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Review Article

Stress, Depression and Obesity among Adolescents: A Narrative Review

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Adolescents try to eat as a way to stress relief, while they suffer from overweight and obesity and feel depressed later. This is a review and analysis of the results of published research literature since 1980 on the relationship of obesity with stress and depression among adolescents. The current review tries to evaluate and describe the effect of stress on obesity and subsequently on depression among adolescents. The literature reveals obvious differences in various emotional problems for boys and girls. However, some studies focused on stress and obesity among adolescents, some others reported depression among obese adolescents. Descriptive design was used for quantitative studies as well as using theories which were used for qualitative studies. Interview and questionnaires were used for data collection. Studies revealed that stress results in overweight and obesity among adolescents through decreasing physical activity and increasing food intake. Consequently, obesity among adolescents as a result of negative body image and concept of proper appearance can cause depression. On the other hand, gender, age and ethnicity affect stress and depression as well as obesity during adolescence.

Keywords: Depressive disorder, Stressor, Overweight, Teens.

INTRODUCTION

Adolescence obesity is one of the main factors to predict adulthood obesity. Adolescent's obesity has risen through the recent two decades and may increase concerns about psychosocial consequences (Swallen et al., 2004). Obesity among adolescents and adults can lead to depression, especially in females. However, it is unclear whether depression may lead to obesity or obesity is a result of depression (Tajik et al., 2014; Goodman and Whitaker, 2002).

Obesity is a result of caloric imbalance and is one of the big challenges of this century (World Health Organization, 2013). Obesity has a high prevalence among all age groups and ethnicities in all countries, particularly in children and adolescents from low-income families (Ogden et al., 2006; Moreno et al., 2005). The percentage of obesity among adolescents has increased from 5% to 18% from 1980 to 2010 in US (Ogden et al., 2012; National Center for Health Statistics, 2012). Based on a study in 2010 it was reported that about one third of adolescents were overweight or obese (Ogden et al., 2012).

Although for a long time the occurrence of depression and stress was considered mainly coincidental with obesity, recently, some studies showed that the consequences of mental health among obese adolescents and children. Meanwhile, obesity can lead to stress, depression and low self-esteem in teens (Tajik et al., 2014; Hollar et al., 2010). Effect of obesity on psychosocial status is more obvious in US studies where the possibility of obesity and biological issues, including inflammatory items is highlighted (Nemiary et al., 2012).

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Obesity has not been established as a psychiatric predictor of mental disorders; however, it has been found to be associated with depression and stress. The relation between psychosocial issues and obesity as a health outcome of a medical condition is important for researchers and policy makers. Some previous studies found an association between obesity, stress and depression (Onyike et al., 2003; Roberts et al., 2000; Pervanidou and Chrousos, 2011) and some others did not (Faubel, 1989; Hammerton et al., 2014).

This review article is aimed at describing a current overview of association of stress and depression with obesity among adolescents based on the findings of the previously published papers. The paper firstly explores data for association of stress and obesity, and then touches on the relationship between obesity and depression among adolescents.

Epidemiology of depressive disorders

Stress is defined as "the non-specific response of the body to any factor that overwhelms or threatens to overwhelm the body's ability to maintain homeostasis" (Sherwood, 2001). A stress-free life is not appropriate which can lead to losing proper reaction and abilities in life's challenges (Jones, 2001). Optimal level of stress is good, but it should not be transformed to distress.

The risk of depression increases from childhood to adolescence (2% to 8%, respectively) (Reeves et al., 2008). Some previous studies showed that the prevalence of depressive disorder was 15%-20% among adolescents which is comparable with depression in adulthood. Some factors such as peer problems and weakness of coping skills can increase the risk of depression among adolescents (Bonin, 2012).

Stressors such as psychological stressors (fear, anxiety), physical stressors (surgery and trauma), and chemical stressors (acid base imbalance and reduced oxygen supply) can induce the stress response (Sherwood, 2001; Torres and Nowson, 2007). Stress can be divided into two forms of stressors including short term stressors (acute) and daily basis stressors (chronic stress) (Folkow, 1997). Different types of stress (chronic or acute) and depressive disorders have some physiologic outcomes such as changes in appetite, gastric emptying, heart rate, and blood pressure (American Psychiatric Association, 2000; Bhatia and Tandon, 2007; Reeves et al., 2008).

Epidemiology of obesity

Obesity is caused by excessive fat accumulation in the body that can impair the body health status (World Health Organization, 2013). BMI is the standard measurement for obesity in children of two years and older. According to the WHO definition, overweight is a BMI greater than 25 kg/m2 and obesity is a BMI greater than 30 kg/m2 in both genders. However, it is considered a rough guide, because the degree of fatness is different for different individuals (Nemiary et al., 2012). Body mass index is calculated for adults as well as adolescents. Obesity is defined as ≥ 30 kg/m2 or ≥ 130% ideal body weight for height. In addition, overweight and obesity among adolescents is defined as growth references of the World Health Organization (WHO, 2013) that overweight is one standard deviation body mass index for age and sex, and obese is two standard deviations body mass index for age and sex.

Almost all countries over the world experienced an increasing number of overweight and obese children and adolescents in the period from 1980-1990 (Janssen et al., 2005). The prevalence of obesity in children and adolescents increased by 120% among blacks and Hispanics, and 50% during the last five years of the 20th century in the United States (US) (Swallen et al., 2004). Studies that were performed in the US showed that this trend is risen up into the 21st century. Moreover, a dramatic increase in obesity among adolescents in US was seen in 2007-2008 (Ogden et al., 2009). The main factors affecting obesity in children and adolescents are inactivity and changes in dietary intake and food pattern (Melnyk et al., 2010).

Stress and obesity

Stress as a disorder can disturb the dynamic balance of all organisms. Chronic stress may lead to vulnerability of adolescence, developing to reach a biological and psychological maturity (Pervanidou and Chrousos, 2011). The association between obesity and chronic stress in adolescence is related to biological and behavioral pathways. For example, lack of sleep, emotional eating impulsive behaviors is defined as stress state. Stress leads to secretion of catecholamine and increased insulin concentration which can result in central obesity.

Acute or chronic stress may affect eating behavior, especially in adolescence as a result of response to stressors (Wardle and Gibson, 2002; Takeda et al., 2004). Greeno and Wing (1994) showed the severity of stress as a factor to explain the response for food consumption, meaning whether people in different levels of stress want to eat food or not. Moreover, Oliver et al. (2000) explained that stress can affect eating and health through mechanisms such as reducing food intake in the short term, but increasing sweet and high fat food intake, slow gastric emptying, increasing blood pressure and activation of adrenal in the long term effect.

During stress, some hormones such as corticotropin-releasing hormone and noradrenaline can suppress appetite, while some can induce appetite such as cortisol. In addition, cortisol secretion has additional effects on development of emotion and puberty. A vicious cycle between stress, body image and obesity is obvious in adolescents (Soma et al., 2009; Kumar et al., 2007). Increasing the cortisol level in the body or cortisol injection can improve appetite, especially for high sugar and fat foods (Epel et al., 2001). It is assumed that food consumption as a result of increasing appetite can be induced by cortisol by binding to hypothalamus receptors. Moreover, cortisol can regulate corticotrophin, leptin and neuropeptide to stimulate appetite (Cavagnini et al., 2000).

In contrast to depression that leads to less food consumption and body weight reduction among adolescents, stress causes higher food intake and excess body weight gain (Dallman et al., 2003). However, researchers showed that physical activity in both depression and stress reduces significantly (Dallman et al., 2003). Stress can affect obesity through three mechanisms among adolescents; first by increasing energy intake and appetite; second by decreasing energy expenditure and physical activity and finally by accumulation of visceral fat and abdominal obesity (Vriendt et al., 2009).

Stress by changing eating behaviors may induce weight changes, whether short-term or long-term, however the reason is less clear (Block et al., 2009). Coccia et al. (2012) showed an association between weight status and stress among adolescents (15-16 years old). They specified those

adolescents with stress are willing to have unhealthy eating behaviors. Stress induces eating tendency, particularly a desire for high-calorie foods (foods with high sugar and fat) (Torres SJ and Nowson, 2007). A Finnish study illustrated a significant association between stress, eating and obesity. They indicated among 4,5810 men and women that consumed high-calorie foods and beverages caused women to feel better in a stressful situation (Kouvonen et al., 2005). Hence, obese people typically expand their food consumption in a stress situation compared to normal time.

In a large study of 4,065 adolescents (11-16 years old), the association between stress and changes in BMI and waist circumference was examined (Jaarsveld et al., 2009). The results showed that moderate and high stress had significant association with BMI and higher waist circumferences, but not for adolescents with low stress. Cartwright et al. (2003) investigated the association between dietary practices and stress among 4,320 teens from different ethnicities. Adolescents with higher stress had more fatty food intake and snacks, but less healthy eating behavior such as eating breakfast and/or higher fruits and vegetables. Cartwright et al. (2003) indicated that this kind of unhealthy eating desire among adolescents during stress situation might lead to chronic diseases.

Obesity and depression

The assumption of coincidental occurrence of obesity and depression was changed to important and strong analysis in American studies (Faith et al., 2002; Stunkard et al., 2003). A meta-analysis study by Luppino et al. (2010) explained a biological link between depression and obesity as inflammation status. Moreover, stressful life leads to inflammation state, which is associated with depression. This situation can lead to increased pro-inflammatory cytokines. Fat tissue in normal weight people, contains fat cells while in obese people it contains macrophages, which can ingest pathogens and exotic materials and can release inflammatory hormones. These hormones can stimulate the immune system at a lower level and make a chronic inflammation (Bastard et al., 2006). Researchers believe that obesity and depression are differences in various cultures and societies (Luppino et al., 2010).

According to data from the National Health and Nutrition Examination Survey (NHANES) -III, the prevalence of major depression among obese adolescents in the 95th -100th percentile, increased significantly to 20% and 30% for boys and girls, respectively (Stunkard et al., 2003). However, a longitudinal study by Herva et al. (2006) found that obesity in adolescents might lead to depression in adulthood. Furthermore, a cross sectional study reported the relation between depression and low self-esteem with obesity among adolescents (12-14 years old). Obese adolescents showed lower academic outcome and higher anxiety and depression (Swallen et al., 2004).

A study by Roberts et al. (2000) indicated that obesity was associated with past year depression. They reported that the most important indicators of depression were functional disability and health status such as obesity. Some cohort studies showed that depression is associated with the severity of obesity level (BMI 30-34.9, BMI 35-39.9, BMI ≥40) (Faith et al., 2002; Roberts et al., 2002). On the other hand, clinical studies indicated that adolescents with severe obesity have a higher risk of getting depression (Hopkinson and Bland, 1982; Black et al., 1992). However, the higher relationship between obesity and depression was seen among female compared to male (Carpenter et al., 2000; Grant et al., 1992).

Body dissatisfaction which is a predictor of depression is one important component factor of obesity (Cash et al., 2004). Body dissatisfaction is related to appearance in adolescents. BMI is positively associated with body satisfaction, especially in female adolescents. A cross-sectional study among 1,490 high school students and also a study among 2,813 Australian youths showed that self-esteem can decline with increasing BMI and subsequent depression may occur (Goldfield et al., 2010; Franklin et al., 2006).

Moderator variables

Moderator variables can affect the strength of the relationship between two other variables. For example, gender, ethnicity as well as age and economic status may influence the association between stress, depression and obesity (Faith et al., 2002; Stunkard et al., 2003; Wardle and Cooke, 2005).

For instance, the relation between depression and obesity exists in female but not in male and in black adolescents but not in whites (Nemiary et al., 2012). Studies reported that the perception of being obese or overweight among black and white adolescents is different (Falkner et al., 2001; Erickson et al., 2000; Strauss, 2000). White adolescents see themselves as obese and they follow an unhealthy diet as a result of low self-esteem, while it is not true for black adolescents. Stunkard et al. (2003) showed that moderator factors may be indicators to select appropriate subjects for psychological interventions or treatments.

Gender differences in obesity, depression and stress were reported contrarily in previous studies (Swallen et al., 2004; Falkner et al., 2001; Ogden et al., 2002). Although Ogden et al. (2002) indicated that there are no differences in gender in obesity rates among adolescents, Erickson et al. (2000) and Strauss (2000) revealed that the prevalence of depression and low self-esteem is higher in overweight girls compared with normal weight girls. However, being overweight or obese in boys does not significantly predict depression (Onyike et al., 2003).

On the other hand, depression itself is a factor for being overweight or obese. A meta-analysis study on obesity and depression showed that depressed female adolescents were more obese than non-depressed. A study indicated that depressed female adolescents would get later obesity (OR 2.57, CI 2.27-2.91, 95%) (Bruce, 2008). Nemiary et al. (2012) concluded that depression during early adolescence may continue to adulthood, particularly among teenage girls whom gender differences appear.

The stress response is different in each gender. Men and women show different solutions or coping strategies in the face of stress (Matud, 2004). Ptacek et al. (1994) showed that in controlled laboratory conditions, despite the similar cognitive status, women and men did not use the same method to cope with stress. Women use more emotion-focused coping, while men seek problem-focused coping. Furthermore, eating response to coping is significantly different between genders. For instance, females prefer to eat more high-calorie foods, while the coping strategies for men are alcohol consumption and/or smoking.

Stress influences health through biological issues and health behaviors (Oliver et al., 2000). Healthy diet has an inverse association with stress, especially among female teens. This means that most females facing stress, eat less healthy diet and subsequently gain more weight (Moore and Cunningham, 2012). Oliver et al. (2000) revealed that females

are more emotional eaters than males (t = 2.66, p <0.05). They showed that emotional eaters may increase sweet, fatty foods during stress.

Conclusion

Several studies support the presence of a vicious cycle between stress, obesity and depression among adolescents. Facing a stressful situation can increase body weight by reason of biological changes and might cause obesity and subsequent obesity leads to depression. The highlighted effect of depression and stress on adolescents is less physical activity and excessive weight gain which are more eminent among females. On the other hand, gender and age are two important factors that can affect depression and stress in adolescence.

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