

# Changes in Sleep Following Diet and Exercise Protocols in Women

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## ABSTRACT

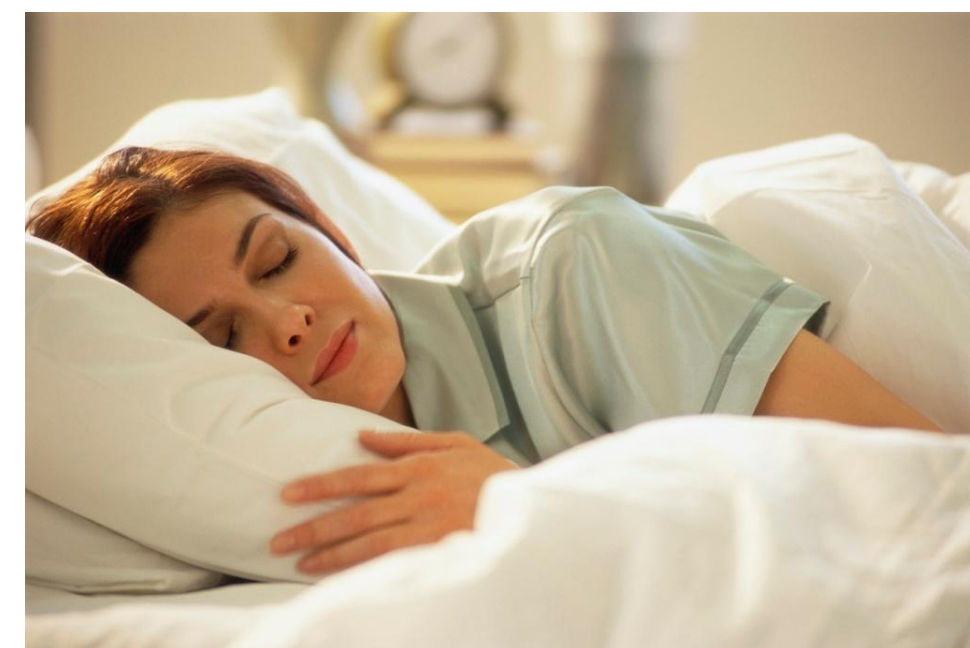
**PURPOSE:** The purpose of this study was to examine the impact of diet-induced weight loss (DWL), circuit training (CT) and diet-induced weight loss combined with CT (DWLCT) on Epworth Sleepiness Scale (ESS) and Pittsburgh Sleep Quality Index (PSQI) in healthy sedentary postmenopausal women.  
**METHODS:** Forty-three postmenopausal (age 57.9 ± 4.7 yrs.) women were randomly assigned to either a DWL (n=16) or CT (n=18) 9 week intervention. DWL participants met with an investigator once per week to be weighed and were given a total weight loss goal of 8-10% of baseline body weight (BW). CT subjects completed a supervised circuit of resistance and aerobic exercise on 3 days per week for 40-45 minutes at a moderate intensity and were asked to remain weight stable (±3 lbs.) Nine participants completed an additional 9 week intervention of combined DWL and CT protocols (DWLCT). All participants had BW, Waist circumference (WC), ESS and PSQI measured prior to and at the end of the intervention and had BW measured weekly. **RESULTS:** Paired t-test results indicated a significant (p=0.46) increase in the ESS (5.7±3.6 to 7.3±4.1) in the DWL group, there were no changes demonstrated in the CT or DWLCT groups for ESS. PSQI was not changed for all groups. BW and BMI decreased significantly (p<0.05) in the DWL and DWLCT groups and no change in the CT group. **CONCLUSIONS:** The results indicate that an increase in daytime sleepiness that accompanied caloric restriction may be offset by a regimen of CT in healthy postmenopausal women.

## BACKGROUND

- ❖ Sleep deprivation and sleep disorders were identified as “an unmet public health problem” by the Institute of Medicine of the National Academies in 2006.
- ❖ It has been estimated that approximately 50-70 million Americans suffer from disorders of sleep and wakefulness which have been associated with an increased risk for hypertension, diabetes, obesity, and heart disease.
- ❖ Excessive daytime sleepiness has been associated with impaired functioning leading to motor vehicle accidents, increased risk of injury, decreased productivity and decreased perceived quality of life.
- ❖ Increasingly more Americans are less physically active which has been related to increased BMI and an increase in associated health risks.
- ❖ Increased BMI has been associated with an increase risk for sleep disorders, more specifically obstructive sleep apnea which has been associated with excessive daytime sleepiness (EDS).
- ❖ Poor sleep quality is related to an elevated BMI
- ❖ Increased physical activity has been independently associated with better sleep quality as well as less daytime sleepiness.
- ❖ Sleep apnea is commonly thought to be a sleep disorder of males. Recent research indicated sleep apnea was present in 50% of women aged 20-70 years.

## PURPOSE

The purpose of this study was to examine the impact of diet-induced weight loss (DWL), circuit training (CT) and diet-induced weight loss combined with CT (DWLCT) on Epworth Sleepiness Scale (ESS) and Pittsburgh Sleep Quality Index (PSQI) in healthy sedentary postmenopausal women.



## METHODS

### Subjects

- ❖ 35 postmenopausal women (Age 58.04 ± 5.22)
- ❖ Previously sedentary (< 3 days/week for 30%/day)

### Anthropometrics & Body Composition

- ❖ Height and Weight (BW)
- ❖ Body Mass Index (BMI)
- ❖ Waist Circumference (WC)

### Fitness Tests

- ❖ VO<sub>2</sub>max: graded walking test on a treadmill

### Laboratory Measurements

- ❖ Systolic and Diastolic Blood Pressure (SBP, DBP)
- ❖ Fasted blood draws:
  - ❖ Total cholesterol (Total-C)
  - ❖ HDL-cholesterol (HDL-C)
  - ❖ Triglycerides (TG)
  - ❖ Blood glucose (BG)

### Questionnaires

- ❖ Epworth Sleepiness Scale (ESS) Range 0-24 with 0 being no sleepiness
- ❖ Pittsburgh Sleep Quality Index (PSQI) Range 0-21 with 0 being no sleep difficulty

### Intervention Protocols

#### Diet Weight Loss (DWL)

- ❖ Weekly individual meeting for 9 weeks
- ❖ Weight loss goal of 8-10% of baseline BW

#### Circuit Training (CT)

- ❖ Supervised circuit of resistance and aerobic exercise 3x/week for 9 weeks
- ❖ Moderate intensity (Aerobic: 60-80% VO<sub>2</sub>max; Resistance: 60-70% 1RM)
- ❖ Weighed weekly to ensure BW remained stable (± 3 lbs.)

#### Diet Weight Loss & Circuit Training (DWLCT)

- ❖ Previous participants from DWL or CT group after 1-month washout period

### Statistical Analysis

- ❖ Mixed-design ANOVAs were used to detect differences between the conditions over time.
- ❖ Follow-up tests included one-way ANOVAs, independent samples t-tests, and paired samples t-tests when interactions or main effects were detected.

## ACKNOWLEDGEMENT

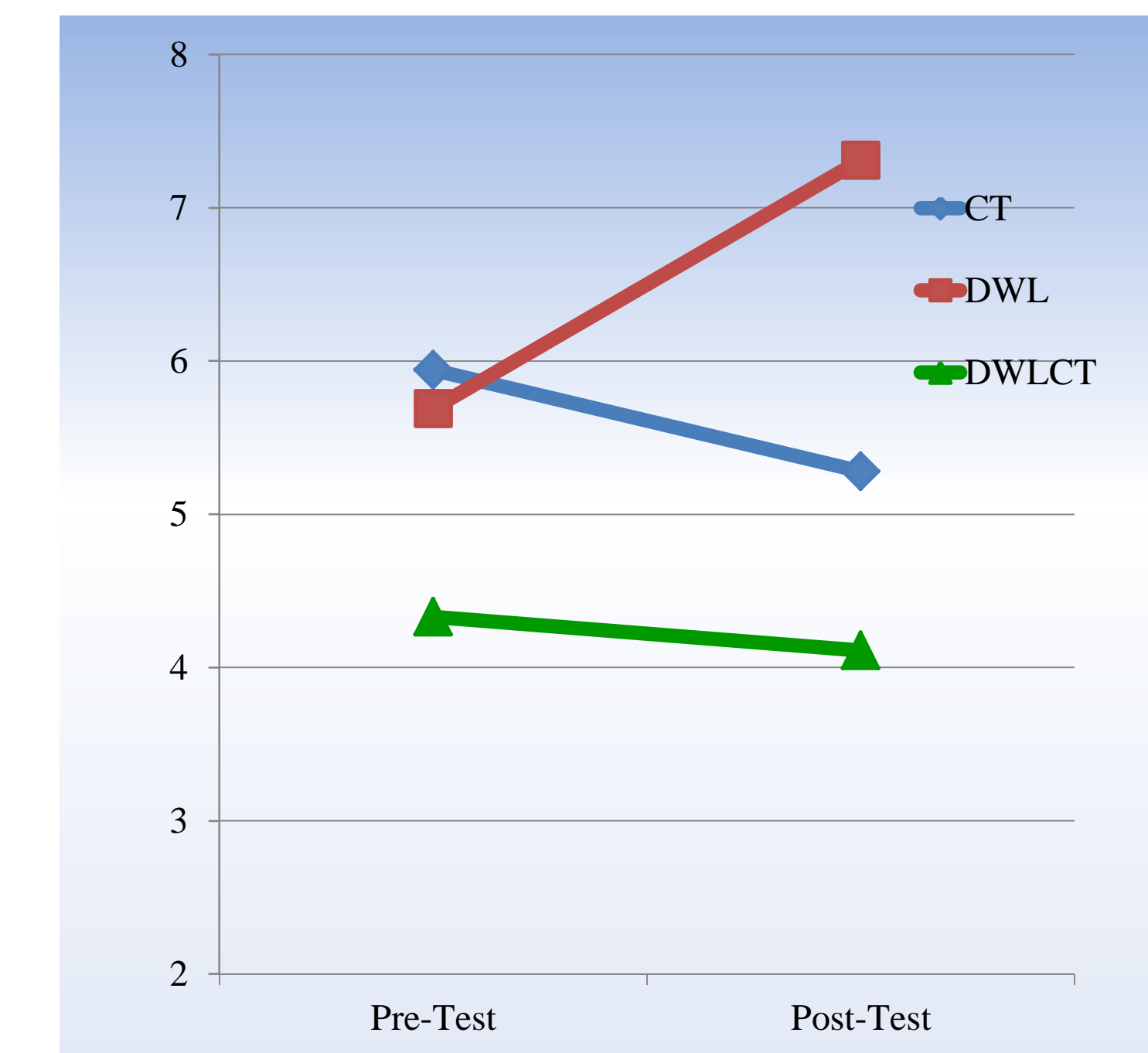
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## RESULTS

**Table 1.** Participant characteristics

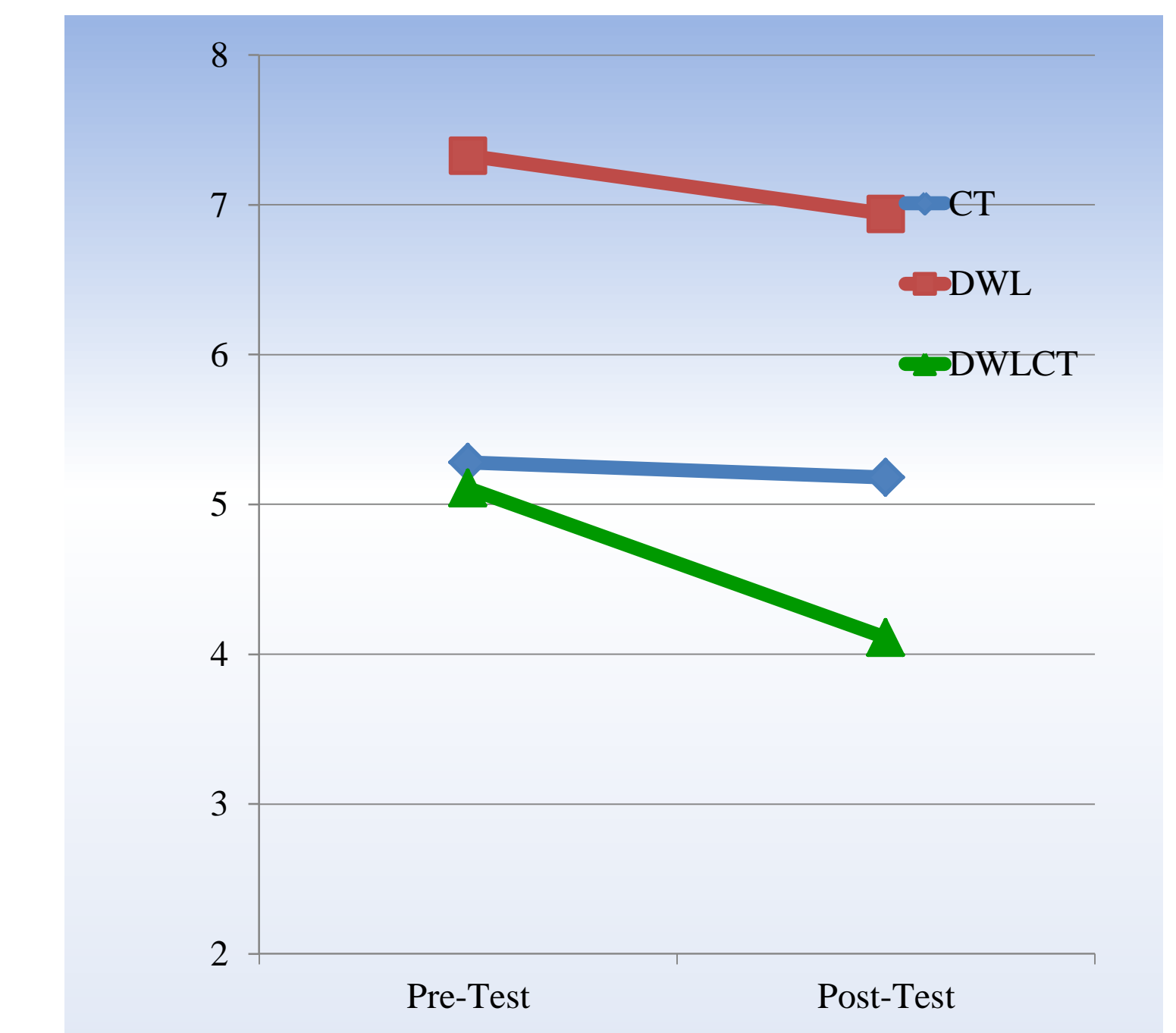
	DWL		CT		DWLCT	
	Pre	Post	Pre	Post	Pre	Post
<b>Weight</b>	80.0 ± 16.5	77.7 ± 6.7*	67.4 ± 9.1 <sup>‡</sup>	66.9 ± 9.4	72.3 ± 11.5	70.6 ± 11.7*
<b>BMI</b>	31.5 ± 5.4	30.6 ± 5.6*	26.7 ± 3.7 <sup>‡</sup>	26.5 ± 3.8 <sup>‡</sup>	27.2 ± 3.7 <sup>‡</sup>	26.5 ± 3.8 <sup>‡</sup>
<b>VO<sub>2</sub> (ml/kg/min)</b>	25.02 ± 4.95	26.14 ± 5.83*	28.32 ± 5.07	29.97 ± 5.26	27.49 ± 6.40	29.34 ± 5.48
<b>ESS</b>	5.94 ± 2.9	5.28 ± 2.46	5.69 ± 3.6	7.31 ± 4.1	4.33 ± 2.29	4.11 ± 2.26
<b>PSQI</b>	5.28 ± 3.6	5.18 ± 2.6	7.33 ± 3.0	6.94 ± 3.27	5.11 ± 2.36	4.11 ± 2.97

Pre-Post significantly different within group (p < .05) <sup>‡</sup> DWL is significantly greater at the same time point (p < .05)



**Figure 1. Epworth Sleepiness Scale (ESS)**

- No significant differences between groups at baseline
- Mixed-design ANOVA, (p = 0.019) time x group interaction for the ESS
- Post-test DWL significantly (p < 0.045) higher daytime sleepiness



**Figure 2. Pittsburgh Sleep Quality Index**

- No differences between groups at baseline
- Trend (p = 0.065) at post test.
- DWL-CT reported significantly (p = 0.028) improved sleep quality than the DWL group.

## DISCUSSION / CONCLUSIONS

There were significant differences in weight, BMI, and % body fat at baseline, which could have impacted the changes in ESS among different groups. However, among this sample, none of these three variables were correlated with ESS score at baseline, nor were changes in these three variables associated with change in ESS score, it can be reasonably assumed that differences in body composition did not impact ESS scores or the change observed in the DWL group.

The significant changes in body weight that were observed in the DWL group were accompanied by an increase in daytime sleepiness as measured by the ESS.

Circuit training (CT) combined with diet induced weight loss precipitated an improvement in quality of sleep in this group of post menopausal women