

Dietary habits, prevalence of obesity and overweight in developed and developing countries

Hábitos alimentares, prevalência da obesidade e do sobrepeso em países desenvolvidos e em desenvolvimento

Hábitos alimentarios, prevalencia de la obesidad y el sobrepeso en países desarrollados e en desarrollo

Received: 07/11/2022 | Reviewed: 07/21/2022 | Accept: 07/23/2022 | Published: 07/29/2022

Aliou Toro Lafia

ORCID: <https://orcid.org/0000-0001-9632-2722>
Federal University of Uberlândia, Brazil
E-mail: torolafiaaliou@gmail.com

Tankpinou Richard Ketounou

ORCID: <https://orcid.org/0000-0001-6404-7746>
State University of Southwestern Bahia, Brazil
E-mail: rketounou@gmail.com

John Nonvignon Bossis Honfoga

ORCID: <https://orcid.org/0000-0003-1478-1023>
State University of Southwestern Bahia, Brazil
E-mail: jnbossis91@hotmail.com

Semako Ibrahim Bonou

ORCID: <https://orcid.org/0000-0001-9547-6236>
Federal University of Campina Grande, Brazil
E-mail: bonouibrahim@gmail.com

Aïssatou Kora Bani Zimé

ORCID: <https://orcid.org/0000-0003-4789-5385>
University of Parakou, Benin
E-mail: korabanizimeaïssatou@gmail.com

Abstract

Obesity is the accumulation of excess adipose tissue that affects a person's health and physical and psychosocial well-being. The classification is based on the body mass index, which makes it possible to compare prevalence rates worldwide. Obesity and overweight have become a global epidemic in both developed and developing countries. The objective of this study is to assess the prevalence of obesity and overweight in some countries. The results showed that in the last two decades, the prevalence of obesity and overweight in the world has more than doubled. The predominance of obesity and overweight is more pronounced in Western and Westernized countries, which are more developed, than in developing countries where malnutrition and obesity coexist. This global epidemic is seen in adults, adolescents and children without exception of gender. Obesity and overweight are one of the main factors in the increase of non-communicable diseases such as cardiovascular diseases, diabetes, musculoskeletal disorders and some types of cancer in the world. Poor diet is the main cause of the growing prevalence of obesity.

Keywords: Diet; Public health; Epidemic.

Resumo

A obesidade é o acúmulo de tecido adiposo em excesso que afeta a saúde e o bem-estar físico e psicossocial da pessoa. A classificação é baseada no índice de massa corporal, que permite de comparar as taxas de prevalência em todo o mundo. A obesidade e o sobrepeso se tornaram uma epidemia global tanto em países desenvolvidos quanto em países em desenvolvimento. O objetivo deste trabalho é avaliar a prevalência da obesidade e do sobrepeso de alguns países. Os resultados mostraram que nas duas últimas décadas, a prevalência da obesidade e do sobrepeso no mundo mais que dobrou. A predominância da obesidade e do sobrepeso é mais acentuada nos países ocidentais e ocidentalizados, que são mais desenvolvidos, do que nos países em desenvolvimentos onde a desnutrição e a obesidade coabitam. Essa epidemia global é observada em adultos, adolescentes e crianças sem exceção de gênero. A obesidade e o sobrepeso são uns dos principais fatores no aumento de doenças não transmissíveis como doenças cardiovasculares, diabetes, distúrbios musculoesqueléticos e alguns tipos de câncer no mundo. A má alimentação é a principal causa da crescente prevalência da obesidade.

Palavras-chave: Alimentação; Saúde pública; Epidemia.

Resumen

La obesidad es la acumulación de un exceso de tejido adiposo que afecta a la salud y al bienestar físico y psicosocial de una persona. La clasificación se basa en el índice de masa corporal, lo que permite comparar las tasas de prevalencia en todo el mundo. La obesidad y el sobrepeso se han convertido en una epidemia mundial, tanto en los países desarrollados como en los que están en vías de desarrollo. El objetivo de este trabajo es evaluar la prevalencia de la obesidad y el sobrepeso en algunos países. Los resultados mostraron que en las dos últimas décadas, la prevalencia de la obesidad y el sobrepeso en el mundo se ha duplicado con creces. El predominio de la obesidad y el sobrepeso es más pronunciada en los países occidentales y occidentalizados, más desarrollados, que en los países en desarrollo, donde cohabitan la desnutrición y la obesidad. Esta epidemia mundial se observa en adultos, adolescentes y niños sin excepción de género. La obesidad y el sobrepeso son uno de los principales factores del aumento de las enfermedades no transmisibles, como las cardiovasculares, la diabetes, los trastornos musculoesqueléticos y algunos tipos de cáncer en el mundo. La mala alimentación es la principal causa de la creciente prevalencia de la obesidad.

Palabras clave: Alimentación; Salud pública; Epidemia.

1. Introduction

The increasing prevalence of obesity has become a major problem in adults as well as among children and adolescents due to the various health-related complications (Dibonaventura et al., 2018; Aranceta-Bartrina et al., 2020). The problem of obesity had not caught the attention of experts in the field for a long time, until it became an epidemic, for them the problem of obesity could be easily solved by controlling food intake (James, 2009). The estimate by 2030 is expected to be 2.16 billion overweight people and 1.12 billion obese in the world (Kolahi et al., 2018). Body Mass Index (BMI) is a good indicator of general health and nutritional status (Ahirwar & Mondal, 2019).

Worldwide, the prevalence of obesity has doubled in the last three decades, being more pronounced in the United States. Today, one in three adults is obese and more than two in three adults are overweight or obese (Gallus et al., 2015). There has been a great advance of obesity in developed countries where family incomes are high (Al muktadir et al., 2019).

Obesity is characterized as the accumulation of excess adipose tissue that impairs physical and psychosocial health and well-being, increasing for this individual the risk of various chronic diseases (D'errico, Pavlova & Spandonaro, 2021; Lombardo et al., 2015). Obesity and overweight have been described as a global epidemic in adults as well as children. A challenge for both developed and developing countries (Cominato et al., 2018). Worldwide, obesity is recognized as a threat to social health. The evolution of obesity, in addition to its great impact on public health, is a socioeconomic burden in all countries (Agha & Agha, 2017). Western eating habits adopted by the world have led modern society to a serious social problem associated with metabolic disorders, responsible for obesity (Kasai et al., 2015).

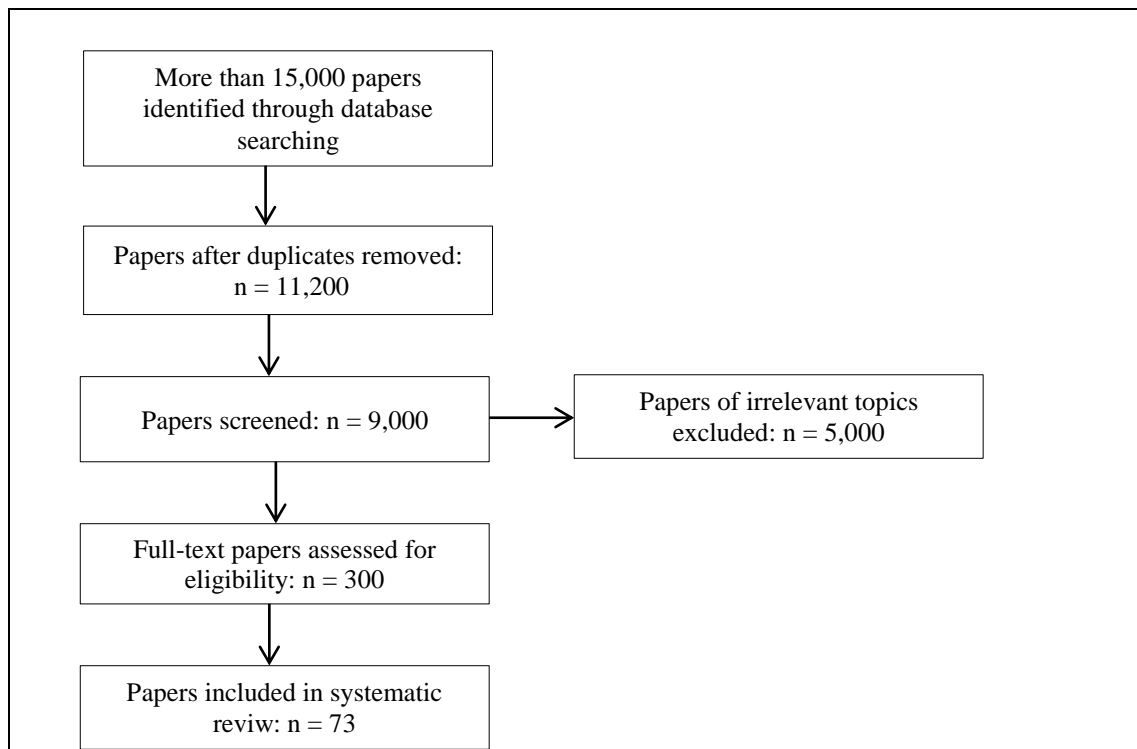
What drew the most attention in the last decade was the acceleration of childhood obesity, the subject of several studies (Galai et al., 2020; Pan et al., 2019; Ma et al., 2020). In developed countries, children are more vulnerable to obesity compared to developing countries (Mastrocola et al., 2019). Overweight or obese children are at greater risk of continuing with the same physical condition into adulthood with serious health problems (Aranceta-Bartrina, Gianzo-Citores & Pérez-Rodrigo, 2020).

2. Methodology

In this work, a systematic review composed of national and international scientific articles was conducted following the methodology adapted from Ahirwar and Monda (2019). The articles were searched in electronic databases (Google Academics and the Periodicals of the Coordination for the Improvement of Higher Level Personnel (CAPES) and websites related to the subjects). The articles were selected according to the methodology adapted from Li et al. (2020) as shown in Figure 1.

Search words include "body mass index," "prevalence of obesity and overweight," "adult obesity," "childhood obesity," "health effects of obesity," and "eating habits."

Figure 1: Flowchart of article selection for the systematic review.



Source: Authors (2022).

3. Results and Discussion

3.1 Dietary habits and other obesity-causing agents

The identification of risk factors for obesity is very important for taking effective preventive measures (Jacob et al., 2020). Unhealthy eating habits are among the factors that can have adverse effects on weight status in young adulthood (Sogari et al., 2018). A sedentary lifestyle combined with the consumption of high-calorie foods is the main cause of the increasing prevalence of obesity (Ahirwar & Mondal, 2019; Rosenthal, 2017). In a study in the United States during the COVID-19 pandemic, participants (38.0%) reported weight gain, attributed to increased consumption of sweets (43.8%) and snack foods (37.4%). In addition, most participants were identified as overweight (34.0%) or obese (47.0%) (Bin Zarah et al., 2020).

Ultra-processed foods tend to be cheaper, thus increasing their accessibility and promoting the prevalence of overweight and obesity (Passos et al., 2020). Excessive consumption of ultra-processed products is directly related to the increase in the levels of fats and sugars in the body, leading to a nutritional imbalance, a risk for an uncontrolled increase in body weight (Cominato et al., 2018). Higher consumption of ultra-processed foods is associated with higher adiposity (Rauber et al., 2020). Developing countries face high risk of obesity due to consumption of energy-dense foods (unhealthy eating habits), sedentary lifestyle, lack of health services and financial support (Ahiwar & Modal, 2019).

The etiology of childhood obesity is broadly subdivided into exogenous causes and endogenous causes. Exogenous obesity is caused by a chronic imbalance between energy intake and expenditure; while endogenous obesity is caused by various genetic, syndromic and endocrine causes (Aggarwal & Jain, 2018). The prevalence of childhood obesity is due to the exaggerated consumption of sugars (Breda et al., 2018). The study by Buoncristiano et al. (2021) showed a relationship between childhood obesity, socioeconomic conditions and education level from parents. Children from low-income families and those with highly educated parents are less likely to be overweight or obese.

Of course, diet is not the only factor associated with obesity, genetics plays a large role in weight gain, as studies have proven the heritability of body mass index (Min et al., 2013). According to Baillie-Hamilton (2002) instead of genetic factors, environmental causes, giving illusion to synthetic organic and inorganic chemicals that are being used in nature, may be the main responsible for the advancement of obesity in the world. Emotional problems, depression, anxiety, and obsessive-compulsive disorder are associated with an increase in childhood and adolescent obesity (Antwi et al., 2013). Shorter sleep times (< 7 hours) daily contribute for obesity by decreasing leptin, increasing ghrelin and impairing insulin sensitivity (Gangwisch et al., 2005).

According to a study carried out in Japan, the gut microbiota differs between obese and non-obese individuals. Obese people are carriers of bacteria such as: *Blautia hydrogenotrophica*, *Coprococcus catus*, *Eubacterium ventriosum*, *Ruminococcus bromii* and *Ruminococcus obeum* in the intestinal microbiota. These bacteria belong to the phylum Firmicutes and carry genes related to the metabolism of polysaccharides, which may be responsible for the accumulation of fatty acids (Kasai et al., 2015). Basal metabolic rate represents the main component of energy expenditure in humans and, therefore, has great relevance in obesity treatment programs (Westphal et al., 2021). A person with a large accumulation of fatty acids and a low basal metabolic rate can easily gain more weight.

3.2 Effect of obesity on health

Obesity and overweight are one of the main factors in the increase of non-communicable diseases such as cardiovascular diseases, diabetes, musculoskeletal disorders and some types of cancer (Biswas et al., 2017; Antwi et al., 2013). No significant correlations were identified between anthropometric indicators of general and abdominal obesity in diabetic and hypertensive-diabetic patients (Barroso et al., 2020). The risk factor for cardiovascular disease is associated with increased cholesterol (AOE et al., 2017). Obesity shortens life expectancy due in large part to disease-associated comorbidities (Dibonaventura et al., 2018). A study in Japan showed that both the prevalence of gastroesophageal reflux disease and the prevalence of hernia were significantly higher in obese individuals (Sakaguchi et al. 2008). Obese people have a high prevalence of hypertension (Macia et al., 2016).

Study showed a linear relationship between increased obesity and severe body pain. Increasing levels of obesity increase the occurrence of severe pain and even experience pain in various parts of the body (Hitt et al., 2007). Obesity has been associated with excessive daytime sleepiness, sleep-related disorders, and loud snoring (Resta et al., 2003). Musculoskeletal disorders especially osteoarthritis and some types of cancers including endometrial, breast, ovarian, prostate, liver, gallbladder, kidney and colon have been associated with obesity (WHO, 2021). Even during the COVID-19 pandemic, overweight people had more complications and severe symptoms. Being overweight can act by dysregulating lymphoid and myeloid responses, which will affect the immune system and prolong inflammatory responses, contributing to the further proliferation of viral infections, and further complications pandemic COVID-19 (Figueiredo et al., 2020).

Living with obesity is riskier than having weight loss surgery (Rosenthal, 2017). Bariatric surgery is the most used procedure for the treatment of morbid obesity (Smith et al., 2011). In addition to surgery being a risk, malnutrition can occur after bariatric surgery due to reduced protein intake or absorption, as well as fat malabsorption, resulting in deficiencies of fat-soluble vitamins and essential fatty acids (Xanthakos & Inge, 2006).

The increase in mortality, suicide and homicide can largely be attributed to physical illnesses, including metabolic abnormalities such as obesity (Annamalai et al., 2017). Obesity is associated with depression and greater suicide attempt especially in women (Klinitzke et al., 2013). In obese people, psychiatric disorders and substance abuse dependence increase the risk of suicide, reported by Heneghan et al. (2012).

Obesity in pregnant women can lead to various complications during pregnancy, childbirth and postpartum. Complications can arise during labor and may cause maternal death, hemorrhage, cesarean delivery, or infection; increased risk of neonatal and infant death (Black et al., 2013). Obese women are at three times the risk of miscarriage and having an operative delivery (Yu et al., 2006).

3.3 Prevalence of obesity

In 2016, more than 1.9 billion of the world's adult population were overweight and obese, 39% and 13% respectively. More than 340 million children and adolescents aged between 5 and 19 years were affected (WHO, 2021). The prevalence of overweight among children under 5 years of age was 6.1%, affecting about 41 million children in 2014. Almost half (48%) of all overweight and obese children under 5 years of age lived in Asia and a quarter (25%) in Africa (WHO, 2016). Table 1 shows the prevalence of obesity and overweight in some countries.

Table 1: Prevalence of obesity and overweight in selected countries from 2005 to 2021.

Country	Age group	Proportion (%)		Yeras	Authors
		Overweight	Obesity		
Spanish	3 a 24	34	10,3	2014-2015	Aranceta-Bartrina et al., 2020
France	≥ 18	29,5	12,2	2010	Gallus et al., 2015
United Kingdom	≥ 18	54,9		2014	Marques et al., 2018
Czech Republic		60,1			
Germany		54,9			
United States	≥ 20	30,3	42,8	2017–2018	Fryar, Carroll, Afful, 2021
	2 a 19	-	41,5	2015–2016	Skinner et al., 2018
Brazil	≥ 18	57,7	20,6	2013	Ferreira, Szwarcwald & Damacena, 2019
Australian	≥ 18	35,5	27,9	2014-2015	Huse et al., 2017
China	≥ 18	30,1	11,9	2012	Wang; Wang; Qu, 2016
	6 a 17	9,6	6,4		
German	≥ 18	35,24	21,29	2013	DiBonaventura et al., 2018
Italy	≥ 18	34,85	12,89		DiBonaventura et al., 2018
Portugal	25 a 74	39,1	28,6	2015	Gaio et la., 2018
Spain	6 a 11	39,9	37,6	2016	Bont et al., 2020
Mexico	≥ 18	38,31	24,42	(2017)	DiBonaventura et al., 2018
India	≥ 18		21,25*	2018	Ahirwar; Mondal, 2019
Turkey	≥ 18	-	21,9	2000	Yumuk, 2005
Senegal	≥ 20	19,2	9,7	2015	Macia; Gueye; Duboz, 2016
Nigeria	≥ 18	27,7*	15,15*	2012	Chukwuonye et al., 2013
Egypt	≥ 18	44,2	39,2	2014	Amugsi et al., 2017
Benin	≥ 18	24,6	10,4	2010	
Ghana	≥ 18	25,4	17,1	2016	Ofori-Asenso et al., 2016

* Average value from various cities. Source: Authors (2022).

Approximately 53% of the European population were overweight and obese in 2014 (Marques et al., 2018). In the Portuguese population, until 2005, the problem of overweight was 38.6% and obesity 13.8% in adults (Carmo et al., 2006). In 2015, the problem of the Body Mass Index (BMI) increased, indicating that overweight in men reached 45.5% and in women

33.2%. Obesity almost doubled from 2005 to 2015, with 32% in women and 25% in men (Gaio et al., 2018). The growth of this disease is everywhere, the forecast of the obesity rate in England by 2035 is 43% (Keaver et al., 2019). The problem is increasing in Turkey as well as in most European countries. In 1990, about 19% of the turquoise adult population was obese and in the year 2000 it increased to 21.9%, a considerably smaller increase compared to Portugal in the ten-year interval (Yumuk, 2005).

The United States is one of the countries in North America with the largest population with a body weight problem. In a survey carried out between 2007 and 2012 among adults aged 25 and over, it showed that 39.96% of men and 29.74% of women were overweight and 35.04% of men and 36.84% of women were obese. (Yang & Colditz, 2015). In the United States, between 2011 and 2014, the prevalence of obesity among children and adolescents aged 2 to 19 years was 17%, and was lower in the higher income group than in the low income group and also lower in the higher education group than in the other groups (Ogden et al., 2018). The obesity rate among children and adolescents in the United States between 2015 and 2016 was 18.5% class I obesity, 6% class II obesity, 1.9% class III obesity and 35.1% were overweight (Skinner et al., 2018).

The prevalence of obesity and overweight children and adolescents (3 to 19 years old) in Canada from 2004 to 2013 was 27% (Rodd & Sharma, 2016). Another study showed that obesity in children and adolescents aged 3 to 19 years, between 2004 and 2013, was more frequent in boys than in girls (Carroll et al., 2015). In Mexico it was no different, by 2050, it is expected that about 34% of the population will be overweight and 54% will be obese, with a decrease in individuals with normal weight from 32% to 12% among men and from 26% to 9% among women (Rtveladze et al., 2013).

In South America, the problem of overweight and obesity is also epidemic. In 2006, the prevalence of overweight among Brazilian adults was 47% for men and 39% for women, obesity was around 11% for both sexes (Gigante, Moura & Sardinha, 2009). The situation may even get worse because in a decade, the obesity rate in Brazil has increased from 7.5 to 17% among adults aged 20 to 39 years and from 14.7% to 25.7% among 40 to 59 years (Gomes et al., 2019).

From 1995 to 2012, Australia was one of the countries in Oceania with the greatest obesity problem. During this period, obesity increased from 19.1% to 27.2% (Keating et al., 2015). Now one in four Australians is considered obese (Buchmueller & Johar, 2015). The prevalence of obesity in Australia in adults is projected to increase from 19% in 1995 to 35% in 2025 (Hayes et al., 2017).

In Asia, the obesity and overweight epidemic is also alarming. In China from 2002 to 2012, obesity in adults went from 7.1% to 11.9% and childhood obesity went from 2.1% to 6.4%. Overall, the prevalence of obesity and overweight increased from 29.9% to 42% (Wang et al., 2016). India has more than 135 million people affected by obesity. Prevalence of obesity is higher among urban populations, states with high socioeconomic status, and in the south of the country (Ahirwar & Mondal, 2019). According to the research by Luhar et al. (2020) by 2040 the prevalence of obesity in adults will triple in India. The problem of overweight and obesity will reach 30.5% and 9.5% in men, and 27.4% and 13.9% among women, respectively. In Jeddah (Saudi Arabia) between 2011 and 2012, in men overweight exceeded 35.1% and obesity 34.8%, in women it was 30.1% overweight and 35.6% obesity (Al-Raddadi et al., 2019).

Africa did not stay on the sidelines of the obesity problem. In Senegal, among women, the prevalence of general obesity was six times higher than among men. This difference was attributed to the physical activities that men perform in their daily routine. In Senegal, as in several West African countries, physical activities are more reserved for men (Macia, Gueye & Duboz, 2016). In the study by Chukwuonye et al. (2013), in Nigeria women were more likely to be obese than men with an increasing trend of overall obesity. In Ghana, an increase in overweight and obesity has been reported, especially in urban areas in women (Ofori-Asenso et al., 2016). In much of Sub-Saharan Africa, the number of obese and overweight populations doubled between 1991 and 2014.

4. Conclusion

Although obesity had declined in some regions, the global prevalence increased considerably. As the epidemic of childhood and adolescent obesity generally emerges, the prevalence of adult obesity will continue to increase alarmingly if preventive measures are not taken. With the increasing adoption of Western eating habits around the world, consumption of ultra-processed foods and a sedentary lifestyle, it can be predicted that the health impact of excessive weight gain will continue to be amplified in the coming years. Obesity, in addition to the negative effects on the health of individuals, represents a cost to society in greater use of social services, weight loss treatments, limited workforce due to reduced mobility and reduced quality of life.

References

- Agha, M. & Agha, R. (2017). The rising prevalence of obesity: part A: impact on public health. *International journal of surgery. Oncology*, 2(7), e17. <https://dx.doi.org/10.1097%2FIIJ.0000000000000017>
- Aggarwal, B., & Jain, V. (2018). Obesity in children: definition, etiology and approach. *The Indian Journal of Pediatrics*, 85(6), 463-471. <https://doi.org/10.1007/s12098-017-2531-x>
- Ahirwar, R. & Mondal, P. R. (2019). Prevalence of obesity in India: A systematic review. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 13(1), 318-321. <https://doi.org/10.1016/j.dsx.2018.08.032>
- Al Mukhtadir, M. H., Islam, M. A., Amin, M. N., Ghosh, S., Siddiqui, S. A., Debnath, D., ... & Sultana, F. (2019). Nutrition transition–Pattern IV: Leads Bangladeshi youth to the increasing prevalence of overweight and obesity. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 13(3), 1943-1947. <https://doi.org/10.1016/j.dsx.2019.04.034>
- Al-Raddadi, R., Bahijri, S. M., Jambi, H. A., Ferns, G., & Tuomilehto, J. (2019). The prevalence of obesity and overweight, associated demographic and lifestyle factors, and health status in the adult population of Jeddah, Saudi Arabia. *Therapeutic advances in chronic disease*, (10), 2040622319878997. <https://doi.org/10.1177%2F2040622319878997>
- Amugsi, D. A., Dimbuene, Z. T., Mberu, B., Muthuri, S., & Ezech, A. C. (2017). Prevalence and time trends in overweight and obesity among urban women: an analysis of demographic and health surveys data from 24 African countries, 1991–2014. *BMJ open*, 7(10), e017344. <http://dx.doi.org/10.1136/bmjopen-2017-017344>
- Annamalai, Aniyizhai, Kosir, Urska, Tek, Cenk (2017). Prevalence of obesity and diabetes in patients with schizophrenia. *World journal of diabetes*, 8(8), 390. <https://dx.doi.org/10.4239%2Fwjcd.v8.i8.390>
- Antwi, F. A., Fazylova, N., Garcon, M. C., Lopez, L., Rubiano, R., & Slyer, J. T. (2013). Effectiveness of web-based programs on the reduction of childhood obesity in school-aged children: a systematic review. *JBI Evidence Synthesis*, 11(6), 1-44. doi: <https://doi.org/10.11124/jbisrir-2013-459>
- Aoe, S., Ichinose, Y., Kohyama, N., Komae, K., Takahashi, A., Abe, D., & Yanagisawa, T. (2017). Effects of high β -glucan barley on visceral fat obesity in Japanese individuals: a randomized, double-blind study. *Nutrition*, (42), 1-6. <https://doi.org/10.1016/j.nut.2017.05.002>
- Aranceta-Bartrina, J., Gianzo-Citores, M., & Pérez-Rodrigo, C. (2020). Prevalence of overweight, obesity and abdominal obesity in the Spanish population aged 3 to 24 years. The ENPE study. *Revista Española de Cardiología (English Edition)*, 73(4), 290-299. <https://doi.org/10.1016/j.rec.2019.07.023>
- Baillie-Hamilton, Paula F. (2002). Toxinas Químicas: Uma Hipótese para Explicar a Epidemia Global de Obesidade. *The Journal of Alternative and Complementary Medicine*, 8(2), 185–192. doi:10.1089/107555302317371479
- Barroso, M. L., Moura, A. M. W. A., & Pinto, N. V. (2020). Correlação entre obesidade geral e abdominal em mulheres ativas diabéticas e/ou hipertensas. *Research, Society and Development*, 9(7), e179973679-e179973679. <http://dx.doi.org/10.33448/rsd-v9i7.3679>
- Bin Zarah, A., Enriquez-Marulanda, J., & Andrade, J. M. (2020). Relationship between dietary habits, food attitudes and food security status among adults living within the United States three months post-mandated quarantine: a cross-sectional study. *Nutrients*, 12(11), 3468. <https://doi.org/10.3390/nu12113468>
- Bont, J., Díaz, Y., Casas, M., García-Gil, M., Vrijheid, M., & Duarte-Salles, T. (2020). Time trends and sociodemographic factors associated with overweight and obesity in children and adolescents in Spain. *JAMA network open*, 3(3), e201171-e201171. <https://doi.org/10.1001/jamanetworkopen.2020.1171>
- Biswas, T., Garnett, SP, Pervin, S., & Rawal, LB (2017). A prevalência de baixo peso, sobrepeso e obesidade em adultos de Bangladesh: dados de uma pesquisa nacional. *PLOS ONE*, 12(5), e0177395. doi:10.1371/journal.pone.0177395
- Black, R. E, Victora, C. G, Walker, S. P, Bhutta, Z. A, Cristão, P., de Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., Uauy, R. (2013). Desnutrição materna e infantil e excesso de peso em países de baixa e média renda. *The Lancet*, 382 (9890), 427-451. doi:10.1016/S0140-6736(13)60937-X
- Breda, J., Jewell, J., & Keller, A. (2019). The importance of the world health organization sugar guidelines for dental health and obesity prevention. *Caries research*, 53(2), 149-152. <https://doi.org/10.1159/000491556>
- Buchmueller, T. C. & Johar, M. (2015). Obesity and health expenditures: evidence from Australia. *Economics & Human Biology*, (17), 42-58. <https://doi.org/10.1016/j.ehb.2015.01.001>

- Buoncristiano, M., Williams, J., Simmonds, P., Nurk, E., Ahrens, W., Nardone, P., & Breda, J. (2021). Socioeconomic inequalities in overweight and obesity among 6-to 9-year-old children in 24 countries from the World Health Organization European region. *Obesity Reviews*, 22, e13213. <https://doi.org/10.1111/obr.13213>
- Carmo, I. D., Dos Santos, O., Camolas, J., Vieira, J., Carreira, M., Medina, L., & Galvão-Teles, A. (2006). Prevalence of obesity in Portugal. *Obesity reviews*, 7(3), 233-237. <https://doi.org/10.1111/j.1467-789X.2006.00243.x>
- Carroll, M. D., Navaneelan, T., Bryan, S., & Ogden, C. L. (2015). Prevalence of obesity among children and adolescents in the United States and Canada. <https://stacks.cdc.gov/view/cdc/33062> (access 25/12/2021).
- Cominato, L., Di Biagio, G. F., Lellis, D., Franco, R. R., Mancini, M. C., & de Melo, M. E. (2018). Obesity prevention: strategies and challenges in Latin America. *Current obesity reports*, 7 (2), 97-104. <https://doi.org/10.1007/s13679-018-0311-1>
- Chukwuonye, I. I., Chuku, A., John, C., Ohagwu, K. A., Imoh, M. E., Isa, S. E., & Oviasu, E. (2013). Prevalence of overweight and obesity in adult Nigerians—a systematic review. *Diabetes, metabolic syndrome and obesity: targets and therapy*, (6), 43. <https://dx.doi.org/10.2147%2FDMSO.S38626>
- D'errico, Margherita, Pavlova, Milena, Spandonaro, Federico. (2021). The economic burden of obesity in Italy: a cost-of-illness study. *The European Journal of Health Economics*, (),1-16. <https://doi.org/10.1007/s10198-021-01358-1>
- DiBonaventura, M., Nicolucci, A., Meincke, H., Le Lay, A., & Fournier, J. (2018). Obesity in Germany and Italy: prevalence, comorbidities, and associations with patient outcomes. *ClinicoEconomics and outcomes research: CEOR*, (10), 457. <https://dx.doi.org/10.2147%2FCEOR.S157673>
- DiBonaventura, M. D., Meincke, H., Le Lay, A., Fournier, J., Bakker, E., & Ehrenreich, A. (2018). Obesity in Mexico: prevalence, comorbidities, associations with patient outcomes, and treatment experiences. *Diabetes, metabolic syndrome and obesity: targets and therapy*, (11), 1. <https://dx.doi.org/10.2147%2FDMSO.S129247>
- Ferreira, A. P. de S., Szwarcwald, C. L., & Damacena, G. N. (2019). Prevalence of obesity and associated factors in the Brazilian population: a study of data from the 2013 National Health Survey. *Revista Brasileira de Epidemiologia*, (22). <https://doi.org/10.1590/1980-549720190024>
- Figueiredo, M. C. F. de., do Nascimento, J. M. F., Araújo, D. S., Silva, T. R., Barros, F. D. D., de Moura, F. V. P., ... & Pereira-Freire, J. A. (2020). O impacto do excesso de peso nas complicações clínicas causadas pela COVID-19: Uma revisão sistemática. *Research, Society and Development*, 9(7), e693974791-e693974791. <http://dx.doi.org/10.33448/rsd-v9i7.4791>
- FRYAR, C. D., CARROLL, M. D., & AFFUL, J. (2021). Prevalence of overweight, obesity, and severe obesity among adults aged 20 and over: United States, 1960–1962 through 2017–2018. *NCHS health e-stats*, (), 1-7. Available: <https://www.cdc.gov/nchs/data/hestat/obesity-adult-17-18/obesity-adult.htm> (access: 24/06/2022).
- Gangwisch, J. E., Malaspina, D., Boden-Albala, B., & Heymsfield, S. B. (2005). Inadequate sleep as a risk factor for obesity: analyses of the NHANES I. *Sleep*, 28(10), 1289-1296. <https://doi.org/10.1093/sleep/28.10.1289>
- Gaio, V., Antunes, L., Namorado, S., Barreto, M., Gil, A., Kyslaya, I., & INSEF Research group. (2018). Prevalence of overweight and obesity in Portugal: results from the first Portuguese Health Examination Survey (INSEF 2015). *Obesity research & clinical practice*, 12(1) 40-50. <https://doi.org/10.1016/j.orcp.2017.08.002>
- Gallus, S., Lugo, A., Murisic, B., Bosetti, C., Boffetta, P., & La Vecchia, C. (2015). Overweight and obesity in 16 European countries. *European journal of nutrition*, 54(5), 679-689. <https://doi.org/10.1007/s00394-014-0746-4>
- Gigante, D. P., Moura, E. C. de, Sardinha, L. M. V. (2009). Prevalence of overweight and obesity and associated factors, Brazil, 2006. *Revista de saude publica*, (43), 83-89. <https://doi.org/10.1590/S0034-89102009000900011>
- Gomes, D. C. K., Sichieri, R., Junior, E. V., Boccolini, C. S., de Moura Souza, A., & Cunha, D. B. (2019). Trends in obesity prevalence among Brazilian adults from 2002 to 2013 by educational level. *BMC Public Health*, 19(1), 1-7. <https://doi.org/10.1186/s12889-019-7289-9>
- Hayes, A. J., Lung, T. W. C., Bauman, A., & Howard, K. (2017). Modelling obesity trends in Australia: unravelling the past and predicting the future. *International journal of obesity*, 41(1), 178-185. <https://doi.org/10.1038/ijo.2016.165>
- Heneghan, H. M., Heinberg, L., Windover, A., Rogula, T., & Schauer, P. R. (2012). Weighing the evidence for an association between obesity and suicide risk. *Surgery for Obesity and Related Diseases*, 8(1), 98-107. <https://doi.org/10.1016/j.soard.2011.10.007>
- Hitt, H.C., McMillen, R.C., Thornton-Neaves, T., Koch, K., & Cosby, A.G. (2007). Comorbidade de obesidade e dor em uma população em geral: resultados do Southern Pain Prevalence Study. *The Journal of Pain*, 8(5), 430-436. <https://doi.org/10.1016/j.jpain.2006.12.003>
- Huse, O., Hettiarachchi, J., Gearon, E., Nichols, M., Allender, S., & Peeters, A. (2018). Obesity in Australia. *Obesity research & clinical practice*, 12(1), 29-39. <https://doi.org/10.1016/j.orcp.2017.10.002>
- Jacob, L., Haro, J. M., Smith, L., & Koyanagi, A. (2020). Association between intelligence quotient and obesity in England. *Lifestyle Medicine*, 1(2), e11. <https://doi.org/10.1002/lim2.11>
- JAMES, W. P. T. (2008). OMS reconhecimento da epidemia global de obesidade. *Jornal internacional da obesidade*, 32(7), S120-S126. <https://doi.org/10.1038/ijo.2008.247>
- Kasai, C., Sugimoto, K., Moritani, I., Tanaka, J., Oya, Y., Inoue, H., ... & Takase, K. (2015). Comparison of the gut microbiota composition between obese and non-obese individuals in a Japanese population, as analyzed by terminal restriction fragment length polymorphism and next-generation sequencing. *BMC gastroenterology*, 15(1), 1-10. <https://doi.org/10.1186/s12876-015-0330-2>

- Keating, C., Backholer, K., Gearon, E., Stevenson, C., Swinburn, B., Moodie, M., ... & Peeters, A. (2015). Prevalência de obesidade classe I, classe II e classe III em adultos australianos entre 1995 e 2011-12. *Pesquisa e prática clínica sobre obesidade*, 9(6), 553-562. <https://doi.org/10.1016/j.orcp.2015.02.004>
- Keaver, L., Pérez-Ferrer, C., Jaccard, A., & Webber, L. (2020). Future trends in social inequalities in obesity in England, Wales and Scotland. *Journal of Public Health*, 42(1), e51-e57. <https://doi.org/10.1093/pubmed/fdz022>
- Klinitzke, G., Steinig, J., Blüher, M., Kersting, A., & Wagner, B. (2013). Obesity and suicide risk in adults—a systematic review. *Journal of affective disorders*, 145 (3), 277-284. <https://doi.org/10.1016/j.jad.2012.07.010>
- Kolahi, A. A., Moghisi, A., & Ekhtiari, Y. S. (2018). Socio-demographic determinants of obesity indexes in Iran: findings from a nationwide STEPS survey. *Health promotion perspectives*, 8(3), 187.
- Li, Y. J., Xie, X. N., Lei, X., Li, Y. M., & Lei, X. (2020). Global prevalence of obesity, overweight and underweight in children, adolescents and adults with autism spectrum disorder, attention-deficit hyperactivity disorder: A systematic review and meta-analysis. *Obesity Reviews*, 21(12), e13123. <https://doi.org/10.1111/obr.13123>
- Lombardo, F. L., Spinelli, A., Lazzeri, G., Lamberti, A., Mazzarella, G., Nardone, P., & Caroli, M. (2015). Severe obesity prevalence in 8-to 9-year-old Italian children: a large population-based study. *European Journal of Clinical Nutrition*, 69(5) 603-608. <https://doi.org/10.1038/ejcn.2014.188>
- Luhar, S., Timæus, I. M., Jones, R., Cunningham, S., Patel, S. A., Kinra, S., & Houben, R. (2020). Forecasting the prevalence of overweight and obesity in India to 2040. *PLoS one*, 15(2), e0229438. <https://doi.org/10.1371/journal.pone.0229438>
- Macia, E., Gueye, L., Duboz, P. (2016). Hypertension and obesity in Dakar, Senegal. *PLoS One*, 11(9), e0161544. <https://doi.org/10.1371/journal.pone.0161544>
- Marques, A., Peralta, M., Naia, A., Loureiro, N., & de Matos, M.G. (2018). Prevalence of adult overweight and obesity in 20 European countries, 2014. *The European Journal of Public Health*, 28(2), 295-300. <https://doi.org/10.1093/eurpub/ckx143>
- Mastrocola, M. R., Roque, S. S., Benning, L. V., & Stanford, F. C. (2020). Obesity education in medical schools, residencies, and fellowships throughout the world: a systematic review. *International Journal of Obesity*, 44(2), 269-279. <https://doi.org/10.1038/s41366-019-0453-6>
- Min, J., Chiu, D. T., Wang, Y. (2013). Variation in the heritability of body mass index based on diverse twin studies: a systematic review. *Obesity Reviews*, 14(11), 871–882. 1206. <https://doi.org/10.1111/obr.12065>
- Ofori-Asenso, R., Agyeman, A. A., Laar, A., & Boateng, D. (2016). Overweight and obesity epidemic in Ghana—a systematic review and meta-analysis. *BMC public health*, 16(1), 1-18. <https://doi.org/10.1186/s12889-016-3901-4>
- Ogden, C. L., Carroll, M. D., Fakhouri, T. H., Hales, C. M., Fryar, C. D., LI, X., & Freedman, D. S. (2018) Prevalence of obesity among youths by household income and education level of head of household—United States 2011–2014. *Morbidity and mortality weekly report*, 67(6), 186. <https://doi.org/10.15585%2Fmmwr.mm6706a3>
- Pan, L., Blanck, H. M., Park, S., Galuska, D. A., Freedman, D. S., Potter, A., & Petersen, R. (2019). State-specific prevalence of obesity among children aged 2–4 years enrolled in the special supplemental nutrition program for women, infants, and children—United States, 2010–2016. *Morbidity and Mortality Weekly Report*, 68(46), 1057. <https://dx.doi.org/10.15585%2Fmmwr.mm6846a3>
- Passos, C. M., Maia, E. G., Levy, R. B., Martins, A. P. B., & Claro, R. M. (2020). Association between the price of ultra-processed foods and obesity in Brazil. *Nutrition, Metabolism and Cardiovascular Diseases*, 30(4), 589-598. <https://doi.org/10.1016/j.numecd.2019.12.011>
- Rauber, F., Steele, E. M., Louzada, M. L. D. C., Millett, C., Monteiro, C. A., & Levy, R. B. (2020). Ultra-processed food consumption and indicators of obesity in the United Kingdom population (2008-2016). *PLoS One*, 15(5), e0232676. <https://doi.org/10.1371/journal.pone.0232676>
- Resta, O. M. P. Foschino Barbaro, P. Bonfitto, T. Giliberti, A. Depalo, N. Pannacciulli, G. De Pergola (2003). Low sleep quality and daytime sleepiness in obese patients without obstructive sleep apnoea syndrome. , 253(5), 536–543. doi:10.1046/j.1365-2796.2003.01133.x
- Rodd, C. & Sharma, A. K. (2016). *Recent trends in the prevalence of overweight and obesity among Canadian children*. *CMAJ*, 188(13), E313-E320. <https://doi.org/10.1503/cmaj.150854>
- Rosenthal, R. J., Morton, J., Brethauer, S., Mattar, S., De Maria, E., Benz, J. K., & Sterrett, D. (2017). Obesity in America. *Surgery for Obesity and Related Diseases*, 13(10), 1643-1650. <https://doi.org/10.1016/j.soard.2017.08.002>
- Rtveladze, K., Marsh, T., Barquera, S., Romero, L. M. S., Levy, D., Melendez, G., & Brown, M. (2013). Obesity prevalence in Mexico: impact on health and economic burden. *Public health nutrition*, 17(1), 233-239. <https://doi.org/10.1017/S1368980013000086>
- Sakaguchi, M., Oka, H., Hashimoto, T., Asakuma, Y., Takao, M., Gon, G., & Ashida, K. (2008). Obesity as a risk factor for GERD in Japan. *Journal of gastroenterology*, 43(1), 57-62. <https://doi.org/10.1007/s00535-007-2128-7>
- Skinner, A. C., Ravanbakht, S. N., Skelton, J. A., Perrin, E. M., & Armstrong, S. C. (2018). Prevalence of obesity and severe obesity in US children, 1999–2016. *Pediatrics*, 141(3). <https://doi.org/10.1542/peds.2017-3459>
- Sogari, G., Velez-Argumedo, C., Gómez, M. I., & Mora, C. (2018). College students and eating habits: A study using an ecological model for healthy behavior. *Nutrients*, 10(12), 1823. <https://doi.org/10.3390/nu10121823>
- Smith, B. R., Schauer, P., Nguyen, N. T. (2011). Surgical approaches to the treatment of obesity: bariatric surgery. *Medical Clinics of North America*, 95(5), 1009-1030. <https://doi.org/10.1016/j.mcna.2011.06.010>
- Wang, Youfa, Wang, L., & Qu, W. (2017). New national data show alarming increase in obesity and noncommunicable chronic diseases in China. *European journal of clinical nutrition*, 71(1), 149-150. <https://doi.org/10.1038/ejcn.2016.171>

Westphal, G., Soares, G. S., de Souza Vespasiano, B., Christinelli, H. C. B., Pereira, I. A. S., Castilho, M. M., & Junior, N. N. (2021). Taxa metabólica basal de adolescentes com sobrepeso ou obesidade. *Research, Society and Development*, 10(1), e35010111964-e35010111964. <http://dx.doi.org/10.33448/rsd-v10i1.11964>

World Health Organization (WHO) (2021). Obesity and overweight. Available: <<https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>> (access 30/12/2021).

World Health Organization (WHO) (2016). Commission presents its final report, calling for high-level action to address major health challenge. Available: <<https://www.who.int/news/item/26-01-2016-commission-presents-its-final-report-calling-for-high-level-action-to-address-major-health-challenge>> (access 30/12/2021).

Xanthakos, Stavra A. & Inge, Thomas H. (2006). Nutritional consequences of bariatric surgery. *Current Opinion in Clinical Nutrition & Metabolic Care*, 9(4), 489-496. <https://doi.org/10.1097/01.mco.0000232913.07355.cf>

Yang, L. & Colditz, G. A. (2015). Prevalence of overweight and obesity in the United States, 2007-2012. *JAMA internal medicine*, 175(8), 1412-1413. doi: 10.1001 / jamainternmed.2015.2405.

Yu, C. K. H., Teoh, T. G., & Robinson, S. (2006). Obesity in pregnancy. *BJOG: An International Journal of Obstetrics & Gynaecology*, 113(10), 1117-1125. <https://doi.org/10.1111/j.1471-0528.2006.00991.x>

Yumuk, V. D. (2005). Prevalence of obesity in Turkey. *Obesity reviews*, 6(1), 9-10. <https://doi.org/10.1111/j.1467-789X.2005.00172.x>