# Effect of low and moderate aerobic training on appetite and Plasma Ghrelin level in obese sedentary women

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**Abstract:** The purpose of this study was to compare aerobic exercises with low and moderate intensity on plasma acyl gherlin changes in obese females. 16 rather obese women were randomly selected and divided into into four groups: 1) High weight with low exercise (45.75± 6.75 yrs, BMI: 29.21±0.5Kg/$m^2$), 2) Obese with moderate exercise (47.12 ± 4.12 yrs, BMI: 29.59 ± 0.127 Kg/$m^2$). All groups practiced running 8 weeks (3 sessions per week), 30 minutes with 50% MHR and low groups practiced the same exercise with 60% MHR. Data were analyzed by T test at 0.05 level. In both groups, plasma acylated ghrelin level increased (P<0.05). Moreover, there was only a significant difference in changes of the appetite and plasma acylated ghrelin level between 4 $^{th}$ and 8 $^{th}$ week of training (P<0.05). **[**Khalil Zadeh M, Ghahramani M, Salehian MH, Shirmohammadzadeh M. **Effect of low and moderate aerobic training on appetite and Plasma Ghrelin level in obese sedentary women. .** *Life Sci J* 2013;10(6s):301-307] (ISSN:1097-8135). http://www.lifesciencesite.com. 47

**Kew words:** exercise intensity, acylated ghrelin, appetite, obese women

## 1. Introduction

Nowadays, there is a global trend towards fatness, and it is not limited to developed countries (Neary et al., 2009). Inactive lifestyle, face the appetite with the problem (Kisileff et al., 1990). And, also it is thought sports activity would be effective on feeding behavior (Brandon et al., 2008). In this regard, conflicting results about the effects exercise on appetite have been reported (Kisileff et al., 1990; King et al., 1997; Blundell et al,, 2003; Blundell & King, 1999). In addition, there is no clear information about high intensity sports on ghrelin concentrations in plasma, so that some research have been reported about the lack of sport effect on ghrelin levels during exercise or after the sport (Takano et al., 2005; Schmidt et al., 2004; Pomerants et al., 2006; Martins et al., 2007b; Kraemer et al., 2007; Katch et al., 1979; Kallio et al., 2001; Dall et al., 2002; Burns et al., 2007), and some to increase it (Sartorio et al., 2008; Kallio et al., 2001; Erdmann et al., 2007' Christ et al., 2006), and others, reducing the amount of this hormone (Vestergaard et al., 2007; Toshinai et al., 2007; Kraemer et al., 2004a; Ghanbari-Niaki, 2006). It is noted that only the acyl ghrelin has the ability to cross the blood-brain barrier (Murphy, 2006). So it seems that only this certain type of hormones impacts on the regulation of appetite. Meanwhile, according to the low and paradoxically report about the effect of exercise on the acyl Ghrelin (Mirzaei, 2009; Mackelvie et al., 2007; Broom et al., 2007), it seems to consider the amount of ghrelin in past researches, has not provided an accurate picture of regulation of appetite. On the other hand, with starting non-active individuals' participation in the sports programs, the amount of fat falls unequally between men and women (Potteiger et al., 2003; Donnelly et al., 2003). Generally, the men with a fixed diet can reduce their weight during participating in the training programs, but the amount of reduction in women, are not as the same as the men (Potteiger et al., 2004; Hagobian et al., 2008; Donnelly et al., 2003, Broom et al., 2007). These results are aligned with other reported observations in the amount of fat oxidation despite sex differences during sports (Potteiger et al., 2003; Henderson et al., 2007, 2008). It has also been reported that the intensity of exercise both acute and low aerobic activity and resistance (a session) increase feelings of hunger and desire for food in both obese and thin women, whereas high-intensity resistance activity, decreased appetite (Ebadi, 2009). Kisileff et al (1990) reported effect of moderate to severe activity on both obese and thin women, that the intense activity in the non-obese women decreased appetite. The average activity increased appetite in obese individuals, while there was not any significant response in any of the activities, in the case of non-obese women (Kisileff et al.,1990). In another research, two types of strenuous activity with 70% maximal oxygen consumption and low activity, with 40% maximal oxygen consumption was studied in women with normal weight and the results showed that none of the activities caused significant differences in womens' appetite (Pomerleau et al., 2004).

In general there are many researches on the impact of exercise intensity on appetite (oblivious to gender) ;

an overall assessment indicate that the low exercise intensity has no any decrease (Thompson et al., 1988) or changes on appetite (Dodd et al., 2008; Imbeault et al., 1997). Physical activities with medium intensity show no change (Kisileff et al., 1990; Melanson et al., 1999; Reger & Allison, 1987; Pomerleau et al., 2004), a decrease (Broom et al., 2009; Kisileff et al., 1990; Martins et al., 2007; Pomerleau et al., 2004) and even increase of appetite (Pomerleau et al., 2004; Martins et al., 2007a; Mackelvie et al., 2007; Ghanbari-Niaki, 2006); also, exercises with high intensity have been reported a decrease (Ghanbari-Niaki, 2006), an increase (Maraki et al., 2005) and no change on appetite (Imbeault et al., 1997); therefore, according to the controversial observations the possibility of accurate conclusions about the aerobic practices in different intensities on appetite is not available at present; so there is a crucial need to develop many accurate researches in this field; therefore the present literature review shows that due to the different abilities in of intensities in women manipulated diet pattern it seems that the related intensity along with high fat oxidation is not considered as a suitable solution in this regard; in the other hand the high degree of fat oxidation and appetite provoking processes cannot cause to satisfying results. Also this can be true for women gain weight programs. Therefore, if the special range of physical intensity (in addition to provide lose-weight background) leads to decrease/increase of appetite (compared to other intensities) this can be practical for those ones who try to gain weight. In this research we try to evaluate for the first time the simulations effect of aerobic exercise on appetite of obese women mental and physiological conditions; so, for the reason it is very distinct research from other similarities.

## 2. Methods

In this research among healthy, non-smoking volunteer women about 20 moderate obese subject (BMI>28) randomly divided into 4 groups (obese with light and moderate exercise); They practiced for 8 weeks (3 sessions per week) after initial warm-up (5 min running with 30% of maximum heart rate, 30 min walk and run with 50% maximum heart rate have been experienced; the group of obese with a medium training also did the same exercise intensity with 60% of maximum heart rate; exercise intensity was set through using heart-rate meter (polar: Finland) (in the range of ±5 shock error rate calculated). it should be noted as previous studies (Neary et al., 2004), all subjects were not in regular follicular period (the mean and criteria deviation of follicular period time is given in table 1); during the fulfillment of the research two subjects were excluded from the study due to personal problems or unwillingness to cooperate. At the end of 14 subject results were analyzed. Characteristics of subjects and their changes in weight are shown in table 1.

**Table 1.** Characteristics and weight changes of subjects and distances

| Index Body mass ($Kg/m^2$) | Age (Year ) | Index Practice | Group |
|---|---|---|---|
| 29.21±0.5 | 45.75 ± 6.75 | Low | Obese |
| 29.59 ± 0.127 | 47.12 ± 4.12 | Moderate | |

Collecting blood samples: in order to measure plasma acyl ghrelin (7cc of blood from the right vein) and based on Mirzaie et al. method, (2009), 1cc of blood was mixed with aprotinin and EDTA and then the sample was added to it; after centrifuge (15min with 1300 rpm), plasma separated and frozen. In time measurements refrozen samples after incubation (two hr at room temperature) adding buffer (m 1000 microliters per 50ML of sample) and washing (two times) and also adding substrate were measured by ELISA using a special kit of acyl ghrelin (Roche).

**Table 2.** Comparison of changes in appetite levels between groups with T test

| | Difference | Sig. |
|---|---|---|

| | | |
|---|---|---|
| 4 Up to 8 Weeks after training | 0.619 ± 2.053 | 0.003 * |

*: Represents the difference is significant (0.05> P ).

**Table 3.** Comparison of changes in satiety levels between groups with ANOVA test

| | | sig |
|---|---|---|
| Prior to 4 Weeks after training | - | - |
| Prior to 8 Weeks after training | 0.526 ± -1.21 | 0.030 * |

*: Represents the difference is significant (0.05> P).

**Table 4**. Changes in Plasma Ghrelin levels were compared between groups using ANOVA tests

| | Mean square | Df | F | sig |
|---|---|---|---|---|
| Prior to 4 Weeks after training | 0.217 | 3 | 2.557 | 0.077 |
| Prior to 8 Weeks after training | 0. 257 | 3 | 2.023 | 0.135 |
| 4 Up to 8 Weeks after training | 0.049 | 3 | 0.658 | 0.587 |

*: There is no significant difference (0.05> P).

**2, 1. Statistical method**

The study of all data distribution way using T test in each group up to the end of 4th and 8th weeks. The data of appetite and acyl ghrelin were also compared by Bonferroni follow-up and iterative measurement tests; also after measuring the degree of each indicator of appetite (feeling of satiety) as well as the changes of plasma ghrelin during before the 4th to the 8th weeks and also 4-8 weeks after beginning of each groups practices, the degree of theses differences after the governed confidence level of normal distribution and their variations in pre-test (Levin-test) were compared by ANOVA tests. Furthermore the relationship between weight changes in the intervals before exercise up to 4 and 8th weeks after the end of practice, and also between 8th weeks practices with the changes corresponding to the indices of appetite (2 indicators), and changes of ghrelin acyl during the same time was evaluated by using the Pearson correlation coefficient. Significant level in all tests was considered with 0.05.

3. **Results**

Through getting reliable and homogeneous variables of each group (appetite, plasma acyl ghrelin in pre-test of Levin-test), the degree of changes related to hunger satiety and also changes of acyl ghrelin were compared between 2 groups by the ANOVA and LSD follow-up tests during before 4-8 weeks and after practicing between 4-8 weeks; the results are shown in table 2 and 4. The results showed that the changes between the feeling of hunger and satiety oblivious to fatness or thin body and the intensity of practice do not include any differences between each groups during the beginning to 4th after practice.

4. **Discussion**

The results showed the degree of hunger in 8 week was higher than both 4th week of before/after the practice. Also decrease the feeling of satiety in 2 groups showed that subjects feeling of appetite were increased; besides during the beginning to the 4th week after practice, the changes of hunger and degree of satiety the oblivious to fatness or thin and the intensity of practice took place observing no any differences between the groups. A decrease of hunger along with light workout has been observed in thin group during before practice to the end of 8th week. In a study, in despite of increased appetite in fat and thin girls after exercise the same increased degree was observed in fat girls (Dodd et al., 2008). In another study vigorous activity only in non-obese women caused to decrease of appetite and also moderate activity as well as increasing appetite in obese individual. Based on another research in women with normal weight intense activity did not change in appetite (Potteiger et al., 2003). In this regard, evidences show that such changes in body temperature pressure and discomfort from strenuous activity (Thompson et al., 1988), increased levels of lactic acid and catecholamines (Katch et al., 1979), changes in glucose levels, fatty acid and plasma insulin (Westerterp-Plantenga et al., 1997), decreased acyl ghrelin secretion in extreme sports (Broom et al., 2009), a negative feedback effect of exercise intensity with growth hormone (Kraemer et al., 2007), a subjective expectation of receiving reward after intense exercise (Kisileff et al., 1990) and obese personal nature in high-hunger response towards high-intense exercise (Donnelly et al., 2003), can be considered as the high-potential and effective factors on responding individual's appetite; it seems that in despite of any recommendations for manipulating the normal diet from researchers, the main aim of the subjects for losing their weights leading to the limited calorie from the diet; this also causes to challenging issues of the appetite. Unfortunately, due to the lack of

clarified information in this field, a case discussion about the degree of hunger and satiety of each group is complicated. However, survey results showed changes in appetite in obese and thin women in different time intervals with low and medium intensities are not the same pattern. Also the lowest increase of appetite in thin group workout takes place in which it can be crucial for those thin women who try to gain weight; also, it is important that due to probability of different personal effects and the lack of reliable results, the research-based planning are needed to get enough data in this regard. In this research changes in plasma ghrelin was not significant in intervals of the study (table 4). This can cause no difference in the amount of changes in appetite physiologically; in this case Mirzaie et al (2009) also reported that in response to aerobic sport there is no significant difference in the level of acyl ghrelin of thin/fat women; moreover in terms of its changes degree between pre-test to post-test ($8^{th}$ week) no any differences observed between groups in which these are adapted with the recent results of the study; according to our observations, acyl ghrelin levels increased during the study in 2 groups. In this regard it is reported that the significant decreased body weight can cause to increase of ghrelin hormone (a crucial increasing hormone of appetite) (Potteiger et al., 2003); In terms of no observed significant difference in the pattern of increasing mental feeling in group's appetite between pre-workout up to the end of $4^{th}$ week ( tables 2 and 3) it seems that because of inactivity of the subjects in this study, finally the beginning day of exercise activity may be along with exhaustive/tiredness, collection of lactic acid and gastro-intestinal disorders; all these factors play key role in the prohibition of increasing appetite (Katch et al, 1979; Toshinai et al, 2007; Westerterp-Plantenga et al, 1997); but over the time and $8^{th}$ week of continuous workouts, physiological adaptations prevent above-mentioned factors and finally the pattern of subjects appetite will have fluctuations.

Mirzaie et al (2009) have also reported that the increase of non-acyl ghrelin in obese women in response to the medium aerobic exercise can cause to a greater appetite (Mirzaei et al., 2009); but other evidences have shown that exercise does not increase parallel in appetite and caloric intake (Chin, 1992). It must be noted that due to the fixation of relative intensity and activity time for fat/thin individuals, it is theoretically expected that thin subjects walk long distance in both low and moderate intensities and therefore it is probably the energy activity expenditures are not the same in thin/fat individuals. The intensity of activity is still quiet manageable in this regard; however in a study lasting more than an hour of exercise in mice reduces the amount of food intake and body weight compared with mice were inactive. At the time of 1hr of exercise food intake increased but this increase was consistent with the amount of needed to maintain body weight? In contrast, long term exercise (more than 6hr) both energy intake and body weight decreased (Dreon et al., 1988). The long term studies in human fitness in mild to moderate intensity exercise similar results have been reported (Woo et al., 1982); so, the possible changes of time up to manipulate the results may happen; in this study weight changes had not similar pattern (table 1); moreover, there is no any significant correlation between weight changes and activity energy in both groups. Therefore in first step in addition to the role of different weight changes method, it may be a question in the mind that body weight has no direct impact on the distance. However it seems that the amount of daily calories is almost independent of subjective feeling (results of VAS) and physiological conditions of hunger (acyl ghrelin levels); in this case there are observations that the volume and content of the food diversity of food and social impact (Harris & Mattes, 2008) and other cultural culprits and food seasonal customs can cause to manipulate receiving dietary; therefore it can be concluded that these changes into the related groups cannot due to the intensity of aerobic exercise or fatness/thinness; according to another research about the appetite and weight changes , the degree of subjects loss-weight in which used just dietary restriction had not any differences with other subjects whose apply activity program and dietary restrictions; so, it is concluded that equalization of energy expenses occur with the decrease degree of other daily activities (Klaas et al., 2005); unfortunately in a research literature review no similar observations found; however these findings represent that the degree of calories changes (appetite) does not completely depend on the feeling of hunger. Due to the lack of observations it is needed to achieve extra researches; it must be noted that one reason in the lack of relative relationship into the indices of appetite changes weight and acyl ghrelin can relate to personal differences among independent groups of people; it is imagined that fulfilling repetitive measurements from one group with similar protocols of the study it can cause to control the role of personal differences; in this way the existence of weight changes between protocols cause to the distribution of the results.

Generally it is not assumed that swing known factors can influence on the appetite and is quiet manageable. The social effects and variation in food availability energy costs and daily matches all can be involved in the economic status or culture. According

to the results of the survey the use of low and moderate intensity aerobic training has no difference in terms of changes in appetite. The moderate intense exercise create more benefits for those thin women who want to participate in the gain-weight programs. However we need to conduct longitudinal and more precise studies in this regard.

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