The Effect of Aerobic Exercise with Carnitine Supplement on Reduction of Weight, Blood Pressure and Heart Rate Levels Among Haramaya University Main Campus Undergraduate Students

Tsegaye Belayneh,[1] Negussie Bussa (PhD),[2] Sangeeta Rani (PhD)[3]

[*]Lecturer, Woilta Sodo University, Ethiopia
[**]Assistant Professor, Haramaya University, Haramaya, Ethiopia
[***] Assistant Professor, Haramaya University, Haramaya, Ethiopia

Abstract- The study was designed to investigate the effect of aerobic exercise with carnitine supplementation on reduction of weight, blood pressure and heart rate levels among Haramaya University students subjected to similar intensity, duration, frequency, and type of exercise. Individuals with BMI 25.5 – 30 kg/m2, age 18 - 30 years old, and no impairment or chronic diseases were involved in the study and the training lasted eight weeks. Twenty overweight individuals, 10 male and 10 female were recruited for the study and randomly assigned to control group (CG) and experimental group (EG) with equal number of participants and sex differences. The experimental group participants were supplemented with 2.5 g carnitine at each aerobic exercise sessions. Throughout the training program, measurements were taken at pre training (PT), during training (DT) and post training (PoT) and comparisons were made between pre training (PT) and during training (DT), and again between pre training (PT) and post training (PoT) of male and female participants for both control and experimental groups by using paired sample T test. The measurements taken were reduction in weight, BMI, blood pressure, heart rate, and body circumferences. Finding of this study revealed that aerobic exercise with carnitine supplement resulted in higher reduction of body weight, BMI, blood pressure, heart rate, and body circumferences when compared to aerobic exercise without carnitine supplement. Particularly, the difference between females was higher than males and female EG reduced the higher values on each parameters. Thus, overweighed individuals particularly females are advised to use carnitine to bring about significant changes in body weight, BMI, blood pressure, heart rate and body circumferences levels.

Index Terms- aerobic exercise, blood pressure, BMI, body weight, carnitine, heart rate, overweight.

I. INTRODUCTION

HHealthy life style is the concern of all human beings to live long and healthy. In the civilized societies there is an increased use of technologies that mostly affect the health of society. The use of modern transportation, communication, working system, etc, make more passive and negatively affect the health and fitness of the people (South Australia Department of Health, 2006).

Over weight and/or obesity is the problem that most occur on passive individuals due to less expenditure of the energy intake. The body needs a certain amount of energy (calories) from food to sustain basic life functions. Body weight is maintained when calories eaten equals the number of calories the body expends. When more calories are consumed than burned, energy balance is tipped toward weight gain, overweight, and obesity. Genetic, environment, behavior and socioeconomic factors may all lead to overweight and obesity (U.S. Department of Health and Human Services, 2004). The excess amount of fat in the body has also risk factor on health conditions. Overweight and obesity are risk factors for diabetes, heart disease, high blood pressure and other health problems. Since there is no single cause of all overweight and obesity, there is no single way to prevent or treat overweight and obesity that will help everyone. Once overweight is developed, it is difficult for many patients to achieve. Most of the time peoples are using exercises, diet, behavioral modification and weight loss drugs. In some cases of extreme obesity, surgery may be recommended (U.S. Department of Health and Human Services, 2010). The medications should be combined with nutrition education, behavioral intervention, exercise program and a long-term weight-maintenance plan (Margaret, 2007).

The use of nutritional supplements are being increasing through the world for weight reduction. According to Adele and O'Byrne special report in (2004) among the fifteen expert reviewed top supplements for fat burning and weight loss, L-carnitine is the best and safest supplement for weight and obesity reduction and for our heart to function efficiently especially during exercise (Adele and O'Byrne, 2004).

Carnitine is a quaternary amine (β-hydroxy-γ-N-trimethyammonium butyric acid with-M.W. of 161.2), and is known as a vitamin and amino acid like substance. L-carnitine is a cofactor required for transformation of free long-chain fatty acids into acylcarnitines and for their subsequent transport into the mitochondrial matrix, where they undergo β-oxidation for cellular energy production. Synthetic carnitine occurs as both D and L isomers. However, only L-carnitine is physiologically active. The main function of carnitine in the body is to facilitate lipid oxidation by transporting long-chain fatty acids into the

inner mitochondria region where they undergo β-oxidation(Cha, 2008).

A study done at Nottingham University, UK in (2006) indicated that the body uses carnitine to turn fat into energy. Specifically, carnitine is required for transporting long chain fatty acids and their derivatives into the mitochondria of cells(Stephens *et al*., 2007).

In humans, carnitine is absorbed in the small intestinal mucosa by sodium-dependent active transport and by passive transport. In blood, carnitine does not need protein for a carrier, and is present in the free or acylcarnitine form. Experimental evidence suggests that the transport of long chain fatty acids into the mitochondria is a rate limiting step in fatty acid oxidation. During sustained low to moderate exercise, fatty acid oxidation increases to become the predominant energy source to muscles. The excess availability of carnitine for transport is so important at this time (Stephens *et al*., 2007).

The supplemental carnitine has different benefits for human physiology. Studies have shown the effects of supplementing L-carnitine on reducing obesity, blood glucose, blood pressure and increasing cardiac functions and exercise or specific metabolites performance. According to Flanagan (2010), L-Carnitine supplementation lead to improvements in several complications seen in uremic patients, including cardiac complications, impaired exercise and functional capacities, muscle symptoms, increased symptomatic intradialytic hypotension and erythropoietin-resistant anemia through normalizing the reduced carnitine palmitoyl transferase activity in red cells. However, they have yielded inconsistent results and the usefulness of carnitine as a functional food for weight loss in combination with aerobic exercise remains unknown (Flanagan *et al.*, 2010).

In addition, there are different results of carnitine supplement related to human, particularly for production of energy from long chain fatty acid, for treatment of different diseases, and increasing exercise performance. Mostly the overweight and obese individuals are unable to practice exercise for long duration up to fat burning. There is also absence of best way of treating overweight and/or obesity and very few finding has been done on the interaction of carnitine with aerobic exercise for treatment of overweight and/or obesity, blood pressure and heart rate. Therefore, the purpose of this study is to investigate the effects of aerobic exercise with carnitine supplement on the reduction of weight, blood pressure and heart rate levels among Haramaya University main campus undergraduate students. The students were engaged in similar intensity, duration, frequency and type of exercise with the use of carnitine and without carnitine supplementation. The finding of this study has importance for Ethiopian who are overweight and/or obese to have best way of treatment for the problem.

The general objective was to find out the effects of aerobic exercise with carnitine supplementation on reduction of weight, blood pressure and heart rate levels among Haramaya University main campus undergraduate students. The Specific objectives were to find out the effects of aerobic exercise with carnitine supplement on reduction of weight, to compare the effects that aerobic exercise with carnitine supplement has brought about on reduction of blood pressure and heart rate and to contrast the results that we obtain after supplementing carnitine on reducing weight, blood pressure and heart rate levels of the participants.

II. MATERIAL AND METHODS

The Study Design

The study layout for this study was as the following table;

Table 1. The study design layout

Total sample		
Treatment	Groups	
	Control group (CG)	Experimental group (EG)
Supplement	None	L-carnitine
Type of exercise	Aerobic exercise	Aerobic exercise
Frequency	4days/week	4days/week
Total duration	8 weeks	8 weeks
Duration /session	60 minute	60 minute
Intensity	Low-moderate (40-60%HR_{max})	Low-moderate(40-60%HR_{max})
Exercise days	Monday, Tuesday, Thursday, and Saturday	Monday, Tuesday, Thursday, and Saturday
Time of training	Afternoon (4:30-5:30Pm).	Afternoon (4:30-5:30Pm).

The sample of the study that was selected with purposive sampling based on the criteria was grouped into two by the systematic random grouping method. The two groups were consisted of equal number of male and female. The supplement was figurella L-carnitine and the dose was 2.5gram/session for one subject. The supplement was administered orally in tablet form 15 minute before the training session with a cup of water. The exercise session was started with low intensity for one week for adaptation process and then transit to moderate intensity. Moderate exercise intensity was used for the rest of durations. The feeding habits of subjects were as usual without changing. Under this design the parameters that were studied were BMI (by weight and height), blood pressure and heart rate. The measurement was taken three times in eight weeks. That were before, during (after 4 weeks) and after the experiment.

Sample Size and Sampling Techniques

Purposive sampling technique was used to select the sample with predetermined criteria's of the study. The criteria's were

being free from disability and chronic disease, the age (between 18 and 30 years old), BMI (25.5-30kg/m^2) and the person who were volunteer to participate. Based on the sampling technique and criteria's, 20 participants (men and women) with control group 10 (5 males and 5 females) and experimental group 10 (5 males and 5 females) participants were selected for the study. The two groups were matched by sex only. In the consideration of the age of participants, there was no significant difference between the two groups (22.80 ± 1.93, for experimental and 22.67 ± 1.87 for control group).

Experimental Measurements

The measurement of body height and weight was done using calibrated height-weight digital balance beam scale. The measurements were recorded in meter and kilogram respectively. The weight and height measurements were taken to calculate the percentage of total body weight and height ratio for determination of BMI. Then, it was calculated as the following;
BMI (kg/m^2) = weight (kg) / height (m^2)

Measurement of blood pressure and resting heart rate were taken at the brachial artery of arm by the use of calibrated digital blood pressure-pulse rate monitor. The measurement of exercise heart rate was used to measure the pulse rate of participants after one minute exercise. Body circumference measurement was also to know the fat content of the body.

Materials for Data Collection

The L-carnitine, calibrated balanced beam scale for weight-height measurement, meter for body circumference measurement, and calibrated digital blood pressure-pulse rate monitor were used in this study. The Haramaya University gymnasium and gymnasium materials were also used as the training place and materials for the study respectively.

Method of Data Analysis

The data collected from the study was analyzed using SPSS version 16 software. The paired sample t test was used for the study to compare pre-training, during training and post training measurements of all designed parameters at significance level $p< 0.05$. The comparisons were made between pre-training and during training, and between pre-training and post training.

III. RESULTS AND DISCUSION

Body Height, Body Weight and BMI

Table 2. Mean body height (m), body weight (kg), and BMI (kg/m^2) for control and experimental groups of male and female participants

Sex	Parameters	CG			EG		
		PT	DT	PoT	PT	DT	PoT
Male	Body Height	1.66±0.05	1.66±0.05	1.66±0.05	1.72±0.05	1.72±0.05	1.72±0.05
	Body Weight	74.88±5.17	72.88±5.74	71.50±5.36	82.98±9.57	80.74±9.30	78.10±8.99
	BMI	27.11±1.23	26.31±1.51	25.77±1.20	27.93±1.66	27.14±1.61	26.23±1.67
	Body Height	1.53±0.09	1.54±0.08	1.54±0.08	1.62±0.09	1.62±0.09	1.63±0.08
Females	Body Weight	63.76±8.15	63.18±7.99	62.98±7.96	75.52±10.88	73.38±9.97	70.90±9.72
	BMI	27.23±1.01	26.63±1.56	26.52±1.51	28.76±1.31	27.82±1.18	26.72±1.33

Note: CG= Control Group, EG=Experimental Group, PT=Pre Training, DT=During Training, PoT=Post Training, and all values are Mean ± SD

Table 3. Comparison between pre training (PT) and during training (DT) of weight (kg) and BMI (kg/m^2) for control and experimental groups of both sexes after four weeks training.

Sex	Parameters	CG			EG		
		MD	Tcal.	P-value	MD	Tcal.	P- values
Male	Weight	2.00	3.14	0.04	2.24	4.71	0.01
	BMI	0.80	2.51	0.07	0.79	5.53	0.01
Female	Weight	0.58	3.79	0.02	2.14	4.32	0.01
	BMI	0.60	1.58	0.20	0.94	8.99	0.00

Note: CG= Control Group, EG=Experimental Group, MD= Mean Difference, Tcal.= T calculated, P- value= significance value at ($p< 0.05$), and T-tabulated= 2.13 for all groups.

As shown from Table 4.1 and 4.2, there were significant differences between the measurements of PT and DT after four week training program. Both male and female participants of experimental group and control group showed significant ($P<0.05$) change in weight.

The experimental group males lost 2.24 kg (3 %) and females lost 2.14 kg (3 %) whereas, the control group males lost 2 kg (3 %) and females lost 0.58 kg (1 %) within the four weeks training program. Female experimental group lost slightly more weight when compared to female control groups. This showed that more fat was burned in the experimental group than the control group and the use of carnitine supplement facilitates fat burning by transporting the long chain fatty acid in to the mitochondria for energy production.

Height was taken for the calculation of BMI. But the change of this character was insignificant and it was not included in the

tables for statistical analysis. Since weight reduction in control and experimental group was different, BMI also showed significant difference between the two groups. Significant reductions (P<0.05) were obserbed in the experimental group of both male and female participants than the control group. In experimental group males and females decreased 0.79 kg/m^2 and 0.94 kg/m^2 respectively, of BMI within four week aerobic exercise and carnitine supplementation. On the other hand, control group males and females reduced the BMI of 0.80 kg/m^2 and 0.60 kg/m^2 respectively, in the four week aerobic exercise training. The reduction in BMI was increased in experimental group especially among female participants.

Table 4. Comparison between pre training (PT) and post training (PoT) of weight (kg), and BMI (kg/m^2) for control and experimental groups of both sexes at the end of 8 week training.

Sex	Parameters	CG			EG		
		MD	Tcal	P- values	MD	Tcal	P- values
Male	Weight	3.38	6.29	0.00	4.88	5.81	0.00
	BMI	1.34	5.38	0.01	1.70	7.37	0.00
Female	Weight	0.78	3.26	0.03	4.62	8.28	0.00
	BMI	0.71	2.00	0.12	2.04	27.79	0.00

Note: CG= Control Group, EG=Experimental Group, MD= Mean Difference, Tcal.= T calculated, P- value= level of significance at (p<0.05)and T-tabulated= 2.13 for all groups.

As Table 4.1 and Table 4.3 showed, there was a significant difference on weight loss of control and experimental group within 8 weeks training program. At end of training male and female participants of experimental group who were taking exercise and carnitine supplement lost 4.88 kg (6 %) and 4.62 kg (6 %) respectively. The control group males lost 3.38 kg (4.5 %) and females 0.78 kg (1 %) of weight. Experimental group taking carnitine in addition to aerobic exercise showed more weight loss compared to the control group. Particularly the difference between females was very high. As a result of change in weight, BMI also changed significantly (p<0.05) in experimental group as well as control group of male participants. Experimental group males and females reduced 1.70 kg/m^2 and 2.04 kg/m^2 of BMI respectively. The control group males and females also decreased BMI 1.34 kg/m^2 and 0.71 kg/m^2 respectively.

The result showed that experimental group who took carnitine supplement and performed exercise reduced BMI more than the control group who was on exercise without any carnitine supplement. The female participants of experimental group lost more compared to control female participants. But within experimental group only slight difference was seen between male and female participants. This was due to the use of carnitine which activate acylCoAs metabolism and transporting long-chain FAs into the mitochondria for utilization energy substrate.

Blood Pressure and Heart Rate

Sex	Parameters	CG			EG		
		PT	DT	PoT	PT	DT	PoT
Male	SBP	127.60±8.91	117.20±1.92	108.00±4.47	131.80±8.79	114.40±7.30	112.20±9.07
	DBP	80.20±8.29	71.40±6.77	74.00±8.94	82.80±4.87	72.20±12.32	73.80±8.14
	RHR	76.60±5.98	72.60±6.47	69.60±6.07	76.80±12.46	69.20±12.62	64.40±9.63
	HER	138.40±15.13	129.60±6.69	126.40±6.07	129.60±15.13	116.80±12.46	109.60±10.43
Female	SBP	115.40±6.27	108.80±9.15	107.20±5.22	120.80±12.29	110.40±9.61	104.40±5.18
	DBP	79.20±5.50	68.80±8.35	71.00±7.42	81.00±13.17	71.00±8.49	71.00±6.67
	RHR	78.80±8.44	72.20±3.90	68.60±4.45	87.60±6.69	79.00±1.73	73.60±6.02
	HER	130.40±9.21	128.80±9.55	122.40±6.69	131.20±9.55	116.80±4.38	115.20±3.35

Note: CG= Control Group, EG=Experimental Group, PT=Pre Training, DT=During Training, PoT=Post Training, SBP=Systolic Blood Pressure, DBP= Diastolic Blood Pressure, RHR= Resting Heart Rate, HER= Exercise Heart Rate, and the data in the form of Mean ± SD

Table showed that the systolic blood pressure and diastolic blood pressure were significantly different between PT and DT after four week training. Blood pressure of the experimental group reduced more than the control group.

Four week of training and carnitine supplementation reduced the mean value of experimental group by 17.40 mmHg and 10.40 mmHg for male and female participants respectively, in systolic blood pressure, 10.60 mmHg and 10 mmHg for male and female participants respectively, in diastolic blood pressure. The control group also showed reduction of 10.40 mmHg in systolic blood pressure and 8.80 mmHg in diastolic blood pressure for males as well as 6.60 mmHg in systolic blood pressure and 10.40 mmHg in diastolic blood pressure for females.

The improvement in systolic blood pressure and diastolic blood pressure was higher in both sexes of the experimental group compared to the control group. But there was no more significant difference between male and female participants of experimental group within four week training program. This was because of carnitine supplement enhanced the function of heart as the fat composition of the body reduced due to the increased appearance of carnitine which facilitated the fat oxidation of the body.

Heart rate also showed significant change in both experimental and control groups. Even though, the change was occurred in both groups more reduction in heart rate observed from the experimental group. That was 7.60 bpm for male and 8.60 bpm for female participants in resting heart rate and 12.80 bpm for male and 14.40 bpm for female participants in exercising heart rate with four week aerobic exercise and carnitine supplement in the experimental group. Whereas, the control group improved 4 bpm in resting heart rate and 8.80 bpm in exercising heart rate of male participants; as well as 6.60 bpm in resting heart rate and 1.60 bpm in exercising heart rate for female participants within four week aerobic exercise training. The experimental group reduced more in heart rate compared to control group. The difference based on sex wise was higher between females than males. This was due to carnitine supplementation which improved the heart ability/ capacity to pump blood efficiently and increased the size of blood vessels.

Table 7. Comparison between pre training (PT) and post training (PoT) of systolic blood pressure (mmHg), diastolic blood pressure (mmHg), resting heart rate (bpm) and exercise heart rate (bpm) for control and experimental groups of male and female participants at the end of 8 weeks training.

Sex	Parameters	CG			EG		
		MD	Tcal.	P- value	MD	Tcal.	P- value
Male	SBP	19.60	3.45	0.03	19.60	2.90	0.04
	DBP	6.20	2.50	0.07	9.00	2.30	0.08
	RHR	7.00	4.72	0.01	12.40	6.08	0.00
	HER	12.00	1.99	0.12	20.00	4.56	0.01
Female	SBP	8.20	4.63	0.01	16.40	4.42	0.01
	DBP	8.20	1.83	0.14	10.00	2.76	0.05
	RHR	10.20	2.09	0.11	14.00	9.23	0.00
	HER	8.00	2.39	0.08	16.00	4.00	0.02

Note: CG= Control Group, EG=Experimental Group, SBP=Systolic Blood Pressure, DBP= Diastolic Blood Pressure, RHR= Resting Heart Rate, HER= Exercise Heart Rate, MD= Mean Difference, Tcal.= T calculated, P- value= level of significance at ($p< 0.05$) and T-tabulated= 2.13 for all groups.

The data (Table 5, Table 6 and Table 7) showed that systolic blood pressure and diastolic blood pressure were significantly reduced for male and female participants of both groups. In the experimental group reductions were shown in the mean value of systolic blood pressure 19.60 mmHg and diastolic blood pressure 9 mmHg for male participants. In female participants systolic and diastolic blood pressures reduced ($p\leq0.05$) mean value of 16.40 mmHg, 10 mmHg respectively after eight week of aerobic exercise and carnitine supplementation. Control group (only on aerobic exercise training) also reduced mean value of systolic blood pressure 19.60 mmHg and diastolic blood pressure 6.20 mmHg among males and 8.20 mmHg for both systolic and diastolic blood pressure of female participants at the end of eight week training program. The improvement of systolic and diastolic blood pressure showed in experimental group was more than the control group. Blood pressure improvements were observed in both groups because of the loss of body fat (body weight) in both groups. But, the difference in blood pressure between the two groups was due to carnitine and increased loss of weight observed in the experimental group.

Significant changes in heart rates were observed in both of experimental and control groups of male and female participants. In experimental (with aerobic exercise and carnitine supplement) group, males improved their mean value of resting and exercising heart rate by 12.40 bpm and 20 bpm respectively. In female participants of experimental group mean value of resting heart rate and exercising heart rate reductions were, 14 bpm, and 16 bpm respectively. In the control group resting heart rate and exercising heart rate were reduced by 7.00 bpm, and 12.00 bpm respectively in male participants and by 10.20 bpm, and 8.00 bpm respectively in female participants. Experimental group reduced more than the control group in resting heart rate and exercising heart rate in both male and female participants within eight week training program.

Body Circumference Measurements

Table 8. Mean of body circumference measurements (cm) for control and experimental groups of male and female participants

Sex	Parameters	CG			EG		
		PT	DT	PoT	PT	DT	PoT
	CC	120.60±1.82	117.60±3.78	115.20±2.77	125.40±6.31	122.60±6.27	121.00±6.08
	BC	31.40±1.14	30.40±0.89	29.40±1.14	33.20±1.64	30.60±1.95	30.40±1.82
Male	WC	91.20±5.93	88.20±5.12	86.00±4.90	96.00±4.30	93.40±3.78	91.80±3.83
	HC	104.60±3.21	103.00±3.87	100.00±2.35	107.40±4.45	105.40±4.39	102.40±5.59
	WHR	0.87±0.06	0.86±0.04	0.86±0.04	0.89±0.03	0.89±0.02	0.90±0.03
	TC	58.60±3.85	56.40±3.51	53.80±3.03	58.80±4.44	56.40±3.51	54.20±4.09
	CC	114.00±6.78	108.80±9.15	108.00±6.44	120.60±3.43	118.00±5.52	115.40±3.91
	BC	30.60±1.52	29.20±1.92	28.00±1.58	32.80±2.17	30.40±2.30	28.80±1.30
Female	WC	90.80±6.22	87.40±8.29	88.00±8.0	104.80±5.72	100.40±6.32	96.80±4.38
	HC	106.80±5.63	104.20±4.44	103.60±3.97	110.20±6.42	108.20±7.60	106.40±7.09
	WHR	0.85±0.03	0.84±0.05	0.86±0.03	0.95±0.05	0.93±0.03	0.91±0.04
	TC	60.40±3.29	58.00±2.55	57.20±2.16	65.00±4.12	61.40±4.72	58.80±3.70

Note: CG= Control Group, EG=Experimental Group, PT=Pre Training, DT=During Training, PoT=Post Training CC= Chest Circumference, BC= Brachial Circumference, WC= Waist Circumference, HC= Hip Circumference, WHR= Waist to Hip Ratio, TC= Thigh Circumference and the data in the form of Mean ± SD.

Table 9. Comparison between pre training (PT) and during training (DT) of body circumferences (cm) for control and experimental groups of male and female participants after four weeks training.

Sex	Parameters	CG			EG		
		MD	Tcal.	P- value	MD	Tcal.	P- value
	CC	3.00	2.74	0.05	2.80	8.63	0.00
	BC	1.00	2.24	0.09	2.60	14.00	0.00
Male	WC	3.00	4.24	0.01	2.60	7.20	0.00
	HC	1.60	3.14	0.04	2.00	3.23	0.03
	WHR	0.02	1.78	0.15	0.00	-0.20	0.85
	TC	2.20	3.77	0.02	2.40	7.67	0.00
	CC	5.20	8.92	0.00	2.60	2.53	0.07
	BC	1.40	2.75	0.05	2.40	9.80	0.00
Female	WC	3.40	2.26	0.09	4.40	7.33	0.00
	HC	2.60	1.91	0.13	2.00	1.91	0.13
	WHR	0.01	0.91	0.42	0.02	0.74	0.50
	TC	2.40	2.33	0.08	3.60	3.88	0.02

Note: CG= Control Group, EG=Experimental Group, CC= Chest Circumference, BC= Brachial Circumference, WC= Waist Circumference, HC= Hip Circumference, WHR= Waist to Hip Ratio, TC= Thigh Circumference, MD= Mean Difference, Tcal.= T calculated, P- value= significance value at (P< 0.05) and T-tabulated= 2.13 for all groups.

Table 8 and 9 showed that there were changes in body circumferences of experimental and control groups except waist to hip ratio as a result of reduction of nominator and denominator (waist and hip).

Within four week training program of the study male experimental group reduced the mean value of chest 2.80 cm, brachial 2.60 cm, waist 2.60 cm, hip 2 cm, and thigh 2.40 cm. The mean values of chest, brachial, waist, hip, and thigh decreased by 2.60 cm, 2.40cm, 4.40cm, 2 cm and 3.60 cm, respectively in female participants of experimental group within four week training program. Control group reduced the mean value of chest circumference 3 cm, brachial 1 cm, waist 3 cm, hip 1.60 cm and thigh 2.20 cm for male participants and chest 5.20cm, brachial 1.40cm, waist 3.40cm, hip 2.60cm and thigh 2.40cm for female participants with four week training program. The reduction of waist hip ratio was 0.02 cm and 0.01cm in male and female control group and 0.02cm female experimental group, respectively. This was because of proportional reduction of waist and hip in both groups.

In comparison, the male experimental group reduced slightly more in body circumferences than the male control group. There was no difference between female participants of experimental and control groups. There were slight differences between male and female participants of experimental group (males reduced more). These were because of carnitine supplementation increased the use of stored fat of the body by shuttling the long chain fatty acids into mitochondria when they converted into acylCoA from the body as a result of exercise.

Manipulating the carnitine pool of skeletal muscle at rest, both physiologically and pharmacologically, had provided insight into the regulation of skeletal muscle fat and carbohydrate oxidation, both at rest and during exercise and the interchange

between anaerobic and oxidative energy provision at the onset of exercise. Increasing muscle total carnitine content would indeed alleviate the decline in skeletal muscle fat oxidation seen during incremental exercise in healthy individuals (Stephens *et al.*, 2007).

Table 10. Comparison between pre training (PT) and post training (PoT) of body circumference (cm) for control and experimental groups of male and female participants at the end of 8 weeks training.

Sex	Parameters	CG			EG		
		MD	Tcal.	P- value	MD	Tcal.	P- value
	CC	5.40	5.01	0.01	4.40	8.63	0.00
	BC	2.00	6.33	0.00	2.80	14	0.00
Male	WC	5.20	6.50	0.00	4.20	7.20	0.00
	HC	4.60	9.02	0.00	5.00	3.23	0.03
	WHR	0.01	1.73	0.16	0.00	-0.20	0.85
	TC	4.80	6.00	0.00	4.60	7.67	0.00
	CC	6.00	6.71	0.00	5.20	7.84	0.00
	BC	2.60	3.83	0.02	4.00	8.94	0.00
Female	WC	2.80	2.26	0.09	8.00	6.14	0.00
	HC	3.20	3.00	0.04	3.80	3.41	0.03
	WHR	-0.01	-0.56	0.61	0.04	1.96	0.12
	TC	3.20	3.30	0.03	6.20	5.36	0.01

Note: CG= Control Group, EG=Experimental Group, CC= Chest Circumference, BC= Brachial Circumference, WC= Waist Circumference, HC= Hip Circumference, WHR= Waist to Hip Ratio, TC= Thigh Circumference, MD= Mean Difference, Tcal. = T calculated, P- value= significance value at (P< 0.05) and T-tabulated= 2.13 for all groups

Table 9, and 10 showed significant (p<0.05) difference between PT and PoT measurements occurred in the chest, brachial, waist, hip, and thigh circumferences of experimental except the waist hip ratio which was not significant. In the control group there were also significant changes except the waist hip ratio.

Throughout the program the reduction of body circumferences in female experimental group was more than the female control group except waist hip ratio. In experimental group females reduced the mean value of chest (5.20 cm), brachial (4 cm), waist (8 cm), hip (3.80 cm), and thigh (6.20 cm) where as males reduced the mean value of chest (4.40 cm), brachial (2.80 cm), waist (4.20 cm), hip (5 cm) and thigh (4.60 cm) within full training program (eight week). In control group, females reduced the mean value of chest circumference (6 cm), brachial (2.60 cm), waist (2.80 cm), hip (3.20 cm) and thigh (3.20 cm) throughout the training program and male participants reduction was chest (5.40 cm), brachial (2 cm), waist (5.20 cm), hip (4.60 cm) and thigh (4.80 cm) throughout the training program. The reduction of waist hip ratio was not significant (p<0.05) in both groups.

In comparison the reduction of body circumference measurements in experimental group was slightly greater than control group specifically among female participants. Great difference was observed around waist and below that of the body parts where more fat was accumulated. Even though, all participants of this study were overweight, the percentage of body fat in females is more than the males by nature and this created the difference between the male and female participants of experimental group. These differences were the result of increased utilization of supplemented carnitine in female experimental group by the presence of more body fat and lower body carnitine due to lower lean mass that synthesis carnitine in nature. From puberty to adulthood, plasma carnitine concentrations in males increased and stabilized at a level that was significantly higher than those in females. This suggested that sex hormones had a role in the regulation of carnitine plasma concentrations and supplementation was more effective in females (Vaz and Wanders, 2002).

IV. Conclusion

In fact of the experimental result of the study, the following conclusions were made; Supplementation of carnitine combined with aerobic exercise increased the rate of reduction of weight and BMI significantly and females were more benefited. As a result of improving the functional capacity of heart muscles due to carnitine supplement, blood pressure improved in the experimental groups of male and female participants better than control group. The result of this study indicated that carnitine supplement combined with aerobic exercise is more efficient to improve the heart rate level. Considerable differences have been observed between experimental and control group in the reductions of body circumference measurements; experimental group showed greater reduction compared to control group especially in case of females.

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AUTHORS

First Author – Tsegaye Belayneh, Lecturer, Woilta Sodo University, Ethiopia
Second Author – Negussie Bussa (PhD), Assistant Professor, Haramaya University, Haramaya, Ethiopia
Third Author – Sangeeta Rani (PhD), Assistant Professor, Haramaya University, Haramaya, Ethiopia