QUALITY IN SPORT
eISSN 2450-3118 · Open Access · Peer-reviewed
apcz.umk.pl/QS Nicolaus Copernicus University in Toruń

BRZEZICKI, Krzysztof, KUC, Katarzyna Jolanta, ZEGADŁO, Katarzyna, DOBRUCKI, Maciej, CIECIORA, Mateusz, KAWIORSKA, Małgorzata, SUROWIEC, Julia, CIECIORA, Aleksandra, JAKUBIAK, Patryk and BEŁCIKOWSKA-SKOWRON, Wiktoria Ruta. Antipsychotic-Induced Obesity: A Literature Review of Pathophysiology, Genetics, and Management Strategies. Quality in Sport. 2026;66:74166. https://doi.org/10.12775/QS.2026.66.74166

ARTICLE TIMELINE
Received: 09.07.2026. Revised: 02.08.2026. Accepted: 02.08.2026. Published: 08.08.2026.

The journal has been awarded 20 points in the parametric evaluation by the Polish Ministry of Higher Education and Science (Annex to the announcement of 05.01.2024, No. 32553). Unique Journal Identifier: 201398. Scientific disciplines assigned: Economics and finance (Field of social sciences); Management and Quality Sciences (Field of social sciences).
Punkty Ministerialne z 2019 – aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398. Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).

ANTIPSYCHOTIC-INDUCED OBESITY: A LITERATURE REVIEW OF PATHOPHYSIOLOGY, GENETICS, AND MANAGEMENT STRATEGIES

Authors:

1. Krzysztof Brzezicki, ORCID https://orcid.org/0009-0005-4315-0644
   E-mail: krzysbrzezicki@gmail.com
   Dr. Ludwik Rydygier Provincial Hospital, Szpitalna 60, 16-400 Suwałki: Suwałki, PL

2. Katarzyna Jolanta Kuc, ORCID https://orcid.org/0009-0002-9585-4377
   E-mail: katarzynakuc.md@gmail.com
   Dr. Tytus Chałubiński Radom Specialist Hospital: ul. Lekarska 4, 26-610 Radom, Poland

3. Katarzyna Zegadło, ORCID https://orcid.org/0009-0000-8489-2058
   E-mail: dr.zegadlo@gmail.com
   Military Institute of Medicine, National Research Institute, Szaserów 128, 04-141 Warsaw, Poland

4. Maciej Dobrucki, ORCID https://orcid.org/0009-0002-0124-1853
   E-mail: maciejdobrucki.md@gmail.com
   Dr. Tytus Chałubiński Radom Specialist Hospital: ul. Lekarska 4, 26-610 Radom, Poland

5. Mateusz Cieciora, ORCID https://orcid.org/0009-0008-0711-9377
E-mail: mateuszcieciora83@gmail.com
University of Technology and Humanities in Radom, Chrobrego 27, 26-600 Radom, Poland

6. Małgorzata Kawiorska, ORCID https://orcid.org/0009-0000-3184-7659
E-mail: malgosiak3108@gmail.com
University of Technology and Humanities in Radom, Chrobrego 27, 26-600 Radom, Poland

7. Julia Surowiec, ORCID https://orcid.org/0009-0009-3356-8261
E-mail: juliasurowiec417@gmail.com
University of Technology and Humanities in Radom, Chrobrego 27, 26-600 Radom, Poland

8. Aleksandra Cieciora, ORCID https://orcid.org/0009-0009-7999-4047
E-mail: aleksandra.cieciora1@wp.pl
University of Technology and Humanities in Radom, Chrobrego 27, 26-600 Radom, Poland

9. Patryk Jakubiak, ORCID https://orcid.org/0009-0006-9138-7213
E-mail: patrykj1@vp.pl
Dr. Tytus Chałubiński Radom Specialist Hospital: Radom, Poland

10. Wiktoria Ruta Bełcikowska-Skowron, ORCID https://orcid.org/0009-0001-1789-1845
E-mail: wb.skowron@gmail.com
Dr. Tytus Chałubiński Radom Specialist Hospital: ul. Lekarska 4, 26-610 Radom, Poland

Corresponding author:
Krzysztof Brzezicki
E-mail: krzysbrzezicki@gmail.com

ABSTRACT

Background: Obesity is a highly prevalent issue observed in individuals with psychiatric disorders undergoing antipsychotic therapy. It adversely impacts health outcomes. Consequently, it elevates the risk of relapse of the primary psychiatric condition and substantially shortens life expectancy.

Aim of the study: This study aims to review current literature regarding obesity among individuals treated with neuroleptics, analyzing data on its etiology, pathophysiology, and physical/mental health complications, alongside therapeutic management strategies.

Material and methods: This article comprises a comprehensive literature review encompassing recent experimental, observational, and meta-analytic studies focused on antipsychotic-induced obesity. We analyzed data regarding the somatic and psychiatric ramifications of obesity, the effects of neuroleptics on body mass, the role of genetic factors in drug-induced weight gain, and treatment modalities.

Results and conclusions: The literature review demonstrates that obesity severely impacts physical health, precipitates metabolic disturbances, and worsens psychiatric outcomes. Antipsychotic-induced weight gain stems from the interaction of psychotropic substances with specific neural receptors, amplified by genetic susceptibility related to receptor gene polymorphisms. Among non-pharmacological interventions, behavioral therapy yields favorable outcomes. GLP-1 receptor agonists appear effective for long-term weight loss, while transitioning antipsychotic therapy to third-generation neuroleptics serves as another beneficial strategy. In each of the above-mentioned therapies, physical activity and diet were used as the basic treatment.

Key words: obesity, schizophrenia, psychotic disorders, antipsychotic drugs, mechanism, treatment

INTRODUCTION

Lifestyle diseases represent one of the most significant public health challenges in developed nations. Patients treated with antipsychotic medications constitute a population at exceptionally high risk for metabolic dysfunction. Among these conditions, obesity is the most prevalent in both the general population and psychiatric cohorts.

Research focusing on obesity within cohorts prescribed psychotropic medications indicates a substantially elevated risk of weight gain among those taking neuroleptics [1]. While patients with schizophrenia represent the most thoroughly investigated demographic in this context, drug-induced obesity also frequently affects individuals with bipolar disorder and other psychiatric conditions featuring psychotic symptoms. Weight gain profoundly impairs quality of life and treatment adherence, and markedly shortens life expectancy by disrupting metabolism, culminating in insulin resistance, type 2 diabetes, hypertension, and dyslipidemia. Consequently, drug-induced obesity substantially diminishes quality of life and lifespan relative to the general population.

DEFINITION

Obesity is defined as abnormal or excessive adipose tissue accumulation that poses a hazard to health. In clinical practice, body mass index (BMI) is the most widely utilized diagnostic indicator. A BMI threshold of 30 kg/m² or greater establishes a diagnosis of obesity. Its primary etiology involves a chronic caloric imbalance wherein energy intake exceeds total energy expenditure.

In 2025, The Lancet Diabetes & Endocrinology proposed an updated definition of obesity, distinguishing two classes based on tissue/organ dysfunction and mobility limitations [2].

Preclinical obesity is characterized by excess adipose tissue without concurrent organ dysfunction, yet conferring an elevated risk of weight-related comorbidities.

Clinical obesity is defined as an excess of adipose tissue that has resulted in symptomatic organ dysfunction and/or limitations in activities of daily living.

The diagnosis relies on BMI or anthropometric criteria confirming excess adiposity (waist circumference ≥ 88 cm for women and ≥ 102 cm for men; waist-to-height ratio > 0.5; waist-to-hip ratio > 0.85 for women and > 0.9 for men), or direct adiposity metrics (visceral fat area via DXA > 100 cm², or body fat percentage > 35% in women and > 25% in men via

bioimpedance analysis). For individuals with a BMI below 30 kg/m², at least two positive anthropometric indicators are mandatory for diagnosis.

Notably, any single direct measurement of body fat exceeding the threshold permits a diagnosis of obesity independent of BMI.

THE IMPACT OF OBESITY ON HEALTH

Obesity adversely affects overall somatic health, with central adiposity - characterized by excess visceral adipose tissue - carrying the most severe clinical consequences.

Abdominal obesity promotes insulin resistance, glucose intolerance, metabolic syndrome, and type 2 diabetes. Furthermore, it exacerbates cardiovascular risk factors - such as hypertension and dyslipidemia—triggers pro-inflammatory and prothrombotic cascades, and elevates the risk of colorectal, pancreatic, endometrial, and breast malignancies [3, 4]. Obese individuals also exhibit higher rates of subfertility, gastroesophageal reflux disease (GERD), cholelithiasis, non-alcoholic fatty liver disease (NAFLD), obstructive sleep apnea, and polycystic ovary syndrome (PCOS).

THE IMPACT OF OBESITY ON THE MENTAL CONDITION

Beyond systemic organ involvement, obesity profoundly affects psychiatric health.

Neurological ramifications include an elevated risk and accelerated progression of Alzheimer's disease and other dementias. Elevated body weight also correlates with cognitive decline in older adults and poorer performance on verbal memory assessments [5].

Furthermore, a high BMI potentially accelerates brain tissue aging. Neuroimaging studies in obese individuals reveal premature age-related structural changes, particularly within the basal ganglia, hippocampus, frontal and temporal lobes, and cerebellum. Similar structural alterations are observed in individuals with psychotic disorders, suggesting that both conditions promote neurodegeneration and may act synergistically when co-occurring.

A study evaluating the joint impact of obesity and psychosis on brain aging revealed that recent-onset psychosis, clinical exacerbations (including negative symptoms), and elevated body mass concurrently accelerate these senescent changes. Remarkably, each one-point increase in BMI was associated with an additional month of brain aging per calendar year.

Interestingly, no direct correlation was found between antipsychotic-induced weight gain specifically and accelerated brain aging. This implies that optimized antipsychotic regimens achieving long-term clinical remission may exert a neuroprotective effect that mitigates structural degradation, independent of secondary drug-induced weight gain.

Additionally, obesity elevates the risk of developing depressive and anxiety disorders by up to 25%, contributing to higher rates of post-schizophrenic depression [6, 7].

EFFECT OF ANTIPSYCHOTIC DRUGS ON BODY WEIGHT

Aggregated data clearly demonstrate that most antipsychotic medications are associated with significant weight gain [1]. Weight loss was recorded only for two agents (molindone and pimozide, the former currently unavailable in Europe); however, the authors note potential confounding factors, such as previous exposure to higher-risk neuroleptics, reduced caloric intake during acute psychosis due to lower antipsychotic efficacy, and a large standard error rendering the weight loss borderline non-significant.

Conversely, all other investigated substances precipitated weight gain. Ranked from lowest to highest mean weight gain, these agents include ziprasidone, haloperidol, risperidone, quetiapine, olanzapine, chlorpromazine, clozapine, and perphenazine.

Predictive models for a 10-week therapeutic course estimated the lowest weight gain for ziprasidone and haloperidol, and the highest for clozapine and olanzapine.

An evaluation of long-term weight changes associated with the three most commonly prescribed antipsychotics (risperidone, olanzapine, and quetiapine) categorized exposure into short-term (up to week 6) and long-term (week 6 to year 4) intervals [8]. While weight gain occurred across all cohorts, the metrics for quetiapine and risperidone were substantially lower and comparable (ranging from a 1.5 kg increase in men on long-term quetiapine to 2.5 kg in women on risperidone). Patients on long-term olanzapine therapy experienced significantly greater weight gain, averaging 5.1 kg over 4 years.

A short-term dose-response relationship was also evident, with lower neuroleptic doses correlating with less pronounced weight gain. Notably, male patients receiving low-dose quetiapine exhibited an initial mean weight gain of 0.5 kg, followed by a net decrease of 0.7 kg from week 6 through year 4, resulting in a net total reduction of 0.3 kg.

INFLUENCE OF GENETIC FACTORS

The contribution of genetics to obesity etiology in the general population is well established, with classic examples including frameshift mutations in the melanocortin 4 receptor (MC4R) and proopiomelanocortin (POMC) genes.

Emerging evidence similarly underlines a strong genetic component in antipsychotic-induced weight gain, accounting for 60% to 80% of individual variability [9].

Research frequently focuses on single nucleotide polymorphisms (SNPs) as key determinants of neuroleptic-induced weight gain. Among the best-documented examples are 5-HT2C receptor gene polymorphisms; because this gene is located on the X chromosome, inheritance patterns differ significantly between sexes [10].

Polymorphisms within leptin and leptin receptor genes also show clear correlations [11]. Several mutations tightly correlate with drug-induced weight gain, while specific protective genotypes have also been identified [12].

Variants of the histaminergic H1, alpha1-adrenergic, and dopaminergic D2 receptors are associated with up to a threefold increase in the risk of substantial weight gain [13, 14, 15].

Additional, though less robustly documented, variants implicated in pro-obesity pathways include the peroxisome proliferator-activated receptor gamma (PPAR-γ) gene, the G-protein beta-3 subunit gene, and various genes regulating lipid metabolism [16, 17, 18].

MECHANISM

Evidence suggests that the propensity for weight gain is strictly tied to the multi-receptor affinity profiles of individual antipsychotic drugs [19]. Off-target antagonism at non-dopaminergic sites often equals or exceeds potency at the D2 receptor [19]. A profound correlation with severe weight gain is observed for agents demonstrating high concurrent affinity for at least two of the following: 5-HT2C, alpha1-adrenergic, or histaminergic H1 receptors. For instance, clozapine, olanzapine, and quetiapine exhibit prominent off-target binding: clozapine potently blocks H1, alpha1, and 5-HT2C receptors; olanzapine targets 5-HT2C and H1 receptors; and quetiapine exhibits high affinity for H1 and alpha1 receptors. Conversely, risperidone carries a more moderate risk, displaying high affinity for alpha1 receptors but only moderate antagonism at H1 and 5-HT2C sites.

NON-PHARMACOLOGICAL TREATMENT

Behavioral therapy serves as a foundational non-pharmacological intervention for antipsychotic-induced obesity [20]. Subjects participated in 12 weekly group sessions followed by 2 biweekly booster sessions and then 2 monthly booster sessions. During the study, patients were provided with an individual self-monitoring assessment and group sessions of weight control methods.

During this time, study participants were encouraged to increase the amount of fruit and vegetables in their diet and reduce the amount of products containing simple sugars. They were also instructed to avoid secondary activities (e.g. watching TV) during meals. Patients were provided with pedometers and instructed to increase their daily step count. People were also educated about the role of meals consumed on weight control and the medical complications of excessive body weight.
Structured lifestyle programs achieved weight loss in 69% of completers, yielding an average reduction of 3.23 kg that was maintained through a 9-month follow-up period, demonstrating the durability of behavioral habit modification.

PHARMACOLOGICAL TREATMENT

Multiple anti-obesity agents can serve as adjunctive treatments, though polypharmacy introduces potential hepatic and renal burdens.

Traditional options like metformin and topiramate display mixed risk-benefit profiles; topiramate, in particular, is constrained by risks of mood deterioration and suicidal ideation [21].
Orlistat offers modest benefits, but only strictly contingent on a low-fat diet.
Fluoxetine-induced weight loss is typically transient and driven solely by temporary appetite suppression.

A study from 2022 analyzed the impact of other substances on weight loss in people with obesity after using neuroleptic drugs [22].
The use of the combination of naltrexone and bupropion did not result in weight loss compared to the control group in the population of people treated for schizophrenia.
The greatest hope is associated with the use of liraglutide, its use resulted not only in a significant decrease in body weight (on average by even -5.29 kg), but also in a beneficial effect on glycated hemoglobin (on average -3.12 mmol/mol), normalization of systolic blood pressure and reduction in total cholesterol concentration (on average -0.51 mmol/l).

One study compared the use of liraglutide in people with mental disorders (schizophrenia, bipolar disorder, major depressive disorder) with people with appetite control disorders and a control group, and showed an average weight loss of about 7.0 kg over 6 months in people

from the group with mental disorders [23]. Such a clear, long-term change in weight was not observed in people from the appetite control disorder group and in the control group.

It was noticed that semaglutide may be effective in the treatment of obesity in mentally ill people by reducing the average body weight during a 6-month treatment by up to 5.53 kg. The authors emphasize the effectiveness of this substance, especially in patients previously taking metformin when it turned out to be ineffective [24].

One group of researchers decided to analyze the impact of therapy with weight-loss drugs in people with mental illnesses, where the appropriate weight-loss drug was selected individually for each participant, and a standard diet and physical exercise were also used [25]. Liraglutide, topiramate, naltrexone in combination with bupropion, combinations of these substances were used, and some patients were additionally treated with phentermine.
As a result of the therapy, a significant decrease in body weight was observed during the 12-month observation period (by an average of 11.79 kg), as well as a decrease in glycated hemoglobin, normalization of hypercholesterolemia and equalization of blood pressure.

3RD GENERATION ANTIPSYCHOTIC DRUGS

Due to the significant impact of first- and second-generation antipsychotic drugs on metabolic diseases such as obesity, great hope is associated with third-generation neuroleptic drugs.

From existing studies, it can be concluded that the use of aripiprazole as the first antipsychotic drug in patients is associated with no or very low risk of weight gain and other metabolic diseases [26].
Research also shows that in people suffering from schizophrenia and other psychotic disorders, replacing the previously used olanzapine with aripiprazole may be associated with stopping the weight gain of the treated person, or even with a decrease in body weight [27]. Aripiprazole may also cause a decrease in some indicators of cholesterolemia, such as VLDL, and reduce the risk of developing type II diabetes [28].

Even greater hopes can be associated with cariprazine, which in studies seems to have an even greater positive effect on patients' weight [29, 30]. Cariprazine not only stopped the development of obesity in people taking olanzapine, but was also associated with weight loss in overweight people taking aripiprazole.

Both aripiprazole and cariprazine in studies showed a similar effect on normalizing the mental state of patients suffering from schizophrenia and other psychotic disorders.
The use of this generation of drugs was also associated with side effects similar to those of the second generation, including insomnia, headache, akathisia and upper respiratory tract infection.

CONCLUSIONS

The problem of metabolic diseases particularly affects people with psychotic disorders treated with neuroleptic drugs. The most common disorder in this case is obesity. This problem affects both people suffering from schizophrenia, but also those suffering from bipolar disorder and other psychiatric disorders with psychotic symptoms.
Obesity, as a disease caused by excessive accumulation of fat tissue in the body, is most often defined by a body mass index of at least 30 kg/m^2. It causes insulin resistance, impaired glucose tolerance, type II diabetes, and increases the risk of hypertension, dyspilidaemia and some types of cancer.
Increased body weight also negatively affects the mental sphere. It accelerates age-related neurodegenerative changes and contributes to the development of depressive and anxiety disorders, including post-schizophrenic depression.
There are active substances of antipsychotic preparations that have the greatest impact on the weight of patients - these are clozapine and olanzapine. Substances with a low potential for weight gain can also be indicated - ziprasidone, haloperidol and quetiapine.
Genetic factors play an important role in the development of drug-induced obesity caused by antipsychotic drugs, the influence of which can be estimated at 60-80% of cases of this disease. The development of obesity in this mechanism seems to be influenced mainly by polymorphisms of genes encoding certain proteins and their receptors. Examples include polymorphisms of the 5HT2C receptor, H1 receptor, α1-adrenergic receptor, leptin and leptin receptor, and many others.
The mechanism contributing to the weight gain in patients treated with neuroleptics may be antagonism to the above-mentioned receptors to an extent equal or greater than to the dopaminergic D2 receptor.
Behavioral therapy may have good effects in the non-pharmacological treatment of obesity. It allows patients to reduce body weight and, by developing healthy habits, prevents the recurrence of obesity.

Substances from the group of GLP-1 analogues, i.e. liraglutide and semaglutide, seem to be pharmacological methods with good effectiveness and relatively few side effects. Both substances caused significant and long-lasting weight loss in people taking them. However, the best effect, with the greatest change in the weight of the subjects, was observed when the drug was individually selected for each patient's situation.

A way to deal with obesity as a side effect of antipsychotic drugs may also be to change these substances to new generation drugs - aripiprazole or cariprazine. These substances have similar antipsychotic effectiveness and have less impact on metabolism. Moreover, in some cases they can even cause weight loss. This effect can be observed particularly with cariprazine.

It should be noted that physical activity and an appropriate diet were an integral element of each of the above-mentioned therapies.

DISCLOSURE

Author's contribution

Conceptualization: Krzysztof Brzezicki, Katarzyna Zegadło, Aleksandra Cieciora

Methodology: Krzysztof Brzezicki, Maciej Dobrucki, Małgorzata Kawiorska

Software: Maciej Dobrucki, Patryk Jakubiak, Wiktoria Ruta Bełcikowska-Skowron

Validation: Krzysztof Brzezicki, Mateusz Cieciora, Julia Surowiec

Formal analysis: Krzysztof Brzezicki, Małgorzata Kawiorska, Wiktoria Ruta Bełcikowska-Skowron

Investigation: Maciej Dobrucki, Mateusz Cieciora, Aleksandra Cieciora

Resources: Krzysztof Brzezicki, Maciej Dobrucki, Julia Surowiec

Data curation: Katarzyna Jolanta Kuc, Julia Surowiec, Patryk Jakubiak

Writing – original draft preparation: Katarzyna Zegadło, Katarzyna Jolanta Kuc, Małgorzata Kawiorska

Writing – review and editing: Krzysztof Brzezicki, Maciej Dobrucki, Aleksandra Cieciora

Visualization: Katarzyna Jolanta Kuc, Mateusz Cieciora

Supervision: Krzysztof Brzezicki, Katarzyna Zegadło

Project administration: Krzysztof Brzezicki, Maciej Dobrucki

All authors have read and agreed with the published version of the manuscript.

Funding Statement: No funding was sought or obtained in relation to this review article.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable

Data Availability Statement: Not applicable

Acknowledgments: The authors wish to emphasize that they do not express gratitude to any individuals or institutions

Conflict of Interest Statement: The authors declare no conflicts of interest.

USE OF GENERATIVE AI

AI was utilized for two specific purposes in this research. Text analysis of clinical reasoning narratives to identify linguistic patterns associated with specific logical fallacies. Assistance in refining the academic English language of the manuscript, ensuring clarity, consistency, and adherence to scientific writing standards. AI were used for additional linguistic refinement of the research manuscript, ensuring proper English grammar, style, and clarity in the presentation of results. It is important to emphasize that all AI tools were used strictly as assistive instruments under human supervision. The final interpretation of results, classification of errors, and conclusions were determined by human experts in clinical medicine and formal logic. The AI tools served primarily to enhance efficiency in data processing, pattern recognition, and linguistic refinement, rather than replacing human judgment in the analytical process.

REFERENCES

1. Allison, D. B., Mentore, J. L., Heo, M., Chandler, L. P., Cappelleri, J. C., Infante, M. C., & Weiden, P. J. (1999). Antipsychotic-induced weight gain: a comprehensive research synthesis. *American journal of Psychiatry*, *156*(11), 1686-1696. https://doi.org/10.1176/ajp.156.11.1686

2. Rubino, F., Cummings, D. E., Eckel, R. H., Cohen, R. V., Wilding, J. P., Brown, W. A., ... & Mingrone, G. (2025). Definition and diagnostic criteria of clinical obesity. *The Lancet Diabetes & Endocrinology*, *13*(3), 221-262. https://doi.org/10.1016/s2213-8587(24)00316-4

3. Després, J. P. (2001). Health consequences of visceral obesity. *Annals of medicine*, *33*(8), 534-541. https://doi.org/10.3109/07853890108995963

4. Świerczyńska, B., Sekuła, M., Smoluchowski, K., Suchodolska, M., & Undziakiewicz, A. (2020). Mechanisms linking obesity and gastrointestinal cancers.

Journal of Education, Health and Sport, *10*(8), 346–354. https://doi.org/10.12775/JEHS.2020.10.08.041

5. McWhinney, S., Kolenic, M., Franke, K., Fialova, M., Knytl, P., Matejka, M., ... & Hajek, T. (2021). Obesity as a risk factor for accelerated brain ageing in first-episode psychosis—a longitudinal study. *Schizophrenia bulletin*, *47*(6), 1772-1781. https://doi.org/10.1093/schbul/sbab064

6. Simon, G. E., Von Korff, M., Saunders, K., Miglioretti, D. L., Crane, P. K., Van Belle, G., & Kessler, R. C. (2006). Association between obesity and psychiatric disorders in the US adult population. *Archives of general psychiatry*, *63*(7), 824-830. https://doi.org/10.1001/archpsyc.63.7.824

7. Dąbrowska, J., Wójcik, M., Samek, I., Jańczyk, M., Bator, D., & Milanowska, J. (2020). Obesity and mental health. *Journal of Education, Health and Sport*, *10*(6), 199–205. https://doi.org/10.12775/JEHS.2020.10.06.022

8. Bazo-Alvarez, J. C., Morris, T. P., Carpenter, J. R., Hayes, J. F., & Petersen, I. (2020). Effects of long-term antipsychotics treatment on body weight: A population-based cohort study. *Journal of Psychopharmacology*, *34*(1), 79-85. https://doi.org/10.1177/0269881119885918

9. Gebhardt, S., Theisen, F. M., Haberhausen, M., Heinzel-Gutenbrunner, M., Wehmeier, P. M., Krieg, J. C., Kühnau, W., Schmidtke, J., Remschmidt, H., & Hebebrand, J. (2010). Body weight gain induced by atypical antipsychotics: an extension of the monozygotic twin and sib pair study. *Journal of clinical pharmacy and therapeutics*, *35*(2), 207–211. https://doi.org/10.1111/j.1365-2710.2009.01084.x

10. McCarthy, S., Mottagui-Tabar, S., Mizuno, Y., Sennblad, B., Hoffstedt, J., Arner, P., Wahlestedt, C., & Andersson, B. (2005). Complex HTR2C linkage disequilibrium and promoter associations with body mass index and serum leptin. *Human genetics*, *117*(6), 545–557. https://doi.org/10.1007/s00439-005-1328-6

11. Opgen-Rhein, C., Brandl, E. J., Müller, D. J., Neuhaus, A. H., Tiwari, A. K., Sander, T., & Dettling, M. (2010). Association of HTR2C, but not LEP or INSIG2, genes with antipsychotic-induced weight gain in a German sample. *Pharmacogenomics*, *11*(6), 773–780. https://doi.org/10.2217/pgs.10.50

12. Yevtushenko, O. O., Cooper, S. J., O'Neill, R., Doherty, J. K., Woodside, J. V., & Reynolds, G. P. (2008). Influence of 5-HT2C receptor and leptin gene polymorphisms, smoking and drug treatment on metabolic disturbances in patients with schizophrenia. *The British journal of psychiatry : the journal of mental science*, *192*(6), 424–428. https://doi.org/10.1192/bjp.bp.107.041723

13. Vehof, J., Risselada, A. J., Al Hadithy, A. F., Burger, H., Snieder, H., Wilffert, B., Arends, J., Wunderink, L., Knegtering, H., Wiersma, D., Cohen, D., Mulder, H., & Bruggeman, R. (2011). Association of genetic variants of the histamine H1 and muscarinic M3 receptors with BMI and HbA1c values in patients on antipsychotic medication. *Psychopharmacology*, *216*(2), 257–265. https://doi.org/10.1007/s00213-011-2211-x

14. Wang, Y. C., Bai, Y. M., Chen, J. Y., Lin, C. C., Lai, I. C., & Liou, Y. J. (2005). Polymorphism of the adrenergic receptor alpha 2a -1291C>G genetic variation and clozapine-induced weight gain. *Journal of neural transmission (Vienna, Austria : 1996)*, *112*(11), 1463–1468. https://doi.org/10.1007/s00702-005-0291-7

15. Lencz, T., Robinson, D. G., Napolitano, B., Sevy, S., Kane, J. M., Goldman, D., & Malhotra, A. K. (2010). DRD2 promoter region variation predicts antipsychotic-induced weight gain in first episode schizophrenia. *Pharmacogenetics and genomics*, *20*(9), 569–572. https://doi.org/10.1097/FPC.0b013e32833ca24b

16. Herken, H., Erdal, M., Aydin, N., Sengul, C., Karadag, F., Barlas, O., & Akin, F. (2009). The association of olanzapine-induced weight gain with peroxisome proliferator-activated receptor-gamma2 Pro12Ala polymorphism in patients with schizophrenia. *DNA and cell biology*, *28*(10), 515–519. https://doi.org/10.1089/dna.2009.0893

17. Wang, Y. C., Bai, Y. M., Chen, J. Y., Lin, C. C., Lai, I. C., & Liou, Y. J. (2005). C825T polymorphism in the human G protein beta3 subunit gene is associated with long-term clozapine treatment-induced body weight change in the Chinese population. *Pharmacogenetics and genomics*, *15*(10), 743–748. https://doi.org/10.1097/01.fpc.0000175600.26893.fa

18. Ruaño, G., Goethe, J. W., Caley, C., Woolley, S., Holford, T. R., Kocherla, M., Windemuth, A., & de Leon, J. (2007). Physiogenomic comparison of weight profiles of olanzapine- and risperidone-treated patients. *Molecular psychiatry*, *12*(5), 474–482. https://doi.org/10.1038/sj.mp.4001944

19. Seeger, T.F., Seymour, P.A., Schmidt, A.W., Zorn, S.H., Schulz, D.W., Lebel, L.A., Mclean, S., Guanowsky, V., Howard, H.R., & Lowe, J. (1995). Ziprasidone (CP-88,059): a new antipsychotic with combined dopamine and serotonin receptor antagonist activity. *The Journal of pharmacology and experimental therapeutics, 275 1*, 101-13 . https://doi.org/10.1016/s0022-3565%2825%2912023-5

20. Kalarchian, M. A., Marcus, M. D., Levine, M. D., Haas, G. L., Greeno, C. G., Weissfeld, L. A., & Qin, L. (2005). Behavioral treatment of obesity in patients taking antipsychotic medications. *Journal of Clinical Psychiatry*, *66*(8), 1058-1063. https://doi.org/10.4088/jcp.v66n0815

21. Werneke, U., Taylor, D., & Sanders, T. A. B. (2002). Options for pharmacological management of obesity in patients treated with atypical antipsychotics. *International Clinical Psychopharmacology*, *17*(4), 145-160. https://doi.org/10.1097/00004850-200207000-00001

22. Lee, K., Abraham, S., & Cleaver, R. (2022). A systematic review of licensed weight-loss medications in treating antipsychotic-induced weight gain and obesity in schizophrenia and psychosis. *General Hospital Psychiatry*, *78*, 58-67. https://doi.org/10.1016/j.genhosppsych.2022.07.006

23. Maccora, C., Ciuoli, C., Goracci, A., Benenati, N., Formichi, C., Pilli, T., ... & Castagna, M. G. (2020). One month weight loss predicts the efficacy of liraglutide in obese patients: data from a single center. *Endocrine Practice*, *26*(2), 235-240. https://doi.org/10.4158/ep-2019-0169

24. Prasad, F., Agarwal, M., Hahn, M., & Mueller, D. J. (2022). P177. Semaglutide to the rescue: real-world clinical data in patients with antipsychotic-induced weight gain not responding to metformin. *Biological Psychiatry*, *91*(9), S158-S159. https://doi.org/10.1177/20451253231165169

25. Tham, M., Chong, T. W., Jenkins, Z. M., & Castle, D. J. (2021). The use of anti-obesity medications in people with mental illness as an adjunct to lifestyle interventions—effectiveness, tolerability and impact on eating behaviours: a 52-week observational study. *Obesity Research & Clinical Practice*, *15*(1), 49-57. https://doi.org/10.1016/j.orcp.2020.11.002

26. Citrome, L., Kalsekar, I., Baker, R. A., & Hebden, T. (2014). A review of real-world data on the effects of aripiprazole on weight and metabolic outcomes in adults. *Current medical research and opinion*, *30*(8), 1629-1641. https://doi.org/10.1185/03007995.2014.908280

27. De Hert, M., Eramo, A., Landsberg, W., Kostic, D., Tsai, L. F., & Baker, R. A. (2015). Efficacy and safety of aripiprazole once-monthly in obese and nonobese patients with schizophrenia: a post hoc analysis. *Neuropsychiatric disease and treatment*, 1299-1306. https://doi.org/10.2147/ndt.s80479

28. Henderson, D. C., Fan, X., Copeland, P. M., Sharma, B., Borba, C. P., Boxill, R., ... & Goff, D. C. (2009). Aripiprazole added to overweight and obese olanzapine-treated schizophrenia patients. *Journal of clinical psychopharmacology*, *29*(2), 165-169. https://doi.org/10.1097/jcp.0b013e31819a8dbe

29. Verma, A., Ranjan, R., Kumar, P., & Maharshi, V. (2026). Effect of Cariprazine versus Aripiprazole on Cardiometabolic Profile in Patients with Schizophrenia switched from Olanzapine due to Weight gain: A Randomized Controlled Trial. *Journal of Psychiatric Research*. https://doi.org/10.1016/j.jpsychires.2026.02.037

30. Halaris, A., & Wuest, J. (2019). Metabolic syndrome reversal with cariprazine. *Journal of Clinical Psychopharmacology*, *39*(4), 413-416. https://doi.org/10.1097/jcp.0000000000001074