ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 11, Issue, 02, pp.1400-1403, February, 2019

DOI: https://doi.org/10.24941/ijcr.34448.02.2019

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

OBESITY AND CARBOHYDRATE CONSUMPTION

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ARTICLE INFO

Article History:
Received 11th November, 2018
Received in revised form
07th December, 2018
Accepted 12th January, 2019
Published online 28th February, 2019

Key Words:
Epidemiolgy.

ABSTRACT

Obesity was formally recognized as a disease by the American Medical Association in 2013, with several other professional organizations worldwide following suit shortly thereafter (Bray, Kim, & Wilding, 2017). Obesity is a multifactorial disease that results from physiological, genetic, and environmental components acting together (Skolnik & Ryan, 2014) and is associated with several comorbidities, including type 2 diabetes mellitus (T2DM), cardiovascular disease, musculoskeletal disorders, obstructive sleep apnea, and several types of cancer. Globally, overweight and obesity are defined by the well-accepted proxy measure of weight compared with height, known as body mass index (BMI) (Cohen, *et al*., 2015). A BMI > 25 kg/m2 is considered overweight and a BMI > 30 kg/m2 is considered obese. Diet plays an important role in body weight. There are three macronutrients that comprise the human diet; fats, proteins, and carbohydrates. Macronutrients are simply nutrients found in food that provide calories or energy to the body when consumed. Fats provide 9 calories per gram and are chemical compounds consisting of an ester of glycerol and one, two, or three fatty acids that aid in metabolizing vitamins & minerals. According to the study by Cohen *et al*. (2015), there is a strong relationship between the increased proportion of carbohydrates consumed in total caloric intake, initiated in the 1970's, and the increased prevalence of obesity since that time. Obesity remains a major public health burden, both globally and within the United States. The prevalence of obesity has increased rapidly over the past 40 years, in both children and adults. This has resulted in crippling financial costs in the US alone, with an overall annual cost estimated to be more than $1.4 trillion as recently as 2014.

Citation: ***Dr. Yussif Mijirah Dokurugu, DR PH, MPH, MA. and Jennifer Richards, MPH, PT, CHES.*** **2019.** "Obesity and carbohydrate consumption", *International Journal of Current Research*, 11, (02), 1400-1403.

INTRODUCTION

Obesity was formally recognized as a disease by the American Medical Association in 2013, with several other professional organizations worldwide following suit shortly thereafter (Bray, Kim, & Wilding, 2017). Obesity is a multifactorial disease that results from physiological, genetic, and environmental components acting together (Skolnik & Ryan, 2014) and is associated with several comorbidities, including type 2 diabetes mellitus (T2DM), cardiovascular disease, musculoskeletal disorders, obstructive sleep apnea, and several types of cancer. Globally, overweight and obesity are defined by the well-accepted proxy measure of weight compared with height, known as body mass index (BMI) (Cohen, *et al*., 2015). A BMI > 25 kg/m^2 is considered overweight and a BMI > 30 kg/m^2 is considered obese. Meldrum, Morris, & Gambone (2017) report the dire financial consequences of the obesity epidemic for 2014. In the US, the additional annual direct cost of health care for an adult obese male was estimated to be $1,152.00 and for an adult obese female to be $3,613.00. The additional total direct cost in national health care expenses was calculated at $427 billion annually. Adding to this figure increased health care costs to employers, lost productivity, and days absent from work, the overall cost to the US economy resulting from obesity was estimated to be more than $1.4 trillion. Because it has become globally epidemic, is related to serious chronic pathologies, and poses a tremendous financial burden, obesity is a significant public health problem. Diet plays an important role in body weight. There are three macronutrients that comprise the human diet; fats, proteins, and carbohydrates. Macronutrients are simply nutrients found in food that provide calories or energy to the body when consumed. Fats provide 9 calories per gram and are chemical compounds consisting of an ester of glycerol and one, two, or three fatty acids that aid in metabolizing vitamins & minerals. Fats are required for the formation of hormones. Proteins provide 4 calories per gram and are molecules that consist of strings of smaller units called amino acids. Proteins provide structural components in body tissues such as muscle, hair, and collagen. They also act as enzymes and antibodies in bodily systems.

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Carbohydrates provide 4 calories per gram and consist of sugars and starches that are made up of the neutral compounds carbon, hydrogen and oxygen. In 1977, the US Senate Select Committee on Nutrition and Human Needs issued new dietary guidelines for the consumption of macronutrients forthe US population (Cohen *et al*., 2015). The recommendations were that fat consumption be reduced to 30% of total caloric intake and that carbohydrate consumption be increased to 55% to 60% of total caloric intake. Since the introduction of these guidelines, rates of overweight and obesity have increased dramatically. From 1971 – 1974 to 2005 – 2008, total caloric intake increased from 2450 kcal/day to 2656 kcal/day in males aged 20 years and older, and from 1542 kcal/day to 1811 kcal/day in females aged 20 years and older; these increases were due to an approximate 10% increase in the proportion of carbohydrates consumed as part of total caloric intake (Skolnik & Ryan, 2014). The overemphasis to decrease dietary fat in recent decades has contributed greatly to the need to add sugar and other carbohydrates to processed foods in order to make them highly palatable, and has been implicated as a major factor in the epidemic levels of obesity we are now seeing (Meldrum *et al*., 2017; Rajaie, Azadbakht, Khazaei, Sherbafchi, & Esmaillzadeh, 2014; Spadaro, Naug, Du Toit, Donner, & Colson, 2015).

Prior to the 1900's, sugar was a rare treat, and the average per-person sugar consumption was 4-6 pounds per year compared to 150-170 pounds consumed per year today (Meldrum *et al*., 2017). Research has suggested the possibility that the consumption of sugar and other carbohydrates may have addictive features under certain physiological, behavioral, and environmental circumstances which work together to create an "obesogenic environment" (Skolnik & Ryan, 2014; Ventura, Santander, Torres, & Contreras, 2014). Further, Ventura *et al*. (2014) outline the concepts of sugar addiction, carbohydrate craving, and emotional eating as aspects of mood disorders, such as anxiety and depression, all of which are strongly correlated with obesity.

Pathophysiology: Obesity has been described as a pathologic state defined by the excess accumulation and maintenance of adipose tissue (Lee & Mattson, 2014), and that it is a chronic and relapsing disease process. Bray *et al*. (2017) suggest that obesity can be viewed from an epidemiological model, wherein an agent affects the host and produces disease. In this model, food (particularly carbohydrate-rich food) is the primary environmental agent that can activate the "pleasure" centers of the brain providing rewards from eating. The host may possess genetic factors that are involved in the host response to this food agent, such as defects in hormonal regulation of appetite and energy homeostasis. The subsequent excess of energy from food may lead to enlargement and/or an increase in the number of body fat cells resulting in overweight/obesity. Enlarged fat cells may interact with the host's microbiome creating an inflammatory environment in the body which, in turn, may modify the metabolic processes in the brain and peripheral systems (such as the gastrointestinal tract). In a susceptible host, these metabolic changes may lead to an internal environment that is conducive to the development of comorbidities associated with the obesogenic state, including T2DM, dyslipidemia, and cardiovascular diseases. In addition to these unfortunate outcomes, weight loss occurring after obesity can activate other dysfunctional hormonal changes that encourage weight regain. This is the rationale for why obesity is chronic and relapsing.

Studies by Skolnik & Ryan (2014) and Spadaro *et al*. (2015) lend further support for explaining obesity from an epidemiological model. Specific effects of excess carbohydrate consumption versus low carbohydrate consumption on body systems have been described in several studies. The results of an animal study of rats by Spadaro *et al*. (2015) showed a significant increase in visceral fat, obesity, and triglyceride levels for those subjects who consumed a diet higher in carbohydrates versus those who consumed a diet lower in carbohydrates. In addition, the authors of the Spadaro study found increased levels of serotonin within the rat hypothalamus as a consequence of carbohydrate overconsumption that led to abnormal eating behavior and subsequent obesity. A randomized clinical trial conducted by Gibas & Gibas (2017) showed that a group of subjects following a low carbohydrate diet had statistically significant decreases in body weight, body fat percentage, BMI, and hemoglobin A1c (HgA1c) levels compared to the group following the standard American diet that was high in carbohydrates.Another study by Rajaie *et al*. (2014) reported that triglyceride levels and the triglyceride to high density lipoprotein cholesterol (HDL-C) ratio were both significantly improved in subjects following a low carbohydrate diet versus those following a higher carbohydrate diet.

Epidemiology: According to the study by Cohen *et al*. (2015), there is a strong relationship between the increased proportion of carbohydrates consumed in total caloric intake, initiated in the 1970's, and the increased prevalence of obesity since that time. Over a 40-year period, fat consumption decreased from 45% of total caloric intake to 34% of totalcaloric intake, with a corresponding increase in carbohydrate consumption from 39% of total caloric intake to 51% of total caloric intake.The authors of the Cohen study reported that in 1971, 42.3% of adult Americans were overweight, 14.7% were obese, and 1.6% were severely obese. Forty years later, 66.1% of adult Americans were overweight, 35.2% were obese, and 7.2% were severely obese. Over that time span, these numbers represent a 56% increase in those who are overweight, more than double the percentage of those who are obese, and a more than 4-fold increase in the percentage of those who are severely obese. A study by Lee & Mattson (2014) reported that in 2013, the global obesity prevalence had almost doubled since 1980, with about 35% of adults being overweight and about 11% of adults being obese. The authors went on to report that obesity prevalence in the US for that same year was even higher, at around 35% for adults and 15% for children. Lastly, they remarked that obesity appears to be linked to societal modernization and that 65% of the world's population live in countries where mortality linked with being overweight or obese is higher now than mortality due to being underweight.

Meldrum *et al*. (2017) report sobering current statistics for obesity. The US incidence of obesity during the past two decades has been higher in women versus men (38.3% and 34.3%, respectively). Prevalence in the US varies significantly by location and is higher in black and Hispanic adults versus whites. The authors of this study further state that, based on current incidence numbers, nearly 40% of the world's population will be overweight and one in five people will be obese by 2030. Further, it should be noted that the risk for multimorbidity (the co-occurrence of chronic conditions such as hypertension and depression) rises with increasing BMI for both men and women. The following examples of this fact are provided in the study by Skolnik & Ryan (2014). One example is that the prevalence of multimorbidity is 23% and 28%,

respectively, for normal weight men and women. This rises to 44% and 51%, respectively, in men and women whose BMI is ≥40 kg/m^2. A second example is that the risk of T2DMincreases with the severity and duration of a person's overweight/obese status as well as with increasing amounts of visceral adiposity.

Treatment: Because there are many contributing factors leading to obesity, health care professionals must use a multi-pronged approach to guide their obese patients towardsuccessful weight loss and the subsequent maintenance of a healthy body weight.Patients must develop a new lifestyle skill set that can be achieved bylearning about the causes of obesity, principles of good nutrition, and the maladaptive behavioral issues that may have played a part in becoming obese. Further, this new lifestyle must be applied by patients in practical and achievable ways for the long term.With these concepts in mind, the centerpiece of the 2013 American Heart Association/American College of Cardiology/The Obesity Society (AHA/ACC/TOS) guidelines is the recommendation that patients should have access to "comprehensive lifestyle intervention (diet, exercise, and behavioral modification), with at least 14 sessions with an interventionalist over the course of 6 months and continued follow-up for a least 1 year." (Skolnik & Ryan, 2014).Skolnik & Ryan go on to advise the use of the transtheoretical health behavior model, "stage of change", to determine a patient's readiness to change and guide clinicians as to the most appropriate ways to address any needed behavioral changes.In a study by Ventura *et al*. (2014), the authors describe the neurobiologic basis of carbohydrate craving and advocate that treatment of obesity should include treatment strategies similar to those used in substance dependency. These strategies might include investigating parenting styles in upbringing, emotional education, and teaching healthy coping mechanisms in response to stress.

Several studies have demonstrated and/or discussed the beneficial effects of carbohydrate-restricted diets in the treatment and resolution of obesity (Gibas & Gibas, 2017; Rajaie *et al*., 2014; Ventura *et al*., 2014). These studies further describe how following a low carbohydrate diet has resulted in decreasing triglyceride levels, HgA1c levels, BMI, and body fat percentage. These particular studies, as well as several meta-analyses, also show evidence that a diet low in carbohydrates can even reverse metabolic syndrome (MetS), which is a clustering of metabolic risk factors that includes central obesity, hyperglycemia, dyslipidemia, and hypertension. This finding is important because, left unchecked, MetS often leads to the development of obesity comorbidities such as T2DM and cardiovascular disease. Reversing obesity will prevent most of its detrimental effects (Bray *et al*., 2017).

Prevention: In most cases, obesity is highly preventable (Lee & Mattson, 2014) and is caused in large part by the relatively recent creation of an "obesogenic environment"through societal changes such as the ubiquitous availability of highly processed, sugar-laden foods and automated technologies that reduce or replace physical activity (Meldrum *et al*., 2017).As a tool for prevention, obesity screening is recommended by the US Preventive Services Task Force and the AHA/ACC/TOS for all adults in order to diagnose and begin to treat this condition (Skolnik & Ryan, 2014). These recommendations further state that BMI is a reasonable proxy for total body fat and should be measured at least annually. Waist circumference should also be included in this annual screening, noting that a waist circumference > 35 inches in women and > 40 inches in men is considered a risk factor for cardiovascular disease. Additional obesity screening criteria include an assessment of the person's physical activity level and a brief behavioral assessment to identify any issues that may contribute to the development of obesity. Regarding children, Bray *et al*. (2017) liken early diagnosis and treatment of obesity to "vaccination" against childhood obesity, especially if started at birth. According to Jebb (2015), traditional health promotion efforts against obesity have relied mostly on health education and information directed at individual dietary and behavioral choices. She states that this individualistic approach has been largely unsuccessful on its own, and she advocates that public health professionals also attempt to modify factors that are conducive to obesity at the population level. This approach might include policy changes that would enable groups of people to modify their behavior without having to do conscious, individual decision-making.

Some of the population-level strategies proposed by Jebb (2015) include (a) implementing a tax on sugar-sweetened beverages (SSBs), (b) restricting food and beverage choices in very specific settings such as schools or day care facilities, or (c) preventing the sale of SSBs, candies, and sugar-laden baked goods in schools. One population-level strategy at the global level that was mentioned in Jebb's study is guidance by the World Health Organization (WHO) that proposes sugar intake be limited to 10% of total caloric intake. Another effort at prevention would be long-term education campaigns that work to create a public consciousness that is conducive to replacing spontaneous unhealthy behaviors with more prudent health behaviors (Ventura *et al*., 2014). In future, if the trend of evidence in research continues to show that a diet low in carbohydrate consumption is effective in weight loss and the reduction of adverse obesity-related disease outcomes, this lifestyle choice could be advocated by health care professionals with confidence and lead to significant reductions in the prevalence of obesity (Gibas & Gibas, 2017).

Summary

Obesity remains a major public health burden, both globally and within the United States. The prevalence of obesity has increased rapidly over the past 40 years, in both children and adults. This has resulted in crippling financial costs in the US alone, with an overall annual costestimated to be more than $1.4 trillion as recently as 2014. Additional costs of the obesity epidemic include poor quality of life due to related chronic comorbidities and years of potential life lost. Sadly, the obesity epidemic is expected to become even worse going forward. It is predicted that nearly 40% of the world's population will be overweight and one in five people will be obese by 2030 (Meldrum *et al*., 2017). Obesity is the result of fundamental changes in modern society, such as the increased consumption of carbohydrate-laden, calorie-dense foods and sedentary lifestyles, that have contributed to an "obesogenic environment", especially in the US (Lee & Mattson, 2014). The World Obesity Federation states that obesity is a chronic, relapsing, progressive disease state and advocates the need for immediate action to prevent and mitigate this global epidemic (Bray *et al*., 2017). This is especially true for childhood obesity, in that obese children tend to become obese adults and obesity spread over more years of life will add an even greater burden of comorbidities, mortality, and financial costs (Meldrum *et al*., 2017).

As Rajaie *et al*. (2014) conclude, there is full agreement worldwide that caloric restriction is the first step in the management of obesity and its related comorbidities. However, the optimal ratio of macronutrient intake for achieving a significant reduction and/or resolution of obesity remains unclear. For example, chronic excessive dietary intake of carbohydrates has been theorized to cause high levels of circulating glucose which in turn starts the chemical cascade that, over time, leads to fatty liver disease and insulin resistance. These conditions lead to further adverse effects related to the obesogenic state, including high triglyceride levels, high LDL levels, and elevated HgA1c. If sustained, poor health outcomes such as T2DM, hypertension, and other cardiometabolic diseases may develop. If this theory is correct, the implication is that a diet low in carbohydrates could ameliorate the prevalence of obesity and its comorbidities. However, there is a lack of unequivocal evidence in the literature to support this theory at this time.

The inability of current dietary recommendations to control the epidemic of diabetesalong with the failure of a sustained 40-year period of US governmental advice advocating a low-fat diet to improve obesity rates, point to the urgent need to reappraise the current dietary guidelines (Gibas & Gibas, 2017). Simply stated, what we have been doing to address the obesity problem is not working. This is unacceptable. But unless further research aimed at determining the true, underlying causes of obesity is conducted, the prevalence of this disease will persist, and may well increase, in both pediatric and adult populations.

REFERENCES

Bray, G. A., Kim, K. K., Wilding, J. P. H., and on behalf of the World Obesity Federation, 2017. Obesity: a chronic relapsing progressive disease process. A position statement of the World Obesity Federation. *Obesity Reviews*, *18,* 715–723. doi: 10.1111/obr.12551

Cohen, E., Cragg, M., deFonseka, J., Hite, A., Rosenberg, M., & Zhou, B. 2015. Statistical review of US macronutrient consumption data, 1965-2011: Americans have been following dietary guidelines, coincident with the rise in obesity. *Nutrition, 31*, 727-732. Retrieved from https://doi.org/10.1016/j.nut.2015.02.007

Gibas, M. K. & Gibas, K. J. 2017. Induced and controlled dietary ketosis as a regulator of obesity and metabolic syndrome pathologies. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews, 11S,* S385-S390. Retrieved from https://doi.org/10.1016/j.dsx.2017.03.022

Jebb, S. A. 2015. Carbohydrates and obesity: from evidence to policy in the UK. *Proceedingsof the Nutrition Society*, *74*(3), 215–220. Retrieved from http://doi.org.famuproxy.fcla.edu/10.1017/S0029665114001645

Lee, E. B., & Mattson, M. P. 2014. The neuropathology of obesity: insights from humandisease. *Acta Neuropathologica*, *127*(1), 3-28. Retrieved from http://link.galegroup.com.famuproxy.fcla.edu/apps/doc/A357967182/AONE?u=tall18692&sid=AONE&xid=1283169d

Meldrum, D. R., Morris, M. A.,&Gambone, J. C. 2017. Obesity pandemic: causes, consequences, and solutions—but do we have the will? *Fertility and Sterility,107*(4)*,* 833-839.Retrieved from https://doi.org/10.1016/ j.fertnstert. 2017.02.104

Rajaie, S., Azadbakht, L., Khazaei, M., Sherbafchi, M., & Esmaillzadeh, A.2014. Moderate replacement of carbohydrates by dietary fats affects features of metabolic syndrome: A randomized crossover clinical trial. *Nutrition, 30*(1), 61-68. Retrieved from https://doi.org/10.1016/ j.nut.2013.06.011

Skolnik, N. S., & Ryan, D. H. 2014. Pathophysiology, epidemiology, and assessment of obesity in adults. *Journal of Family Practice*, *63*(7),S3-S10.

Spadaro, P. A., Naug, H. L., Du Toit, E. F., Donner, D., & Colson, N. J. 2015. A refined high carbohydrate diet is associated with changes in the serotonin pathway and visceral obesity. *Genetics Research, 97*, e23. doi:10.1017/S0016672315000233

Ventura, T., Santander, J., Torres, R., & Contreras, A. M. 2014. Neurobiologic basis of craving for carbohydrates. *Nutrition, 30,* 252-256. Retrieved from https://doi.org /10.1016/j.nut.2013.06.010

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