**ORIGINAL ARTICLE**

# The impact of indoor rowing exercise on leptin and adiponectin levels in young adult obese - a pilot study

**Nur Farhana Md Yunus*[a], Damayanthi Durairajanayagam[b], Mazlifah Omar[b], Romizan Jathin[a]**

*[a]Centre of Physiotherapy Studies, Faculty of Health Sciences, Universiti Teknologi MARA, Puncak Alam Campus, 42300 Puncak Alam, Selangor, Malaysia; [b]Faculty of Medicine, Universiti Teknologi MARA, Kampus Sungai Buloh.*

**Corresponding Author**

Nur Farhana Md Yunus
nurfarhana@uitm.edu.my

**Abstract:**

Among the obese, high leptin levels is said to be a sign of leptin resistance, while low adiponectin levels are due to the reciprocal relationship between these adipokines in relation to adipocytes. Leptin and adiponectin are hormones that are linked to the development of obesity-related diseases. Thus, an optimal exercise programs needs to be identified as an intervention to reduce leptin and increase adiponectin levels among obese individuals. The effects of exercise on these adipokines in obese subjects are inconclusive. Rowing is a non-weight bearing form of exercise and can be regarded as one of the safest exercises for obese adults. However, the effect of indoor rowing exercise on leptin and adiponectin among obese individuals is not well reported. This study determined the impact of a 12-week indoor rowing exercise on leptin and adiponectin; and the correlation between pre- and post-exercise changes in these adipokines in young adult obese subjects. Twelve young adult obese males and females (aged 18-35 years, BMI $\geq$30kg/m$^2$) were divided into an Intervention and a Control Group (n=6 respectively). The Intervention Group performed rowing exercise 3 times per week for 12 weeks. Subjects in the Control group continued with their daily activities as per their normal routine. All variables were measured before and after 12 weeks in each group as well as between the groups. Levels of the two adipokines were quantified using ELISA. There was no significant difference in both adipokines following indoor rowing exercise. However, there was a significant negative correlation between pre- and post-exercise changes in leptin and adiponectin. In conclusion, indoor rowing exercise as performed in this study did not seem to significantly affect these adipokines in young adult obese subjects. This could be due to the small sample size, gender mix and exercise regimen among these subjects.

**Keywords:** adiponectin, indoor rowing exercise, leptin, obesity

## 1. INTRODUCTION

Obesity is defined as abnormal or excessive fat accumulation in adipose tissue to an extent that may impair health [1]. (World Health Organization [WHO], 2016). At present, obesity is a worldwide issues in all age groups. The amount of excess fat along with its distribution throughout the body has a great health implications. BMI is the most acknowledged measure of obesity as recommended by World Health Organization (WHO) using the cut-off point of 30kg/m$^2$.

Leptin is known as the body weight regulator hormone. The function of leptin as an indicator to the hypothalamus on the amount of fat stored in the body's fat cells. Leptin receptors are highly expressed in the hypothalamus, which is important in regulating body weight. However, in obese persons, leptin indicator does not function optimally due to leptin resistance

Increase fat deposition in obesity causes dysregulation of adipokine levels subsequently contributes to the onset of obesity-related diseases. It is recognized that leptin has pro-inflammatory properties, while adiponectin has anti-inflammatory properties, cardio-protective characteristics (anti-atherogenic) and improves insulin sensitivity (anti-diabetic) [2]. (Ouchi & Walsh, 2007). Thus, both these hormones are associated with metabolic syndrome as well as important clinical benefits for the prevention and/or treatment of obesity and obesity-related diseases.

A strong positive correlation of serum leptin concentration with of body fat percentage has been shown previously [4]. (Maffei et al., 1995). This can be explained by the fact that increase in adipocytes size will lead to synthesis of more leptin. A study in hundred healthy non-obese subjects in the East Coast of Malaysia reported that higher serum leptin correlated with higher body fat percentage in women than men in the same BMI category [5]. (Abdulwahab et al., 2013). Adiponectin plays a role in the regulation of insulin sensitivity [6]. (Fantuzzi et al., 2005). Adiponectin levels are lower in obese people compared to the non-obese, as well as in individuals who are insulin resistant; patients with type II diabetes mellitus, hypertension [7]. (Hotta et al., 2000). In contrast to leptin, adiponectin expression is lower in overweight and obese individuals [8]. (Bouassida et al., 2010).

However, weight gain in normal healthy subjects showed increase in adiponectin expression with a supposed decrease in adiponectin expression in obese subjects, indicating that this could be due to leptin resistance that occurs in the obese but not in normal healthy weight subjects [9]. (Singh et al., 2016). Therefore, it might be that the inverse correlation of leptin and adiponectin levels is only present in the obese population.

Leptin and adiponectin play an important role in energy balance and insulin action. Many previous studies have discussed the effects of exercise, combined exercise and diet on leptin and adiponectin concentration [10,11,12,13]. (Ackel-D'Elia et al., 2014; Racil, Ounis, La & Manar, 2013; Lau et al., 2010; Sari et al., 2007) but reported inconsistent results. There are several factors for this inconsistency, among which are the subject variation, types of exercise, intensity and duration of exercise that may contribute to the study results. Therefore, further investigation on the impact of exercise on these adipokines is needed.

Indoor rowing exercise offers both aerobic and resistance exercise. The advantage of rowing exercise is lower injury rate compared to other exercises as rowing is practiced in sitting which less effect on the knee joints. These factors make rowing exercise safe for obese people. To date, the effect of indoor rowing exercise has been explored among visually-impaired subjects [14]. (Shin et al. 2015) and the elderly [15]. (Asaka et al. 2012). There were a changes on body composition and skeletal muscle mass was reported in both studies. However, the effect of rowing exercise on leptin and adiponectin among obese individuals are still vague.Therefore, indoor rowing exercise was chosen as an exercise tool in this study to determine the impact of exercise on leptin and adiponectin in obese and to correlate the post exercise changes of these two adipokines.

## 2. METHODOLOGY

### 2.1. Study design and subject

A pre-post measurement was conducted after obtaining ethical approval. A total of 12 obese subjects were recruited based on the criteria as set in the study protocol. Subjects' participation was at voluntary basis based on convenience sampling. Subjects were divided into two groups: control (n=6) and intervention (n=6). Anthropometry together with leptin and adiponectin levels were determined before and after completion of a 12-week indoor rowing exercise.

### 2.2. Inclusion and exclusion criteria

The inclusion criteria in this study were subjects aged between 18-35 years old with BMI ≥30kg/m2, independent in functional activities, able to comprehend study procedures and able to comply with the exercise intervention. Those who had existing heart and respiratory disease, contraindications of MRI (claustrophobia), musculoskeletal problem of lower limbs, abnormal body geometry such as amputation of lower limbs and neurological deficits on lower limbs were excluded.

### 2.3. Instrumentation

#### *2.3.1. Height & weight*

Height was measured to the nearest 0.5cm using a SECA wall mounted stadiometer with barefoot. Body weight was measured to the nearest 0.1kg using a SECA weight scale (SECA Mod 220, SECA GMBH & Co. Germany). Subjects wore light clothing during weight measurement.

#### *2.3.2. Body mass index (BMI)*

Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. Following the recommendations of WHO, BMI above or equal to 30.0 $kg/m^2$ categorized as obese was selected in this study.

#### *2.3.3. Leptin & Adiponectin*

Leptin and adiponectin were measured using a commercial Enzyme-linked Immunosorbent Assay (ELISA) kit, Quantikine ELISA, (Human Leptin Immunoassay DLP00/SLP00 R& D System, USA and Human Adiponectin Platinum ELISA- BMS2032/2TEN) obtained from eBioSc, Austria. The intra- and inter-assay co-efficient of variation for the assays ranged between 3.75%±10.96% for adiponectin and 1.03%±3.75% for leptin.

#### *2.3.4. Indoor rowing exercise*

Subjects performed indoor rowing exercise using the Concept2 rower model E (Concept2 Inc., Morrisville, VT, USA) at intensity 60-80%$HR_{max}$, 3x/week for 12 weeks. The exercise was set up using interval training, each session included a 2 minute x 10 repetitions with 1 minute rest between each interval. The subjects were given instructions on how to use the rowing machine prior to the exercise training. The subjects rowed at a self-selected stroke rate and resistance level. As all subjects were novices, the chosen resistance level was start at 3 and further increase depend on subject's performance. The heart rate achieved in each interval session was recorded to monitor the target exercise intensity. The subject's heart rate, blood pressure and rate of exertion were recorded pre and post each exercise session in the subject's exercise log.

### 2.4. Statistical analysis

SPSS windows version 21 was used to analyze the data. Descriptive statistics for the mean and standard deviation was calculated for anthropometric and study variables. Kruskal Wallis test was chosen to determine the significant difference between and within the groups at pre- and post-exercise respectively in both groups, while Pearson correlation was used for correlation. The level of significance was set at $p<0.05$.

## 3. RESULT AND DISCUSSION

### 3.1. Demographic and anthropometric measures

The pre-exercise data among intervention and control groups for anthropometric and study variables (Table 1).

### 3.2. Impact of indoor rowing exercise on leptin and adiponectin

There was no significant difference in serum leptin and adiponectin levels between the control and intervention groups at pre- and post-exercise and there was also no significant difference seen in serum leptin and adiponectin levels within both groups at pre- and post-exercise respectively (Table 2). This could be due to duration of exercise and gender mix of the subjects that which have influenced their leptin and adiponectin levels.

### 3.3. Correlation between post exercise changes leptin and adiponectin

There was a significant negative correlation between post-exercise changes of serum leptin and adiponectin levels in control group ($p<0.03$) and intervention group ($p<0.05$) (Table 3).

Table 1. Anthropometric and study variables at pre exercise in both groups

| Variable | Intervention Group | Control Group |
|---|---|---|
| Age (years) | 26.5±6.03 | 25.67±4.03 |
| Weight (kg) | 88.02±15.68 | 83.67±7.41 |
| BMI (kg/m$^2$) | 33.47±3.80 | 32.07±3.23 |
| Leptin (ng/mL) | 4.65±2.78 | 6.00±3.1 |
| Adiponectin (ng/mL) | 5.75±2.91 | 6.71±2.80 |

Table 2. Impact of indoor rowing exercise on leptin and adiponectin between and within groups at pre-and post-exercise

| Variable | Group | Week | p |
|---|---|---|---|
| Leptin (ng/mL) | Control (n=6) | Pre -exercise | 0.097 |
| | | Post-exercise | |
| | Intervention (n=6) | Pre -exercise | |
| | | Post-exercise | |
| Adiponectin (ng/mL) | Control (n=6) | Pre –exercise | 0.157 |
| | | Post-exercise | |
| | Intervention (n=6) | Pre –exercise | |
| | | Post-exercise | |

Table 3. Correlation between pre- and post-exercise changes of leptin and adiponectin

| Variable | Group | r | p |
|---|---|---|---|
| Leptin (ng/mL) | Control | -0.87 | 0.03* |
| | Intervention | -0.82 | 0.05* |

*$p<0.05$

## 4. CONCLUSION

A 12-weeks of indoor rowing at intensity 60-80% $HR_{max}$ using interval training exercise did not seem to significantly affect leptin and adiponectin levels in obese subjects. This could be due to the small sample size, gender mix and exercise regimen. Future studies should include a larger sample size with subjects that are gender matched. In addition, this exercise regimen in obese could be improved in terms of duration and intensity.

## ACKNOWLEDGEMENTS

This work was supported by Research Acculturation Grant Scheme (RAGS/2013/UiTM/SKK09/4;600-RMI/RAGS 5/3(113/2013).

## REFERENCES

[1] World Health Organization. Fact sheet: obesity and overweight.[Online].Available:http://www.who.int/mediacentre/factsheets/fs311/en/.[Accessed May 10, 2016].

[2] Ouchi, N., & Walsh, K. "Adiponectin as an anti-inflammatory factor," *Clinica Chimica Acta*. https://doi.org/10.1016/j.cca.2007.01.026.2007.

[3] Moran, A.E., *et al*.,"Cost-Effectiveness of Hypertension Therapy According to 2014 Guidelines," *NEJM*, 372: 447-55, 2015.

[4] Jozwiak, BP., Bogousslavsky, J., "Antihypertensive and Lipid Lowering Treatment in Stroke Prevention: Current State and Future," *Acta neurol. Belg*., 105: 57-61, 2005.

[5] Abdulwahab, D., Basma, E., Abdulrazaq, A., Naziyah, S., Osama, Y., & Roszaman, R. Gender differences in fasting serum leptin level among Malaysian population[Power Point Slides].http://www.irep.iium.edu.my/31325/1/2013.

[6] Fantuzzi, G. "Adipose tissue, adipokines, and inflammation," *Journal of Allergy and Clinical Immunology*, *115*(5), 911–920. 2005.

[7] Hotta, K., Funahashi, T., Arita, Y., Takahashi, M., Matsuda, M., Okamoto, Y., … Matsuzawa, Y. "Plasma concentrations of a novel, adipose-specific protein, adiponectin, in type 2 diabetic patients," *Arteriosclerosis, Thrombosis, and Vascular Biology*, *20*(6), 1595–1599. 2000.

[8] Bouassida, A., Chamari, K., Zaouali, M., Feki, Y., Zbidi, A., & Tabka, Z. "Review on leptin and adiponectin responses and adaptations to acute and chronic exercise," *British Journal of Sports Medicine*, *44*(9), 620–630. 2010.

[9] Singh, P., Sharma, P., Sahakyan, K. R., Davison, D. E., Sert-Kuniyoshi, F. H., Romero-Corral, A., … Somers, V. K. "Differential effects of leptin on adiponectin expression with weight gain versus obesity HHS Public Access,"*Int J Obes*

*(Lond)*, *40*(2), 266–274. 2016.

[10] Ackel-D'Elia, C., Carnier, J., Bueno, C. R., Campos, R. M. S., Sanches, P. L., Clemente, A. P. G., … Dâmaso, A. R. "Effects of different physical exercises on leptin concentration in obese adolescents," *International Journal of Sports Medicine*, 35(2), 164–171. 2014.

[11] Racil.G., Universit, H. O., Ouest, P., La, N., & Manar, T. El. "Effects of high vs. Moderate exercise intensity during interval training on lipids and adiponectin levels in obese young females, (October). 2013.

[12] Lau, P. W. C., Kong, Z., Choi, C. rak, Yu, C. C. W., Chan, D. F. Y., Sung, R. Y. T., & Leung, B. W. C. "Effects of Short-Term Resistance Training on Serum Leptin Levels in Obese Adolescents," *Journal of Exercise Science and Fitness*, *8*(1), 54–60.2010.

[13] Sari, R., Balci, M. K., Balci, N., & Karayalcin, U. "Acute Effect of Exercise on Plasma Leptin Level and Insulin Resistance in Obese Women with Stable Caloric Intake," *Endocrine Research*, *32*(1–2), 9–17. 2007.

[14] Shin, K.-Y., Choi, E.-H., Lim, J.-Y., Cho, A.-R., & Lim, Y.-H. "Effects of Indoor Rowing Exercise on the Body Composition and the Scoliosis of Visually Impaired People: A Preliminary Study," *Annals of Rehabilitation Medicine*, *39*(4), 592–598. 2015.

[15] Asaka, M., Kawano, H., & Higuchi, M. "Rowing as an aerobic and resistance exercise for elderly people," *J Phys Fitness Sports Med*, *1*(2), 227–234.2012.