Research Journal of Biological Sciences 3 (11): 1356-1364, 2008
ISSN: 1815-8846

Effects of Leptin, Diet and Various Exercises on the Obesity

Mehmet Göral
Department of Physical Education and Sports, Dumlupınar University, 43020, Kutahya, Turkey

Abstract: This research is made to define damages of the obesity, cure processes with body exercises and effects of the leptin on the obesity. In this research, scientific researches about the subject were analyzed carefully and it was handled on these literatures. As a result, it is presented that an inactive life and fatty diets cause the obesity and the leptin influences the anti-obesity. Besides, it is shown that some body exercises reduce the obesity by wasting calories.

Key words: Leptin, exercise, obesity, diet

INTRODUCTION

When the human body is searched, it is shown that the human is perfect with the central neutral system, the sense organs, the respiration, the excretion, the hormonal, the skeleton and the muscle systems. We try to damage this perfect system with an inactive life and by consuming foods extremely. As a result of this, the obesity appears by breaking the balance among the nutrition and consuming energy. The obesity is accepted as an illness. There are many physical and psychological damages of the obesity on human beings. Especially, it causes psychological problems at the early ages. At the adult ages, it negatively affects the quality of life and the health. Especially, about the cardio and vessel illnesses fat people are under more risk than normal weighted people (Booth *et al*., 2005; Catford and Caterson, 2003; Catlin *et al*., 2003). There are many factors to evaluate the obesity. Main importance of them are to reduce movements in human life and to consume foods over needs. After machines have joined the daily lives, humans started to use their energy exclusively on managing and operating these machines. This situation reduced basic movements like walking, running, climbing and jumping in the human daily lives.

The obesity appears due to no change in nutrition habits and no increase in any physical activities in the daily life. In the cure of obesity, the method which is adviced by researchers commonly supports diet and exercise with changing behaviours. The main point in the diet is to limit taking energy over needs and to provide balanced diet. The fatty tissue should be protected while the fatty is disappearing in exercises. Two examples show us the effects of calories on gaining weight in average and small movements. As a result of 10 g fatty over needed 90 calories are gained, in this way, in the first year 3.6 kg are collected and then in total 18 kg are added to weight at the end of fifth year (Addy *et al*., 2004; Andersson *et al*., 1991; Ball *et al*., 2001; Bell *et al*., 2004; Blundell and King, 1988; Booth *et al*., 2000; Brennan *et al*., 2003; Brownson *et al*., 2001; Brukner and Brown, 2005; Cohen *et al*., 2006; Cox *et al*., 1987; Cutler *et al*., 2003; Department of Health, 2004; De Silva *et al*., 2005; Finch *et al*., 2001).

Health is defined as 'to be in a good situation of a person physically, psychological and social aspects' by WHO (2003). Obesity is the opposite of this definition. In order to solve the problem which threatens our health it is required to be aware of it. The goal of the research is to attract more attention to the obesity which affects over than 1/6 of the world population and damages the society materially, morally and healthy. In the research, the obesity is defined and information is given about the damages of the obesity. Moreover, which methods are used to determine the obesity and details about diet and necessary exercises during the cure processes are included in the thesis. The research subject is handled theoretically, also search and scan method was used (Dunstan *et al*., 2005; Durrant *et al*., 1982; Mohan *et al*., 2005; Poortinga, 2006; Powell *et al*., 1991; Pratt *et al*., 2000; Wadden *et al*., 2002; WHO, 2000, 2003).

The extreme increase of body fatty tissue over the normal body measures results the situation of obesity. The obesity is an illness which is caused by collecting fatty on the body because of wrong and extreme nutrition. We can easily say that whether people are obese or not by calculating the fatty percentage. For a normal person the fatty percentage should be under 20% for men, under 30% for women. If the fatty percentage increases over 20% for men, 30% for women, they can be classified as

obese. If it is over 50-70%, they are heavy obese. The obesity does not only appear as overweight. Also, it is an illness. Many researches were conducted about the obesity. This research was made to help obese people to get health (Diez-Roux, 2001; Donnelly *et al*., 2000; Duncan and Mummery, 2005; Dwyer *et al*., 1970; Ewing *et al*., 2003; Evans *et al*., 2004; Fisher *et al*., 2004; Flegal *et al*., 2002; Foster *et al*., 2004; Frank *et al*., 2004; Gable and Lutz, 2000; Giles-Corti *et al*., 2003; Haslam and James, 2005).

MATERIALS AND METHODS

The research was prepared by scanning literatures. It was appraised by handling the connection between the leptin and the obesity, explaining the reasons and damages of the obesity and focusing on the cure of obesity by the helps of exercises (Bennet *et al*., 1996; Brabant *et al*., 2000; Chehab *et al*., 1996; Kissileff *et al*., 1990; Lopez, 2004; Leon *et al*., 1979; Lindström *et al*., 2001, 2003; National Institutes of Health, 1998; Pelleymounter *et al*., 1995; Pischon *et al*., 2003; Pi-Sunyer and Woo, 1985).

Leptin and obesity: The leptin that is secreted and synthesised by the main fatty tissue service as an anti-obesity factor by arranging to take energy and effecting specific receiver in hypothalamus and to consume energy. There are many factors to secrete and synthesise. The leptin has some functions as the reproduction, the hematopoez to arrange gastrointestinal functions, as the angiogenez to arrange activations of sympathetic nervous system, the thermogenez and the brain development. The leptin is a hormone which looks like cytokines and includes 167 amino acid. The gram molecule is 16 kda and it has many functions in the body system. The ob/ob gene which is on long part of the seventh chromosome (7q31) of human is coded. Firstly, the ob/ob was determined as mutagenic gene in a mutant mouse. The leptin exists in two types: independent from and dependent to the protein. It is thought that the independent form is responsible on activities of the leptin. In researches, major part of the leptin of obese people is in the independent form. Hence, increasing the independent leptin form on obese people is evidence that supports the main reason is not failure of the leptin, it is leptin resistance to prevent the obesity (Pelleymounter *et al*., 1995).

The half-life of the leptin is about 30 min and it is secreted 2-3 h before eating. It has a diurnal rhythm and it rises at peak levels in the mornings and earlier hours, but in the afternoon it decreases to the low levels. The serum level on women is higher than it is on men. This situation explains that the fatty tissue and serum visceral fat rate is over. The main role of the leptin is to arrange the energy metabolism and to prevent the obesity development by giving negative 'feedback' to the brain (especially hypothalamus in the brain). Furthermore, it has many roles in arranging metabolism, sexual development, reproduction, hematopoez, immune system and also arranging gastrointestinal functions, sympathetic nervous system activations, the angiogenezis and the osteogenezis (Bennet *et al*., 1996; Friedman, 1997).

In the energy homoestasi, activations of the nucleus arbutus in the brain are different than others. For example; paraventriculer nucleus (PVN) lesions conclude with the obesity, lateral hypothalamic (LHA) lesions in the brain conclude with anorexia to save low weight. Therefore, arcuate nucleus neurons in the brain transport leptin signals to the 2 neurons and the coordination between two neurons is provided. During the challenging period to loose weight, LHA neurons are activated and the feeling of eating increases with the decrease of anorexigenic signals from PVN neurons and energy consumption decreases. Hence, gaining weight is provided by filling fatty warehouses on the body. By transforming signals which are waste of opposite PVN neurons, feeling of taking foods decreases, energy consumption increases and a reduction in fatty warehouses on the body occurs. At the result, the leptin prevents to gain over-weight by preventing anabolic signals transformation that causes to gain weight mentally by activating catabolic signals transformation that provides consuming energy. Except the leptin, signals are transformed to the brain from the gastrointestinal system to determine the dimension and frequency of the meal. Some of them transform with mechanical imputs thanks to streching of gastrointestinal tractus, major part of them transform with afferents on vagus. The first discovered and the most important hormonal satisfaction signal is the cholecystokinin. Besides this, the leptin works in a good coordination with the cholecystokinin. The leptin increases the sensitiveness to the cholecystokinin and so the meal volume decreases. The leptin requires the leukocyte and increases the effects of erythropoietin on the erythrocyte. The leptin supports phagocytes by activating the macrophages and requires the release of pro and anti-inflammatory cytokines. It is shown that it increases neovascularization by decreasing the cure of a bruise. Besides this, researches show us that the leptin is in a good communication tool with some mediators and it has a complex communication network. These mediators are separated to anabolic and catabolic. Anabolic provide the positive energy balance by increasing the take of nutrient

and decreasing the consumption of energy. On the contrary, catabolic decrease the take of nutrient, increase the consumption of energy. The leptin appearing in the hematopoietic tissues and 'stem' cells that are in embryonical development terms show that leptin may have a role in the hemotopoesis. Last researches include that the leptin effects to the development of hematopoietic cells especially T cells and macrophages with cytokines in early stages of the hematopoesis. In addition, it is determined that the leptin effects on macrophages directly (Brabant *et al*., 2000; Chehab *et al*., 1996; Havel, 1999; McConway *et al*., 2000; Wang *et al*., 1998).

The obesity can be classifies according to the below mentioned factors: Anatomical build, age level, amount of the fatty, gender, socio-economical level, endocrine factors, psychogenic factors, life style and nutrition habits, metabolic factors, physical activations and environmental factors. Damages of the obesity: psychological problems, mechanical inability, metabolic and cardiovascular problems, difficulties in treatments and problematic pregnancy.

Methods of determining the obesity

Area method formulas: Although, implementation is expensive and hard, the mistake rate is low. Because of this, measurements are used to develop methods.

Two formulas, that is, Brozek and Sirri formulas are used to calculate the fatless body mass and the fatty rate (Rutt and Coleman, 2005; Saelens *et al*., 2003; Schoeller, 1998; Jequier and Tappy, 1999; Snyder *et al*., 1997; Stubbs *et al*., 2002, 2004; Stubbs and Lee, 2004).

- Formulas of Sirri percent fatty = (4.950-4.50)/ Db)×100 (Db body density).
- Formulas of Brazek percent fatty = (4.570-4.142)/Db) ×100 (Db body density).
- Total Body Fatty (kg) = Body weight (kg)×percent fatty.
- The fatless body weight = Body weight (kg) - The fatty weight.

Area methods: We need some techniques that are detailed and are not found everywhere to calculate the fatty rate on the body. In clinical implementations to implement antropometric measurements according to height, weight and skin curl thickness are advised.

Normally, there is no common agreement but measurement's results are accepted by some authorities. According to this, the normal body fatty rate is 14% for 25 years-old men and 26% for women. If the body fatty rate is over 20% for men and 30% for women, the obesity is diagnosed (Neville *et al*., 2004; Orchard and Finch, 2002; Parizkova *et al*., 1968; Rutt and Coleman, 2005; Saelens *et al*., 2003; Schoeller, 1998; Jequier and Tappy, 1999; Snyder *et al*., 1997; Stubbs *et al*., 2002, 2004; Stubbs and Lee, 2004).

Body mass index: The best method of determining a person is fat or not is the Body mass index (BMI) (Table 1). BMI = Weight (kg)/Height (m) (Rutt and Coleman, 2005; Saelens *et al*., 2003; Sallis and Glanz, 2006; Saris *et al*., 1989; Saris *et al*., 2003; Scheurink *et al*., 1999; WHO, 2000, 2003).

The cure of the obesity

The diet: When you advice about the diet, needs and habits of patients should be considered.

Properties of the diet which will be implemented:

- It should be harmless, provide enough nutrition.
- Daily necessary calories should be given in minimum 3 meals.
- Proteins, vitamins and minerals on patients should be stocked. Basic nutrition elements should be provided enough and in balanced.
- The implementation should be easy and effective on long-term.

For an obese person, rather than diet exposing measured nourishment habits is more agreeable. The motivation is the key for patients (Mohan *et al*., 2005; Murgatroyd *et al*., 1999; Richard, 1995; Schulz and Schoeller, 1994; Stahl *et al*., 2001; Story *et al*., 2006a, b; Woo *et al*., 1982; van Erp-Baart *et al*., 1989; Zhang *et al*., 1994).

The main principles of a limited and stable energy diet:

- To decrease weight to necessity and saving on this level.
- To provide basic nutriment elements.
- To provide suitability of the diet according to life style, beliefs, socio-economic situation of the patient.
- To provide learning about the diet and accepting it by patients.
- To provide the balance of energy that diet requires.

Table 1: Body Mass Index (BMI) of WHO

WHO classification	BMI (kg m^{-2})
Weak	<1.5
Normal kg	18.5-24.9
Over weighted	25.0-29.9
Fat	≥30.0-0
I°	30.0-34.9
Ii°	35.0-39.9
III°	≥40.0

- To determine time of weakening.
- To arrange numbers of the meals (Mohan *et al*., 2005; Murgatroyd *et al*., 1999; Richard, 1995).

The composition of the diet for weakening: The proteins, fatty, carbohydrates, drugs, water, salt, vitamins, minerals, alcohol.

Classification according to the contents of calories: Low-calorie diet, limited diet, one meal diet, one food reduced diet, very low calorie diet, completely hungered diet, high protein diet (Story *et al*., 2006; Woo *et al*., 1982; van Erp-Baart *et al*., 1989; Zhang *et al*., 1994).

Damages of losing weight with hunger:

- Reducing the dynamism on blood pressure. Typical signs are dizziness and faint.
- The uric acid increases.
- Bloodless and sleeplessness.
- Problems of kidney's blood shedding and filtration processes.
- Losing hair.
- Muscular stretching, increase in cramps and power reducing.

Emotional troubles: Reducing of the physical activation capacity (Cox *et al*., 1987; Cutler *et al*., 2003; Department of Health, 2004; De Silva *et al*., 2005; Keim *et al*., 1990; Diez-Roux, 2001).

- Behaviour changes.
- Behaviour changing programs are focus on changing the nourishment and exercise habits to control the weight on long-term.
- During motivating fat people for behavioural.
- To escape from habits which cause to eat extremely.
- Eating foods slowly.
- To appraise on results of some behaviours can be used.

The success rate of behaviour changing programs is complicated. Results of some researches reflect that the effects of behaviour on cure processes to lose weight in the middle-level and this situation goes on during one year.

In some parts of researches that are conducted about the behavioural cure in the obesity, there is not any information about results of watching patients in long-term. After 5 years observation of 36 people who joined the cure program it is understood that they have returned to the initial weights although, they lost weight during the cure program (Dwyer *et al*., 1970; Ewing *et al*., 2003; Evans *et al*., 2004; Maughan, 1999; Melzer *et al*., 2004).

The cure with medicine: If the weakening is succeeded as the result of diet, exercises and education, there will be no necessity to the medicine based cure program. It is advised to use these medicines under the control of doctors. We should use the medicines that have minimum repercussions (Finch *et al*., 2001; Fisher *et al*., 2004; Flegal *et al*., 2002; Foster *et al*., 2004).

Medicines that doctors use for the cure of obesity in their clinic can be seperated three main groups.

Post tagged: Medicines in this group break, the appetite but they damage the nervous system and cause to insolvency.

Thermogenic medicines: They include thyroxine T4, thriiodothyronin T3, ephedrine and growth hormone. These medicines have serious cardiovascular repercussions.

Nourishment absorption inhibitors: They include like the colestramin, the tetrahydrolipstatin, the acarbose. These medicines have gastrointestinal repercussions, they do not provide important weight-losing in chronicle using but they have roles in to go on losing weight.

Exercises: The exercises are very important part of the life. Besides this, limitation of energy on the level of consumed energy with the exercises provides the best results for the cure program. The exercises should conclude with losing weight, the body fatty and saving the fatness of body mass (Table 2). Benefits of exercises except losing weight are losing fatty and saving the muscle mass. The muscle tissue wastes energy also during the rest. Whereas some diets help to lose weights by not requiring exercises, however that diet programs provide to lose weight on muscle tissues and water volume of the body. This situation causes to gain weight again and it is inconvenient for the health (Addy *et al*.,

Table 2: Amount of calories which are consumed

	Calorie consumed in 1 h time	
Activity type	Male	Female
Sleeping	62-63	52-53
Resting in bed dressing-undressing-having bath etc.	71-77	80-88
Time passing by sitting	110-128	80-88
Reading, watching TV etc.	91-98	70-77
Handiwork at stand and walking slowly	95-210	150-166
Walking fast	286-308	220-242
Works done by bending down and up (Garden, farm works and light gymnastics)	280-311	215-236
Playing tennis, digging	351-375	297
Running-walking	455-490	350-385
Riding bicycle (Slow)	227-245	175-192
Houseworks	162-175	125-137

2004; Andersson *et al*., 1991; Ball *et al*., 2001; Booth *et al*., 2000; Brennan *et al*., 2003; Brownson *et al*., 2001; Brukner and Brown, 2005).

Each exercises cause to lose energy. However, especially the aerobic exercises are important to cure the obesity. It is provided to use the body fatty with aerobic exercises.

- Exercises.
- To consume energy should be encouraged.
- Losing fatty should be provided, the fatness body mass should be saved.
- The vital danger should not be created.
- The level of activations of patients.

Types of exercises

Walking: You should not despise the walking because 1 h walking causes to consume 132 calories for women, 156 calories for men. Fast walking causes to consume 180 calories for women, 220 calories for men. Legs, hip, back and arm muscles work during walking. If you start recently, walk slowly and orderly. Furthermore, you should be careful that your shoes should be soft. Especially, you should begin with foot and leg exercises.

Jogging: The jogging is the easiest way to lose calories. Before all, people who do jogging should be controlled by a doctor. If not, it can be a nightmare. If you do jogging in outdoor, forest or seashore you can take maximum efficiency because the respiratory system and the circulation system develop thanks to oxygen.

Tennis: Nowadays, tennis is one of the most favourite sports. However, playing tennis is not easy. To stretch before and after the game for 15 min prevents injury. It is an ideal sport for people who have weight problems. All muscles work with tennis.

Cycling: It is one of good sports to lose weight and to get form. Bicycles that are used by children, adults, elder people do not have any damages and difficulty. It provides to develop of your bones. It helps you to escape from stress. Especially, undersides of legs work. Besides this, it is effective for arms, shoulders and backs.

Aerobic: The aerobic that starts slowly and then increases the tempo and provides different areas to be worked. It is causes the strictness to the body besides cardiovascular benefits. If you do in a sport center, you should prefer a suitable level. You may be injured in the high level practices. If you prefer soft shoes, you can feel more comfortable.

Step: The step is an exercise which increases stage to stage like aerobic. Especially, it gets underside of the body worked. Besides this, it provides cardiovascular benefits. At the beginning of the step, to start with a low step board reduces injury risks.

Physical activities during body weight control:

- To increase physical activities and it should be a part of your life during the diet.
- To weaken becomes hard by increasing physical activities without the diet.
- Don't start exercises without warming.
- If you do exercises first time, start slowly.
- For people who have started recently, the best exercise is walking. You should try to increase your walking level everyday.
- After at least one month walking pass to the jogging program.
- Be careful that heartbeat speed should not pass over 120-140 in a minute.
- Apply to a health association before starting physical activities.

Benefits of stable exercises:

- Exercises increase HDL and decrease LDL.
- Exercises increase HDL/LDL.
- Exercises increase glucose tolerance, decrease insulin needs.
- Exercises increase the resistance against tiredness and stress by increasing Max VO_2, improve feeling good by decreasing blood pressure.
- The weakening can be realised with exercises only without the diet by fat people who have hiperplasia in their fatty tissue.

The attention points in exercises that aim to lose weight:

- The resistance type like aerobic should be preferred.
- Consuming energy should be increased from less to much.
- Types of exercises should be funny.
- Losing weight weekly should be half or one kilo.
- Daily time and weekly frequency are important in losing weight. In the cure of the obesity, the important is total consumed-weight.
- Exercises' destiny should be made for 30 min in a day and 3-5 times with 60-70% of the pulse.
- Stretching should be done before exercises.
- Active resting should be done after exercises.
- Don't charge extremely.

Doing regional exercise or massage is unnecessary because when the balance of energy goes on negatively,

the fatty tissue gets from regions that the tissues are more intensive (Addy *et al*., 2004; Andersson *et al*., 1991; Ball *et al*., 2001; Booth *et al*., 2000; Brennan *et al*., 2003; Brownson *et al*., 2001; Brukner and Brown, 2005; Catford and Caterson, 2003; Catlin *et al*., 2003; Chehab *et al*., 1996; Cohen *et al*., 2006; Cox *et al*., 1987; Cutler *et al*., 2003; Department of Health, 2004).

Formulating low and high level of your capacity in exercises:

- Your real age-220.
- Result × 0.7 for high level.
- Result × 0.6 for low level.

RESULTS AND DISCUSSION

The aim is not to lose overweigth; it is to save weight by weakening on long-term. Therefore, the necessary thing is to change habits and adopt a new life style. The necessity is to start a healthy nourishment program that includes low fatty and calorie rates. We should not forget that by losing 5% of our actual overweight, we can provide to get better about some illnesses besides obesity and to get the life longer.

The directional approach is required to cure the obesity. The medicine is an important part of it. It is possible to succeed with reduced-fatty and low calories diet, stable exercises and the behaviour cure which aim to change the life style (Cox *et al*., 1987). Losing weight is not possible with the diet. I hope that it is thought you about importance of exercises. Dynamic exercise programs that make some muscle groups worked has to be followed besides diet. Swimming and cycling are recommended sport branches for obese people (Department of Health, 2004; De Silva *et al*., 2005; Duncan and Mummery, 2005; Durrant *et al*., 1982). At the middle-level, half an hour physical activities is advised according to the results of National Institute of Health Consensus Conference 1996. Losing 1500 calories in a week has to be the aim of the activity level. A research that compares physical activities like fast walking, jogging, cycling, swimming, playing tennis, aerobic and dancing shows that it reduces coroner illness frequency as same as other professional exercise programs. Fast walking during 3 h or over in a week reduces coroner disease events about 30-40%. The easiest and beneficial exercise is walking (Department of Health, 2004; Dwyer *et al*., 1970; Ewing *et al*., 2003).

The obesity firstly and in general occurs in childhood. Parents have many missions to prevent their children from obesity. They should nourish children in a balance and they should not orientate them to an active lide style. Thanks to this, active life style will be a living behaviour of children. Hence, obesity will not appear suddenly.

Obesity is caused as a result of a long weight collecting process. Therefore, if a person is on the level of obesity, short-term solutions are impossible, because person does not get fatty in a day, so that breaking away from the obesity can not be realized in short-term normally. Because of short-term solutions, people think that they break away from the obesity, but after a little time they gain weight again. The numbers of the fatty cells of each people are determined. It does not decrease or increase but volumes of fatty cells decrease or increase. There is some methods to decrease the volume of the fatty cells: stable nourishment, active life and high pleasure. Other than these solutions are imitations (Stubbs *et al*., 2002, 2004; Stubbs and Lee, 2004; Wadden *et al*., 2002; Wang *et al*., 1998; WHO, 2000, 2003; Woo *et al*., 1982; van Erp-Baart *et al*., 1989; Zhang *et al*., 1994).

- You should know that obesity causes serious illnesses and gets life-time shorter.
- Stable nourishment habits have to be adopted.
- The head and mentality is the most important stuffs to lose weight.
- To gain weight again should be prevented with changes in behaviours.
- The active life style should be adopted.

REFERENCES

Addy, C.L. *et al*., 2004. Associations of perceived social and physical environmental support with physical activity and walking behaviour. Am. J. Pub. Health, 94 (3): 440-443.

Andersson, B. *et al*., 1991. The effects of exercise, training on body composition and metabolism in men and women. Int. J. Obes., 15 (1): 75-81.

Ball, K. *et al*., 2001. Perceived environmental aesthetics and convenience and company are associated with walking for exercise among australian adults. Preven. Med., 33 (5): 434-440.

Bell, C. *et al*., 2004. High energy flux mediates the tonically augmented beta-clin endocrinol. Metab, 89 (7): 3573-3578.

Bennet, B.D. *et al*., 1996. A role for leptine and its cognate receptor in haematopoiesis. Curr. Biol., 6: 1170-1180.

Blundell, J.E. and N.A. King, 1988. Effects of exercise on appetite control: Loose coupling between energy expenditure and energy intake. Int. J. Obes. Relat. Metab. Disord., 22 (2): S22-S29.

Booth, K.M. *et al*., 2005. Obesity and the built environment. J. Am. Dietet. Assoc., 105 (5, 1): 110-117.

Booth, M.L. *et al*., 2000. Social-cognitive and perceived environment influences associated with physical activity in older Australians. Preven. Med., 31 (1): 15-22.

Brabant, G. *et al*., 2000. Free and protein bound leptine are distinct and independently controlled factors in energy regulation. Diabetologia, 43: 438-442.

Brennan, L.K. *et al*., 2003. Linking perceptions of the community to behaviour: Are protective social factors associated with physical activity? Health Edu. Behav., 30 (6): 740-755.

Brownson, R.C. *et al*., 2001. Environmental and policy determinants of physical activity in the united states. Am. J. Pub. Health, 91 (12): 1995-2003.

Brukner, P.D. and W. Brown, 2005. Is exercise good for you?, Med. J. Aust., 183 (10): 538-541.

Catford, J.C. and I.D. Caterson, 2003. Snowballing obesity: Australians will get run over if they just sit there. Med. J. Aust., 179 (11/12): 577-579.

Catlin, T.K. *et al*., 2003. Environmental and policy factors associated with overweight among adults in Missouri. Am. J. Health Promotion, 17 (4): 249-258.

Chehab, F.F. *et al*., 1996. Correction of the sterility defection homozygous obese female mice by treatment with the human recombinant Leptine. Natl. Genet., 2: 318-320.

Cohen, D.A. *et al*., 2006. Collective efficacy and obesity: The potential influence of social factors on health. Soc. Sci. Med., 62 (3): 769-778.

Cox, B.D. *et al*., 1987. The health and life style survey. Health Promotion Research Trust, London.

Cutler, D.M. *et al*., 2003. Why have Americans become more obese? J. Econ. Perspect., 17 (3): 93-118.

De Silva, M.J. *et al*., 2005. Social capital and mental illness: A systematic review. J. Epidemiol. Commun. Health, 59 (8): 619-627.

Department of Health, 2004. At least 5 a week: Evidence on the impact of physical activity and its relationship to health. A report from the chief medical officer. London.

Diez-Roux, A., 2001. Investigating neighbourhood and area effects on health. Am. J. Pub. Health, 91 (11): 1783-1789.

Donnelly, J.E. *et al*., 2000. The effects of 18 months of intermittent vs. Continuous exercise on Aerobic Capacity, body weight and composition and metabolic fitness in previously sedentary, moderately obese females. Int. J. Obes. Relat. Metab. Disord., 24 (5): 566-572.

Duncan, M. and K. Mummery, 2005. Psychosocial and environmental factors associated with physical activity among city dwellers in Regional Queensland. Preventive Med., 40 (4): 363-372.

Dunstan, F. *et al*., 2005. An observation tool to assist with the assessment of urban residential environments. J. Environ. Psychol., 25 (3): 293-305.

Durrant, M.L. *et al*., 1982. Effect of exercise on energy intake and eating patterns in lean and obese humans. Physiol. Behav., 29 (3): 449-454.

Dwyer, J.T. *et al*., 1970. The social psychology of dieting. J. Health Soc. Behav., 11 (4): 269-287.

Evans, J. *et al*., 2004. Disordered eating and disordered schooling: What schools do to middle class girls?. Br. J. Sociol. Edu., 25 (2): 123-142.

Ewing, R. *et al*., 2003. Relationship between Urban Sprawl and Physical Activity, Obesity and Morbidity. Am. J. Health Promotion, 18 (1): 47-57.

Finch, C. *et al*., 2001. Current Injury or Disability as a barrier to being more physically active. Med. Sci. Sports Exerc., 33 (5): 778-782.

Fisher, K.J. *et al*., 2004. Neighborhood-level influences on physical activity among older adults: A multilevel analysis. J.Aging Phys. Activity, 12 (1): 45-63.

Flegal, K.M. *et al*., 2002. Prevalence and Trends in Obesity among US Adults, 1999-2000. J. Am. Med. Assoc., 288 (14): 1723-1727.

Foster, C. *et al*., 2004. Environmental perceptions and reported walking in English adults. J. Epidemiol. Commun. Health, 58 (11): 924-928.

Frank, L.D. *et al*., 2004. Obesity relationships with community design, physical activity and time spend in cars. Am. J. Preven. Med., 27 (2): 87-96.

Friedman, J.M., 1997. Role of Leptine and its Receptors in the Control of Body Weight. In: Blum, W.F., W. Kiess and Rascher Weds. Leptine-the Voice of Adipose Tissue. Johann Ambrosius Barth Verlag, Germany, pp: 3-22.

Gable, S. and S. Lutz, 2000. Household, parent and child contributions to childhood obesity. Family Relations, 49 (3): 293-300.

Giles-Corti, B. *et al*., 2003. Environmental and life style factors associated overweight and obesity in Perth, Australia. Am. J. Health Promotion With, 18 (1): 93-102.

Haslam, D.W. and W.P. James, 2005. Obesity. Lancet, 366 (9492): 1197-1209.

Havel, P.J., 1999. Role of adipose tissue in body-weight regulation: Mechanisms Regulating Leptine production and energy balance. Proc. Nutr. Soc., 59 (3): 359-371.

Jequier, E. and L. Tappy, 1999. Regulation of body weight in humans. Physiol. Rev., 79 (2): 451-480.

Keim, N.L. *et al*., 1990. The effect of exercise on energy intake and body composition in overweight women. Int. J. Obes., 14 (4): 335-346.

Kissileff, H.R. *et al*., 1990. Acute effects of exercise on food intake in obese and nonobese women. Am. J. Clin. Nutr., 52 (2): 240-245.

Leon, A.S. *et al*., 1979. Effects of A Vigorous Walking Program on Body Composition and Carbohydrate and Lipid Metabolism of Obese Young Men. Am. J. Clin. Nutr., 32 (9): 1776-1787.

Lindström, M. *et al*., 2001. Socioeconomic differences in leisure time physical activity: The role of shaping participation and social Capital in Shaping Health Related Behaviour. Soc. Sci. Med., 52 (3): 441-451.

Lindström, M. *et al*., 2003. Social capital and leisure time physical activity: A Population Based Multilevel Analysis in Malmö, Sweden. J. Epidemiol. Commun. Health, 57 (1): 23-28.

Lopez, R., 2004. Urban sprawl and risk for being overweight or obese. Am. J. Pub. Health, 94 (9): 1574-1579.

Maughan, R.J., 1999. Role of Micronutrients in sport and physical activity. Br. Med. Bull., 55 (3): 683-690.

McConway, M.G. *et al*., 2000. Differences in circulating concentrations of total, free and bound Leptine relate to gender and body composition in adult humans. Ann. Clin. Biochem., 37: 717-723.

Melzer, K. *et al*., 2004. Physical activity: The health benefits outweigh the risks. Curr. Opin. Clin. Nutr. Metab. Care, 7 (6): 641-647.

Mohan, J. *et al*., 2005. Social capital, geography and health: A small area analysis for England. Soc. Sci. Med., 60 (6): 1267-1283.

Murgatroyd, P.R. *et al*., 1999. Effects of inactivity and diet composition on human energy balance. Int. J. Obes. Relat. Metab. Disord., 23 (12): 1269-1275.

National Institutes of Health, 1998. National institutes of health, clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults-the evidence report. Obesi. Res., 6 (2): 51-209.

Neville, J. *et al*., 2004. Confronting the epidemic: The need for global solutions. J. Pub. Health Policy, 25 (34): 418-434.

Orchard, J.W. and C.F. Finch, 2002.Australia needs to follow New Zealand's Lead on Sports Injuries. Med. J. Aust., 177: 38-39.

Parizkova, J. *et al*., 1968. Body composition and physical fitness and comments and reply. Curr. Anthropol., 9 (4): 273-287.

Pelleymounter, M.A. *et al*., 1995. Effects of the obese gene product on body weight regulation in Ob/Ob Mice. Science, 269: 540-543.

Pischon, T. *et al*., 2003. Leisure-Time physical activity and reduced plasma levels of obesity-related inflammatory markers. Obest. Res., 11 (9): 1055-1064.

Pi-Sunyer, F.X. and R. Woo, 1985. Effect of exercise on food intake in human subjects. Am. J. Clin. Nutr., 42 (5): 983-990.

Poortinga, W., 2006. Social capital: An individual or collective resource for health? Soc. Sci. Med., 62 (2): 292-302.

Powell, K.E. *et al*., 1991. The dimensions of health promotion applied to physical activity. J. Pub. Health Policy, 12 (4): 492-509.

Pratt, M. *et al*., 2000. Higher direct medical costs associated with physical inactivity. Physician Sportsmed, 28 (10).

Richard, D., 1995. Exercise and the Neurobiological control of food intake and energy expenditure. Int. J. Obes. Relat. Metab. Disord., 19 (4): 73-79.

Rutt, C.D. and K.J. Coleman, 2005. Examining the Relationships among Built Environment, Physical Activity and Body Mass Index in El Paso, TX. Preven. Med., 40 (6): 831-841.

Saelens, B.E. *et al*., 2003. Neighborhood-Based differences in physical activity: An environment evaluation scale evaluation. Am. J. Pub. Health, 93 (9): 1552-1558.

Sallis, J.F. and K. Glanz, 2006. The role of built environments in physical activity, eating and obesity in childhood. Future Child, pp: 89-108.

Saris, W.H. *et al*., 1989. Study on food intake and energy expenditure during extreme sustained exercise: The Tour de France. Int. J. Sports Med., 10 (1): 26-31.

Saris, W.H. *et al*., 2003. How much physical activity is enough to prevent unhealthy weight gain? Outcome of the IASO First Stock Conference and Consensus Statement. Obes. Rev., 4 (2): 101-114.

Scheurink, A.J. *et al*., 1999. Exercise and the regulation of energy intake. Int. J. Obes. Relat. Metab. Disord., 23 (3): 1-6.

Schoeller, D.A., 1998. Balancing energy expenditure and body weight. Am. J. Clin. Nutr., 68 (4): 956-961.

Schulz, L.O. and D.A. Schoeller, 1994. A compilation of total daily energy expenditures and body weights in healthy adults. Am. J. Clin. Nutr., 60 (5): 676-681.

Snyder, K.A. *et al*., 1997. The effects of long-term, moderate intensity, intermittent overweight females. Int. J. Obes. Relat. Metab. Disord., 21 (12): 1180-1189.

Stahl, T. *et al*., 2001. The importance of the social environment for physically active exercise on aerobic capacity, body composition, blood lipids, insulin and glucose in lifestyle-results from an international study. Soc. Sci. Med., 52 (1): 1-10.

Story, M. *et al*., 2006. The role of schools in obesity prevention. Future Child., 16 (1): 109-142.

Story, M. *et al*., 2006. The role of child care settings in obesity prevention. Future Child., 16 (1): 143-168.

Stubbs, R.J. *et al*., 2002. The effect of graded levels of exercise on energy intake and balance in free-living women. Int. J. Obes. Relat. Metab. Disord., 26 (6): 866-869.

Stubbs, R.J. *et al*., 2004. A decrease in physical activity affects appetite, energy and nutrient balance in lean men feeding adlibitum. Am. J. Clin. Nutr., 79 (1): 62-69.

Stubbs, C.O. and Lee, A.J., 2004. The obesity epidemic: Both energy intake and physical activity contribute. Med. J. Aust., 181 (9): 489-491.

Van Erp-Baart, A.M. *et al*., 1989. Nationwide survey on nutritional habits in elite athletes. Part I. Energy, carbohydrate, protein and fat intake. Int. J. Sports Med., 10 (1): S3-S10.

Wadden, T.A. *et al*., 2002. Psychosocial Consequences of Obesity and Weight Loss. In: Wadden, T.A. and J. Stundards (Eds.). Handbook of obesity treatment, Guildford Press, New York, pp: 144-169.

Wang, J. *et al*., 1998. Anutrient-Sensing Pathway Regulates Leptine Gene Expression in Muscle and Fat. Nature, 393: 684-688.

WHO, 2000. Obesity: Preventing and managing the global epidemic. WHO Technical Report Series Number 894. Geneva: World Health Organisation.

WHO, 2003. Overweight and obesity. World Health Organisation, Geneva.

Woo, R. *et al*., 1982. Effect of exercise on spontaneous calorie intake in obesity. Am. J. Clin. Nutr., 36 (3): 470-477.

Zhang, Y. *et al*., 1994. Positional cloning of the mouse obese gene andits human homologue. Nature, 372: 425-432.