjects was determined before and after supplementation of fruits.

Estimation of serum lipid levels

The serum lipid profile is useful in determining the amount of different lipids in the blood in order to assess the risk levels of obesity. The following lipids fractions were estimated

- Estimation of cholesterol CHUD-PAD method suggested by Allian 1995 [14]
- Estimation of triglycerides-GPO-1981
- Estimation of HDL using CHOD-PAD method. A high HDL cholesterol levels of considered to be a negative risk factor and low HDL cholesterol is considered to be a positive risk factor.

Results and Discussion

Socio-economic background of the selected obese women

Socio economic background of the 30 selected obese women was collected using an interview schedule. Of the 30 respondents 20 percent were between the age group of 25-35 followed by 50 percent in the age group of 46-55 years and the rest 30 percent in the obese women were illiterate, 30 percent were primary, 13 percent were higher secondary and 26 percent were graduates. Out of the 30 respondents 93 and 7 percent were Hindu and Christians respectively. It was found that majority (62 percent) of the respondents belonged to nuclear family and only 10 percent were in joint families. It was observed that small (2 to 4) and large families (5 to 7) were 80 and 20 percent respectively.

With regard to total income, 43 percent had total monthly income of Rs5000-8000, 50 percent had the income level of Rs3000-5000 and 7 percent had Rs 1000-3000. As the total income of the family increased, the obesity among the women also increased.

Expenditure pattern of the families

Monthly expenditure pattern of the families on food items is reflection of the economic status. Majority of the families (60%) spend Rs 500-1500 of their total monthly income for food, 26.67 percent spend 1501-2500 and 13.33 percent spend 2501-3500. Majority of the families (70%) spend Rs 100-300, 20 percent Rs 300-500 and 10 percent spend Rs 500-1000 of their total monthly income in clothing. 85 percent spend Rs 250-350 of their total monthly income for rent. Majority of the families (53%) spend Rs 100-300 of their total monthly income in education. 26.67 percent spend Rs 300-700. fifty three percent of the families (53.33%) spend Rs 500-700 and 30 percent spend Rs 100-300 for health. Eight seven percent spend Rs 100-300 and 13 percent spend for transport.

Frequency of food consumption

The frequency of food items consumed by the respondents was recorded in order to know the influence of food items on their weight gain. The type of foods and the frequency used had a direct influence on the quantum of nutrient intake of an individual. Cereals being the staple food, were consumed daily by the respondents. The inclusion of rice in the diet was more frequent than other cereals like wheat and ragi. Out of 30 respondents, 82 percent included pulses daily in the diet, 18 percent had pulses on alternate days. Vegetables were used daily by 75 percent of respondents, 25 percent of them included vegetables on alternate days in their meals.

Only 50 percent included fruits daily in their diet, 23 percent respondents had used on alternate days and 20 percent respondents had fruits once in a week and 7 percent respondents did not include fruits in their diet because they were diabetic. Green leafy vegetables, the cheapest and nutritious fibre rich food was used daily by 33 percent of respondents, on alternate days by 34 percent and once in a week by 26.67 percent. Majority of the respondents (97%) used milk and milk products daily.

The majority of the respondents (50%) consumed flesh foods and eggs once in a week, 26.67 percent respondents used in alternate days and 23.33 percent respondents never used flesh foods. 43.34 percent of the respondents consumed sugar daily whereas 40 percent consumed sugar on alternate days, as an attempt to reduce sugar intake for weight reduction. Sixteen percent respondents never used sugar in their daily diet because they were diabetic.

Anthropometric Measurement

In control group, the height of the respondents ranged between 140 to 150 cm for 13.33 percent, while 66.27 percent and 20 percent of the respondents belonged to 151 to 160 cm and 161 to 170 cm respectively. In experimental group the height of the respondents ranged between 140 to 150 cm, 151 to 160 cm, 161 to 170 cm for 20, 73.33 and 6.67 percent respectively. The weight of the respondents in

control group ranged between 60 to 65 kg for 26.67 percent, while 46.67 percent and 26.66 percent of the respondents belonged to 66 to 75 kg and 76 to 85 kg respectively. In experimental group the weight of the respondents ranged between 60 to 65, 66 to 75, 76 to 85 kg for 20, 73.33 and 6.67 percent respectively. The respondents were classified according to the BMI which is shown in table 5. Among the selected respondents 20 percent of them had a BMI ranged between 19 to 24 and 26.67 percent had 25 to 29 followed by 53.33 percent had BMI of 30 to 40. The waist and hip ratio of the respondents in control group was 1.15 in 46.67 percent of the respondents, 1.25, 1.35 and 1.45 in 26.67, 20 and 6.67 percent respectively. In experimental group, the waist and hip ratio ranged between 1.15, 1.25, 1.35 and 1.45 in 60, 20, 13.33 and 6.67 percent of the respondents respectively.

Table 2: Anthropometric Measurement

S. No	Particulars	Number of respondents		Percent of respondents	
		Control group	Experimental group	Control group	Experimental group
1.	**Height (cm)**				
	140-150	2	3	13.33	20.00
	151-160	10	11	66.66	73.33
	161-170	3	1	20.00	6.67
2.	**Weight (kg)**				
	60-65	4	3	26.67	20.00
	66-75	7	11	46.67	73.33
	76-85	4	1	26.66	6.67
3.	**Body mass index (BMI)**				
	Normal (19-24)	3	-	20.00	-
	Grade I obesity (25-29)	4	5	26.67	33.33
	Grade II obesity (30-40)	8	10	53.33	66.67
	Grade III obesity (above 40)	-	-	-	-
4.	**Waist and hip ratio**				
	1.09-1.15	7	9	46.67	60
	1.16-1.25	4	3	26.66	20
	1.26-1.35	3	2	20.00	13.33
	1.36-1.45	1	1	6.67	6.67

Yip *et al*. (2011) [13] revealed that a high waist to hip ratio was associated with a lower risk of severe low back pain.

Reasons, discomforts and health complications of the respondents as reported by respondents

Table 3: Reason for obesity as reported by the respondents

S. No	Reasons	Percent of respondents
1.	Genetics	30
2.	Reduced physical activity	36.67
3.	Excess food intake	33.33
4.	Secondary to a health problem	-

Table 3 depicts the view of the respondents on obesity. When the reasons for obesity were equipped the respondents gave varied answer. 30 percent respondents had the opinion that the cause of their obesity was due to genetics. 33.33 percent reported that the reason for their obesity was due to excess food intake.

Johnson (2007) [4] observed that obesity has a strong genetic component. If one or both parents are obese, obesity risk for children is raised because genes determine one's body shape and to some extent weight. Among the selected respondents, 36.67 percent opined that they were obese because of low physical activity.

Table 4: Discomfort due to obesity as reported by the respondent

S. No	Problems	Percent of respondents
1.	Cannot walk fast	26.67
2.	Cannot climb stair	-
3.	Cannot bend to do work	30
4.	Fast fatigue	-
5.	Breathlessness	43.33

Table 4 gives the details of discomforts felt by the respondents. The respondent's expressed that they had many discomforts due to obesity. 26.67 percent of them expressed that they cannot walk fast and they cannot climb stair. 30 percent of the respondents cannot bend to do work and 43.33 percent respondents had a problem of breathlessness. These discomforts might be the cause for their sedentary life style and vice versa.

Table 5: Health complications due to obesity as reported by the respondents

S. No.	Health complication	Percent of respondents
1.	Hypertension	73.33
2.	Diabetes	26.67
3.	Heart aliment	-
4.	Stroke	-
5.	Cancer	-
6.	Gallstones	-
7.	Gout	-

Table 5 gives the details of health complication of the respondents. The higher number of respondents (73.33 percent) was suffering from hypertension. The increased fat deposition may increase the tension of the blood vessels. 26.67 percent respondents were suffering from diabetes. Yip *et al.,* 2011 [13] reported that obesity is closely associated with increased levels of blood pressure and serum total cholesterol with stroke.

Table 6: Methods used to reduce the weight

S. No	Particulars	Percent of respondents
1.	Diet	50
2.	Exercise	16.67
3.	Yoga	6.67
4.	Walking	13.33
5.	Jogging	-
6.	Did not attempt to reduced weight	13.33

Table 6 depicts the various measures that were followed by the respondents to reduce their weight. 50 percent respondents were on weight reducing diet which is the easiest way to reduce the weight. 16.67 percent respondents were on the exercise, 6.67 percent respondents involved in yoga and 13.33 percent respondents in walking. From the data collected, 13.33 percent respondents did not follow any measure to reduce the weight. The reason might be due to lack of awareness regarding ill effects of obesity.

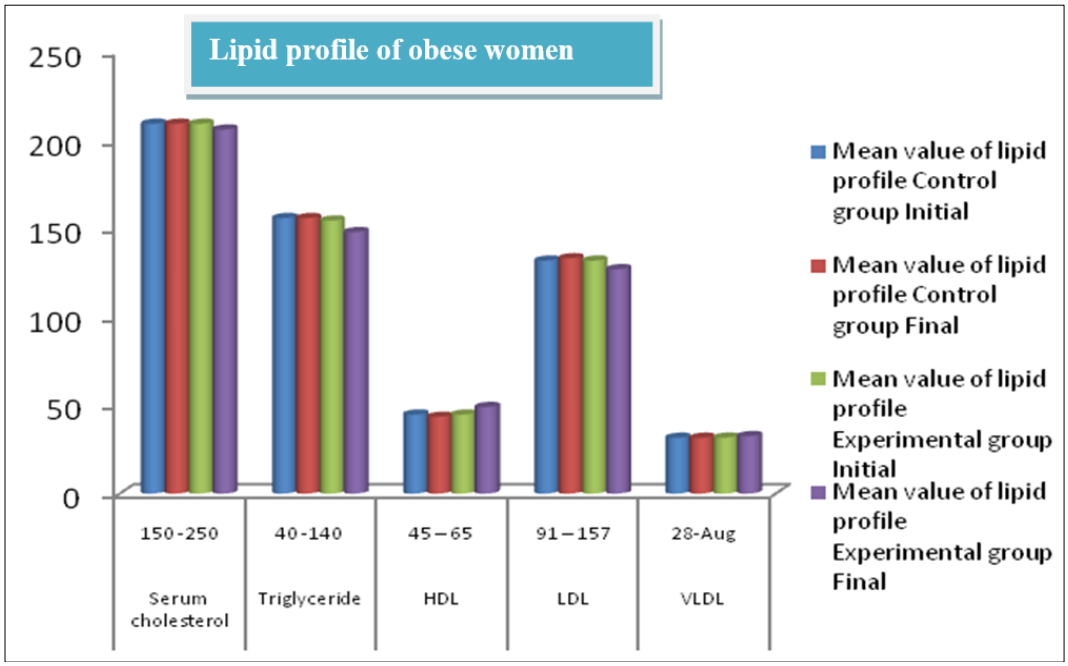
Table 7: Antioxidant activities of selected fruits

S. No	Fruits	Antioxidant activities
1.	Guava	168
2.	Amla	203

Antioxidant activity of guava and amla is represented in table 7. The guava which contains 168 level and amla contain 203 level of antioxidant activity. Hence these fruits were selected for supplementation to obese women.

Lipid profile of obese women

Fig 1 presents the lipid profile of the selected respondents. Among the selected respondents in control group, the lipid fractions were 209.133 mg/dl serum cholesterol, 155.8 mg/dl triglyceride, 44.66 mg/dl HDL, 131.73 mg/dl LDL and 31.53 mg/dl VLDL respectively. Among the selected respondents in experimental group the lipid fractions were initially same in serum cholesterol, triglyceride, HDL, LDL and VLDL in control group. The lipid fractions were finally (after 100 days) decreased in 205.86 mg/dl serum cholesterol, 126.86 mg/dl LDL and the increased from 147.86 mg/dl triglyceride, 48.93 mg/dl HLD and 32.46 mg/dl VLDL respectively. The lipid fractions were higher in triglyceride, HDL and VLDL in experimental group when to control group. There was (triglyceride) changes in the both in control and experimental group which brone the cardiovascular diseases.



HDL-High Density Lipoprotein, LDL-Low Density Lipoprotein, VLDL-Very Low Density Lipoprotein

Fig 1: Lipid profile of obese women

The nutritional status and serum lipid profile of the women before and after nature cure treatment were studied. In the first phase liquid foods providing 408 kcal and 7 g of protein per day were given. The second phase of the diet provided 774 kcal and 28 g of protein, while the third phase diet provided 962 kcal and 38 g of proteins. Analysis of blood for total cholesterol, HDL, LDL and VLDL cholesterol and triglyceride revealed that except for HDL cholesterol, the other values were higher than normal. After nature cure treatment these values had reduced significantly and there was an increase effectively reduced through nature cure treatment along with exercise and proper dietary restriction, thus ensuring better health for individuals (Thilakavathi and Purushothaman, 2002) [9]. Ward (2008) [11] has shown a clean and consistent association between obesity and abnormalities in lipoprotein fractions. These include both increases in VLDL and reduction in HDL which were observed in both men and women. A high production of total body cholesterol in obese subjects leads to a greater production of VLDL. Obesity induces an increase in hepatic lipase in women. Perhaps low estrogen levels would have contributed to the low LDL concentration.

Conclusion

Present study concludes that, daily intake of 1500 mg of vitamin C has positive lowering effect on anthropometric measurements and lipid profile however it is not significantly effective in lowering atherogenic indices in a short span of three months. Among the selected respondents only 10 percent to were in joint family and 90 percent in nuclear family. The total monthly income was high above 8000 for 43.33 percent of the selected respondents. The anthropometric measurement of the selected respondents was found to be slightly higher than experimental group. Reduced physical activity was considered as the major reason for obesity by 36.37 percent of the respondents. The discomforts experienced by the selected women due to

obesity were difficult in walking, climbing stairs, bending to do work and breathlessness. The health complications due to obesity were hypertension (73.33 percent) and diabetes (26.67 percent). Minimum number of selected respondents (13.33 percent) followed walking to reduce the weight. Antioxidant activity of guava and amla fruits contain 168 and 203 percent. Hence, there fruits were selected supplements obese women. The lipid fractions were higher in HDL and VLDL in experimental group when to control group. There was (triglyceride) changes in the both in control and experimental group which brone the cardiovascular diseases. Long-term administration of vitamin C may be helpful for dieticians and clinicians in advising high intake of vitamin C through the diet like amla, guava, citrus fruits etc., in controlling obesity and related disorders.

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