

REVIEW

The interaction of obesity, metabolic health and quality of life

O. Oral¹, I. Ojo², M. Maqbool³, P. Thapa⁴, S. Alawode², M. Surakat²

¹Ege University, Faculty of Sports Sciences, Izmir, Turkey, ²University College Hospital, Ibadan, Oyo State, Nigeria, ³Department of Pharmaceutical Sciences, University of Kashmir, India, ⁴Life Skill Education Institutes/Yeti Health Science Academy, Katmandu, Nepal

ABSTRACT

Background: This article aims to examine the relationship between obesity and quality of life, the potential implications for metabolic health, and how this knowledge could inform the development of strategies to promote healthier weight management.

Materials and Methods: In order to gain a comprehensive understanding of the topic, a literature search was conducted using various databases and keywords related to “metabolic health”, “genetics”, “obesity”, “quality of life”, “exercise”, and “obesity genes”. The search was limited to peer-reviewed articles published in English between 2004 and 2024. Animal model studies were excluded to focus on human research. The review included randomized controlled trials, cohort studies, and systematic reviews that warranted a diverse range of evidence. The inclusion criteria for this review were established to filter studies that assessed the relationship between obesity, metabolic health and quality of life. The review included randomized controlled trials, cohort studies and systematic reviews that warranted a diverse range of evidence. Data extraction focused on intervention characteristics, participant demographics, health outcomes and the impact of obesity on metabolic health and quality of life, was published in a peer-reviewed journal and written in English. After careful evaluation, a total of 35 studies were selected for inclusion.

Results: Obesity is a complex condition that can be influenced by a number of different factors, including genetics, the environment, lifestyle, and behavior. It may be possible to gain insight into metabolic health and devise effective weight control strategies by understanding the genetic components of obesity.

Conclusion: The relationship between obesity and metabolic health is complex and not yet fully understood, which presents an opportunity for further research. While there is a general consensus that lifestyle factors such as diet and physical activity play a significant role in the development of obesity, there is also a great deal of research indicating that genetics may significantly influence an individual's susceptibility to obesity and its metabolic consequences. It is believed that certain genetic variations may potentially contribute to an individual's susceptibility to weight gain, fat storage in certain areas, and the development of insulin resistance.

Keywords: Metabolic health, genetics, obesity, quality of life, exercise, obesity genes

O. Oral, I. Ojo, M. Maqbool, P. Thapa, S. Alawode, M. Surakat. The interaction of obesity, metabolic health and quality of life. *Scientific Chronicles* 2025; 30(1): 50-57

INTRODUCTION

In recent years, many research studies on healthy living have aimed to understand in more depth the complex relationship between obesity genetics, metabolic health, and overall quality of life. Most of these studies have demonstrated the complex interaction of genetic factors such as the FTO and MC4R genes, which are known to significantly affect energy balance and fat distribution in individuals prone to obesity [1]. Other studies in this area have investigated how metabolic health, characterized by insulin sensitivity and lipid profiles, directly affects various aspects of well-being, including psychological health and social interactions [2]. Obesity is known to be a chronic health problem that is seen both alone and together with many metabolic diseases it causes; It is considered a serious disease that needs to be prevented and treated in order to normalize living standards, especially in terms of elderly health. When the obesity problem, which is likely to create more serious health risks in the elderly, is viewed from this perspective, awareness should be increased that regular physical activity can maximize the chances of obesity treatment in the prevention and treatment of obesity [3]. In articles that have also investigated dietary style, the role of lifestyle factors such as dietary patterns rich in whole foods and regular physical activity has been emphasized as important in regulating the expression of obesity-related genes and positively affecting metabolic health outcomes [4].

As the prevalence of obesity continues to increase globally, a deeper understanding of the genetic basis of this condition will certainly be useful in developing more effective health strategies. The emerging research in the field of

epigenetics sheds light on the dynamic interaction between genetic predisposition and environmental factors, and many articles suggest that lifestyle changes can lead to beneficial epigenetic changes [5]. When the results obtained from these studies are evaluated in detail, it is possible to realize new perspectives on possible intervention targets to improve metabolic health and reduce the negative impact of obesity on quality of life. Moreover, it should not be overlooked that understanding how socioeconomic status and access to health care affect these dynamics is of great importance for creating effective public health interventions [6].

In addition to these studies, a number of articles have also been published that aim to synthesize current research on metabolic health, its determinants, and its effects on quality of life. Many research studies have examined a wide range of topics from epidemiology to molecular genetics. As a result of these reviews, a comprehensive overview has been obtained of the multifaceted nature of metabolic health and its comprehensive implications for individual well-being and public health policy [7,8]. Moreover, these studies have aimed to shed light on the complex interactions between genetic, environmental, and behavioral factors that affect metabolic health outcomes and quality of life measures. In addition, the potential value of personalized medicine in developing interventions tailored to individual genetic profiles and lifestyle factors has been highlighted [9].

It is becoming increasingly clear that genetic factors can influence the way our bodies burn calories. Some genes, for instance, may slow down our metabolism, which could

result in more calories being stored as fat. Given this imbalance in calorie burning, it seems clear that understanding one's genetic makeup is crucial to creating effective weight management strategies[9,10]. Because of that reason, in recent years, there has been a notable increase in the number of studies focusing on the impact of an individual's genetic makeup on energy expenditure and calorie balance in the context of obesity [11,12].

It would be beneficial, therefore, to consider the role of genetic factors in the causes and treatment of obesity when developing strategies for weight management. Fortunately, it has been observed that certain strategies, such as nutrition and physical activity planning, can help reduce the effects of certain genes that may slow down metabolism and cause more calories to be stored as fat [13,14].

MATERIALS AND METHODS

A comprehensive search of the literature was undertaken using a range of databases, including the US National Library of Medicine (PubMed), Scopus, EBSCO, MEDLINE, DRJI, (Directory of Research Journal Indexing), Embase, Web of Science, Google Scholar, and SportDiscus. In order to gain a comprehensive understanding of the subject matter, a number of keywords were selected, including key search terms "metabolic health", "genetics", "obesity", "quality of life", "exercise", and "obesity genes" In addition, relevant literature was also sourced from searching for articles in reference lists derived from the data searches. The search was limited to peer-reviewed articles published in English between 2004 and 2024, to focus the results. For a comprehensive

understanding of the relationship between metabolic health, obesity, longevity and various systemic diseases, studies using animal models were excluded. To be included in this review, studies had to meet a number of criteria. First, they had to examine the relationship between obesity, metabolic health and quality of life. Second, they had to be published in a peer-reviewed journal. Thirdly, they had to be in English. After a careful selection process, 35 studies were chosen to be included in this review.

RESULTS AND DISCUSSION

The relationship between obesity and metabolic health is complex and bidirectional. While obesity is known to be a significant risk factor for various metabolic disorders such as insulin resistance, type 2 diabetes, dyslipidemia, and cardiovascular disease, poor metabolic health can also worsen obesity by disrupting hormonal regulatory pathways involved in appetite control and energy metabolism [15].

Lifestyle factors such as diet quality and physical activity level are known to play an important role in determining an individual's risk of developing obesity. Diets rich in processed foods rich in sugar and fat have been shown to be closely linked to weight gain and metabolic dysfunction [15]. Regular physical activity not only helps maintain a healthy weight, but also contributes to improving overall metabolic health by increasing insulin sensitivity and promoting lipid metabolism, suggesting that regular exercise plays an active role in the prevention and treatment of obesity and in maintaining metabolic health in all

individuals, including children and adolescents [3,16].

It is becoming increasingly clear that the consequences of obesity and poor metabolic health extend beyond physical well-being, affecting an individual's quality of life in a number of ways. It is becoming increasingly clear that the deterioration of metabolic health due to a number of factors, including obesity, cardiovascular disease, musculoskeletal disorders, depression, anxiety, social stigma, reduced mobility, and some chronic diseases, can have a significant impact on an individual's quality of life [17]. It is worth noting that psychological problems resulting from body image issues or social discrimination can add another layer of complexity to the difficult living conditions faced by individuals living with obesity [18].

In a study that suggests that genes associated with obesity may play a role in metabolic health and energy balance function, it has been observed that certain genetic variants may be associated with altered resting metabolic rate, thermogenesis, and nutrient distribution [19]. It is possible that these genetic effects may affect an individual's ability to maintain energy balance, which could potentially contribute to the development of metabolic disorders such as type 2 diabetes and dyslipidemia.

A study by Loos and Yeo (2014) suggests that individuals with a high genetic risk score for obesity may be at a 25-30% higher risk of developing type 2 diabetes compared to those with a low genetic risk score [20]. This is an important finding that highlights the potential impact of obesity genes on long-term metabolic health outcomes.

The evidence that has emerged from research on the causes and treatment of obesity suggests that psychological and behavioral factors may play a significant role in the complex etiology of obesity. Given the potential influence of individual differences in personality traits, cognitive function, and impulse control on compliance with food cues, eating behaviors, and lifestyle interventions, it seems reasonable to suggest that these concepts could inform the diagnosis and treatment of obesity [21].

As a result of examining the genetic structure of the factors that cause obesity, it has been shown that genetically associated variations in dopamine signaling and reward pathways may potentially interact with psychological factors to affect the tendency to overeat and gain weight. In a study conducted by Cornelis et al. (2014), it was found that there was an association between genetic risk for obesity and disinhibited eating behaviors. This finding highlighted the potential value in further emphasizing the interaction between genetic and psychological factors in the development of obesity [22]. Cornelis et al. (2014) also indicated a potential association between genetic risk scores for obesity and disinhibited eating behaviors [22]. This study suggests that there may be an interaction between genetic and psychological factors in the development of obesity. It highlights the potential influence of genetic variations associated with dopamine signaling and reward pathways on susceptibility to overeating and weight gain, which could be further investigated.

A study conducted by Tyrrell et al. (2017) indicated that the impact of obesity-associated genetic variants on BMI may be

more pronounced in individuals with lower socioeconomic backgrounds [23]. It would be beneficial to gain a deeper understanding of how genetic susceptibility intersects with social determinants of health. This could potentially lead to the development of more equitable and effective interventions to address obesity at the population level. Additionally, this finding suggests that there may be an interaction between genetic susceptibility and social factors, which could be further explored.

In light of these considerations, it seems clear that a more nuanced understanding of the complex interactions between genetics, epigenetics, social determinants of health, and psychological factors in the development and progression of obesity is crucial for the development of targeted interventions that address the multifaceted nature of obesity [24]. It would be remiss of us not to consider the potential for more effective strategies to prevent and manage obesity at both individual and societal levels. In doing so, it may be beneficial to take into account a number of factors, including genetic predisposition, epigenetic regulations, social determinants of health, and psychological and behavioral factors [25].

CONCLUSION

Obesity, a chronic disease caused by excess accumulation of fat due to energy intake surpassing expenditure, can lead to various health issues such as diabetes, depression, musculoskeletal problems, cancer, and cardiovascular diseases. Unbalanced eating habits, sedentary lifestyle, and lack of exercise are the primary factors contributing to obesity. Metabolism, the process of converting

nutrients into energy, is essential for bodily functions. Basal metabolic rate (BMR) determines the number of calories needed for these basic functions at rest. Managing a healthy weight plays a significant role in maintaining metabolic health and overall quality of life. It is particularly important for individuals with obesity to focus on healthy weight management for optimal metabolic health. By adopting healthy habits and maintaining a healthy weight, individuals can promote long-term well-being and quality of life.

Maintaining a healthy weight requires a balance between energy intake (calories consumed), energy expenditure through physical activity, and the body's metabolic processes. This balance, known as energy balance, is crucial for overall health. When the calories consumed exceed the daily intake, it leads to a positive energy balance and weight gain. Conversely, a negative energy balance occurs when more calories are burned than consumed, resulting in weight loss. Weight control methods play a significant role in maintaining metabolic health. Excess calories are stored as fat, leading to weight gain and an increased risk of health issues like obesity, diabetes, heart disease, and certain cancers. To achieve and maintain a healthy weight, it is recommended to consume fewer calories than the body needs through scientifically designed diets and engage in regular physical activity. This approach promotes healthy weight loss and prevents related health problems.

It would be beneficial to consider adopting a natural and balanced diet along with regular exercise programs in order to achieve and maintain a healthy weight. It is also worth noting that regular physical activity

plays an important role in healthy weight management. Engaging in activities such as swimming, walking, running, cycling, and so on not only helps to burn calories but also has the added benefit of improving overall metabolic health, while also strengthening bones, muscles, and joints. In scientific research studies, it has been suggested that planning a regular exercise program of low or moderate intensity for at least 150 minutes a week could be an effective method for promoting life health and healthy weight control. It is therefore clear that adopting healthy eating habits and physical activity routines can play an important role in protecting and improving the quality of life of individuals, particularly given the known risks associated with overweight and obesity.

In terms of diet and exercise planning, it might be more beneficial to consider a combination of different approaches. Given the

insights that genetic tests can provide into how the body responds to different foods and activities, it may be possible to increase the chance of maintaining a healthy weight by creating a personalized plan that fits the individual's genetic profile. In the field of obesity genetics studies, gene therapy is a highly innovative and promising area of research. Scientists are exploring ways to alter or repair faulty genes, which could potentially lead to new treatments for obesity. They are also continuing to search for genetic-based solutions in the prevention and treatment of obesity by targeting specific genetic pathways.

Acknowledgment:

We would like to express our special thanks to Dr. George N. NOMIKOS for his very successful contribution to the literature research process and unique academic support in the publication during the process of this review article.

REFERENCES

1. Frayling TM, Timpson NJ, Weedon MN, et al. A common variant in the FTO gene is associated with body mass index and predisposes to childhood and adult obesity. *Science*. 2007 May 11;316(5826):889-94.
2. Kahn SE, Cooper ME, Del Prato S. Pathophysiology and treatment of type 2 diabetes: perspectives on the past, present, and future. *Lancet*. 2014 Mar 22;383(9922):1068-83.
3. Oral O, Rezaee Z, Iyanuloluwa O. Obesity and Its Related Problems in the Elderly and the Therapeutic Effects of Physical Activity. In *Difficulties and Challenges in Geriatric Health Management 2024*;(pp. 217-235). IGI Global. 3
4. Lovejoy JC, Sainsbury A; Stock Conference 2008 Working Group. Sex differences in obesity and the regulation of energy homeostasis. *Obes Rev*. 2009 Mar;10(2):154-67.
5. Feinberg AP. The Key Role of Epigenetics in Human Disease Prevention and Mitigation. *N Engl J Med*. 2018 Apr 5;378(14):1323-1334.

6. González-Candia A, Candia AA, Ebensperger G, Reyes RV, Llanos AJ, Herrera EA. The newborn sheep translational model for pulmonary arterial hypertension of the neonate at high altitude. *J Dev Orig Health Dis.* 2020 Oct;11(5):452-463.
7. Bombak A. Obesity, health at every size, and public health policy. *Am J Public Health.* 2014 Feb;104(2):e60-7.
8. Zhang K, Ma Y, Luo Y, Song Y, Xiong G, Ma Y, Sun X, Kan C. Metabolic diseases and healthy aging: identifying environmental and behavioral risk factors and promoting public health. *Front Public Health.* 2023 Oct 13;11:1253506.
9. Marti A, Moreno-Aliaga MJ, Hebebrand J, Martínez JA. Genes, lifestyles and obesity. *Int J Obes Relat Metab Disord.* 2004 Nov;28 Suppl 3:S29-36.
10. Speakman JR. Obesity: the integrated roles of environment and genetics. *J Nutr.* 2004 Aug;134(8 Suppl):2090S-2105S.
11. Butler AA, Kozak LP. A recurring problem with the analysis of energy expenditure in genetic models expressing lean and obese phenotypes. *Diabetes.* 2010 Feb;59(2):323-9.
12. Chung WK, Leibel RL. Considerations regarding the genetics of obesity. *Obesity (Silver Spring).* 2008 Dec;16 Suppl 3(Suppl 3):S33-9.
13. Drozdovska S, Andrieieva O, Orlenko V, et al. Personalized Strategy of Obesity Prevention and Management Based on the Analysis of Pathogenetic, Genetic, and Microbiotic Factors. *IntechOpen.* 2022
14. Martínez JA, Milagro FI. Genetics of weight loss: A basis for personalized obesity management. *Trends in Food Science & Technology,* 2015;42(2), 97-115.
15. Swinburn BA, Caterson I, Seidell JC, James WP. Diet, nutrition and the prevention of excess weight gain and obesity. *Public Health Nutr.* 2004 Feb;7(1A):123-46.
16. Strasser B. Physical activity in obesity and metabolic syndrome. *Ann N Y Acad Sci.* 2013 Apr;1281(1):141-59.
17. Guerra JVS, Dias MMG, Brilhante AJVC, Terra MF, García-Arévalo M, Figueira ACM. Multifactorial Basis and Therapeutic Strategies in Metabolism-Related Diseases. *Nutrients.* 2021 Aug 18;13(8):2830.
18. Serrano-Fuentes N, Rogers A, Portillo MC. Beyond individual responsibility: Exploring lay understandings of the contribution of environments on personal trajectories of obesity. *PLoS One.* 2024 May 8;19(5):e0302927.
19. Müller MJ, Geisler C, Heymsfield SB, Bosy-Westphal A. Recent advances in understanding body weight homeostasis in humans. *F1000Res.* 2018 Jul 9;7:F1000 Faculty Rev-1025.

20. Loos RJ, Yeo GS. The bigger picture of FTO: the first GWAS-identified obesity gene. *Nat Rev Endocrinol.* 2014 Jan;10(1):51-61.
21. Vainik U, García-García I, Dagher A. Uncontrolled eating: a unifying heritable trait linked with obesity, overeating, personality and the brain. *Eur J Neurosci.* 2019 Aug;50(3):2430-2445.
22. Cornelis MC, Rimm EB, Curhan GC, et al. Obesity susceptibility loci and uncontrolled eating, emotional eating and cognitive restraint behaviors in men and women. *Obesity (Silver Spring).* 2014 May;22(5):E135-41.
23. Tyrrell J, Wood AR, Ames RM, et al. Gene-obesogenic environment interactions in the UK Biobank study. *Int J Epidemiol.* 2017 Apr 1;46(2):559-575.
24. Stevens J, Pratt C, Boyington J, et al. Multilevel Interventions Targeting Obesity: Research Recommendations for Vulnerable Populations. *Am J Prev Med.* 2017 Jan;52(1):115-124.
25. Egger G, Dixon J. Beyond obesity and lifestyle: a review of 21st century chronic disease determinants. *Biomed Res Int.* 2014;2014:731685.