



The Importance of Poultry Meat in Medicine: A Review

Sufian Abdo Jilo^{1*}  and Lenco Abdulhak Hasan² 

¹Jimma University College of Agriculture and Veterinary Medicine, School of Veterinary Medicine, Jimma, Ethiopia

²Wako Gutu Foundation, Robe, Ethiopia

*Corresponding author's Email: sufianabdojilo@gmail.com

Received: 06 October 2022

Accepted: 02 December 2022

ABSTRACT

The animal products, such as meat, milk, skin, blood, honey, and urine, have medicinal value for human diseases. Due to having high-quality components, poultry meat has therapeutic value. The present review aimed to describe the medicinal values of poultry meat for individuals who consume it during their life. Most poultry meat is classified as white meat, which contains lower fat and higher protein, compared with the meat of ovine, bovine, and pig. This feature of poultry meat (lower fat and higher protein) helps its consumers to have a normal physiological function of different organ systems. Moreover, it prevents many non-infectious diseases, including overweight, diabetes, and cardiovascular diseases. Selenium and low contents of carcinogenic substances (myoglobin, heme iron, and saturated fat) in poultry meat also prevent different types of cancers. Poultry meat is also recommended to avoid anemia, cardiovascular diseases, and diabetes. Dietary proteins, vitamins, and minerals in chicken meat are used for anti-aging, developing muscle and bone, improving the immune system, and increasing brain function. Traditionally, poultry is recommended as a supportive treatment for respiratory diseases, such as the common cold. Thus, consumption of poultry meat, especially chickens, up to 300g/once a week is recommended to prevent and reduce the risks of gastrointestinal cancers such as oesophageal cancer. Generally, regular consumption of poultry meat has health benefits for humans to prevent and reduce the risk of different diseases as chicken meat is a rich source of nutrition that can enhance the immunity system and tackle human disease risk factors.

Keywords: Consumption, Health benefits, Meat, Poultry

INTRODUCTION

Human being reared different types of bird species, including chicken, ostrich, guinea fowl, duck, and turkey, to gain meat sources (Abafogi et al., 2022). Most poultry meats are categorized as white meat, while the meat of other domesticated animals is classified as red meat. Chicken meat contains the most valuable proteins and amino acids for human health. Several scientific studies conducted in different parts of the world on different food consumption habits with varying taboos of food indicated the relationship between human nutrition and human health (EFSA, 2017; Ambaw et al., 2021). Many investigations support the correlation between the consumption of chicken meat and the prevention of cardiovascular diseases and their risk factors, such as obesity, diabetes mellitus, and cancers (EUP, 2019; Aditya, 2020). The meats of poultry are essential sources

of beneficent diet for human health. The high contents of protein, vitamins, minerals, and low contents of lipid have made chicken meats beneficial for people of all ages (Franca et al., 2015). Chicken meat contains all necessary amino acids, including cartilage proteins and tissue-building materials. The large amount of minerals in chicken meat supports the blood, cardiovascular, and nervous systems (EUP, 2019). The low cholesterol and fat content make chicken meat real salvation for those suffering from problems with blood vessels (Gordana et al., 2018). This review aimed to explain the beneficial effects of poultry meat on human health.

Obesity

Recent studies have observed the importance of chicken meat consumption for controlling and preventing obesity (Astrup et al., 2014). Generally, consuming dietary protein obtained from poultry meat effectively reduces

obesity because poultry meat has high protein and low-fat content (Marangoni et al., 2015; Metin and Orkide, 2017). The report mentioned that the risk of obesity was lower in individuals who consumed food containing low carbohydrates and was rich in protein compared with other types of food with a high amount of carbohydrates and low amount of protein content (Stoica et al., 2020). The reason is that protein with high satiety leads to minimizing the consumption of sugar, glucose, and different sweet foods, so humans eat a low amount of calories per day (Astrup et al., 2014).

Poultry meat consumption within 5-6 months results in weight loss due to low contents of carbohydrates and high amounts of proteins (Paoli, 2014). This mechanism could result in increased satiety, followed by fewer calorie consumptions during subsequent meals and decreased carbohydrate consumption within dietary regimens containing higher proportions of proteins (Astrup et al., 2014). It was also claimed that these mechanisms could be a synergistic effect. In addition to their satiety-producing effect and prevention of carbohydrate consumption, proteins are also responsible for higher thermogenesis through increasing protein synthesis and adenosine triphosphate utilization related to peptide bond formation as well as urea formation and glucose synthesis from other types of nutrients (Westerterp et al., 2009). The intake of protein in substitution of the same amount of carbohydrates decreases the overall glycemic diet, which results in the control of overweight (Promintzer and Krebs, 2006).

Cardiovascular diseases

Protein consumption greatly impacts well-being and normality of the cardiovascular system (Hu, 2005). Poultry meat is a proper diet for reducing the risk of developing diseases related to the blood circulation system, including heart and blood vessel diseases. The collagen produced from poultry is used to control hypertension (High blood pressure, Marangoni et al., 2015; López et al., 2019). Saturated fat and cholesterol are the main risk factors causing atherosclerosis, cardiovascular diseases, hypertension, and increased blood cholesterol (Abete et al., 2014). Due to low contents of saturated fat and cholesterol, the risk of occurrence of those diseases would be decreased by 19% when poultry meat is replaced as a meal with other meat (Bernstein et al., 2010). Previous studies in America on women indicated a negative association between the consumption of chicken meat and the risk of cardiovascular diseases (Hu et al., 1999). The research carried out more than two decades ago indicated a

positive correlation between the frequent consumption of chicken meat and the health condition of individuals (Feskens et al., 2013). The reason could be the minimized Na^+ (Sodium), Fe (heme iron), and more polyunsaturated fats in meals. Therefore, poultry meat is a great solution and an effective strategy for reducing cardiovascular disease (Hu, 2005). Due to the high content of Niacin, poultry meat helps the body generates energy and produces red blood cells (Adebowale, 2019). Niacin is taken as therapy in individuals with a history of hyperlipidemia (Keene et al., 2014; Garg et al., 2017). Niacin is an effective medication for cardiovascular diseases, reducing the risk of sudden death due to heart and blood vessel diseases (Duggal et al., 2010). Thus, poultry meat consumption is an important cause in reducing the risks of heart attack, hypertension, and other cardiovascular diseases (Adebowale, 2019).

Diabetes

Recently, it has been found that food consumption style is the foremost important factor for developing or preventing metabolic diseases, such as diabetes (Sami et al., 2017, Martín-Peláez et al., 2020; Guo et al., 2020). Subsequent food consumption increases or decreases the risk factors of diabetes in humans. The consumption of saturated fat originating from animal fat is among the most crucial risk factors for type 2 diabetes (Feskens et al., 2013). The positive association between the consumption of lipids and insulin resistance and, therefore, frequent consumption of red meat are the main risk factors for type 2 diabetes (Pan et al., 2011).

Even though the frequent consumption of animal-origin protein represents a risk of diabetes, the intake of poultry as a way of balanced food is advisable for reducing the development of metabolic disease in society (Esposito et al., 2010). A healthy lifestyle, which includes consuming poultry meat and plant-originated food, is related to minimizing the risk of death in individuals with diabetes (Sluik et al., 2014). These findings support the adjustment of lifestyle and food intake habits, within which poultry with low content of saturated fat provides a healthier alternative to animal protein ingestion in daily food, so it is suggested as an indication of a healthy diet (Enkhmaa, 2018).

Previous studies have revealed the effect of lifestyle interventions on the decreased possibility of type 2 diabetes by reducing numerous risk factors, including too much ingestion of fat, especially saturated fat (Pan et al., 2011, Lee et al., 2013; Rice Bradley, 2018). It was indicated that for individuals who consumed a high

amount of animal proteins, the incidence of diabetes was higher (Van Nielen et al., 2014). However, studies on the ingestion of chicken meat have proved the insignificant association between the frequent ingestion of poultry meat and diabetes (Feskens et al., 2013). Frequent and enormous ingestion of poultry meat could effectively prevent diabetes type 2 (Esposito et al., 2010). The finding from the European prospective investigation into cancer and nutrition (EPIC) research indicated that following a healthier lifestyle and ingesting chicken meat with other plant-originated food is associated with a reduction in the death rate in diabetic patients (Bingham and Riboli, 2004). Thus, it is confirmed that diabetic patients can achieve significant profits from an overall lifestyle modification, including chicken meat ingestion (Sluik et al., 2014).

Cancer

Different types of cancer which occur in the gastrointestinal organ are highly related to the ingestion of red meat (Gordana et al., 2018). Myoglobin found in red meat could generate precancerous tumors through the catalytic impact of heme iron on the creation of carcinogenic N-nitroso compounds and the formation of cytotoxic and genotoxic aldehydes through lipid peroxidation (Turesky 2007 and Bastide et al., 2011). These potentially harmful contents of red meat (myoglobin, saturated fat, heme iron, sodium, N-nitroso compounds, and aromatic amines) formed by high-temperature cooking, as a result of red meat is the main factor for the occurrence of cancers (Gordana et al., 2018). Thus, it confirmed that excessive intake of red meat is a significant risk factor for the incidence of cancer in different parts of the body. The amount of harmful substance in red meat which causes cancer is higher than in white meat. Thus, poultry meat has a low amount of myoglobin, compared to other types of meat. Thus, frequent intake of red meat increases the chance of occurrence of cancers, while consumption of poultry meat indicates a negative association with the development of cancer in different parts of the human body, which includes hepatocellular carcinoma, ovarian tumor, lung cancer, oesophageal cancer (Salehi et al., 2013). There is a negative association between the frequent ingestion of chicken meat and the risk of developing oesophageal cancer. In addition, the occurrence of esophageal cancer is reduced by about 53% in Europe through frequent consumption of 300 g/week of poultry meat (Zhu et al., 2014). The study carried out by the Mario Negri Institute of Milan in the late 1990s in three regions of Northern Italy (Milan, Padua, and Pordenone) showed that poultry

meat ingestion was associated with reducing the risk of occurrences of oesophageal cancers (Bosetti et al., 2000).

Another research revealed that the development of breast cancer in women was inversely associated with their history of chicken meat consumption (Bingham and Riboli, 2004). The investigation about the effects of different food sources on the development of cancer indicated that replacing an equal amount of daily consumption of red meat with poultry meat could reduce the risk of breast cancer by 17-24% in women and reduce the risk of lung cancer by 10% (Farvid et al., 2014).

Body function

Poultry meat is enriched by different essential mineral, which includes Ca^+ (calcium), Mg^+ (magnesium), P^- (phosphorus), and Na^+ (sodium) when compared with other red meat (Marangoni et al., 2015). An almost similar amount of iron (0.97-1.04 mg/100g) is found in pork and poultry meat. Iron is needed to form hemoglobin, used as remedies for anemia and regular muscle activity. Calcium and phosphorus are essential for normal bone activity and formation. The phosphorus in chicken meat needs to maintain the normal skeleton system, central nervous system function, teeth care, and metabolic function. Sodium is an electrolyte, and magnesium is input for the normal formation of protein and muscle functions. While selenium is found in high amounts in chickens (8.6 μg to 41 μg /100g), frequent consumption of chicken meat (55 μg per day) could increase metabolism rates, particularly the thyroid hormones, antioxidant defense system, and immune system of the body (Surai et al., 2018).

Of all types of vitamins in poultry meat, vitamin B3 (Niacin) is found in the highest amount, and the amount of vitamins A and B6 is also higher in poultry meat than in other animals. Niacin is essential for the normal metabolism of carbohydrates and energy generation. Its function is to prevent problems such as cataracts, various skin diseases, and the nervous system. Niacin is responsible for the synthesis of nutrients of sex hormones and gets a better circulation system, and reduces blood cholesterol (Garg et al., 2017). The persistent shortage of Niacin in humans and animals causes pelagic disease, which is identified by abnormal skin pigmentation (skin redness), gastrointestinal disorder, and abnormality of brain function or dementia (Hegyi et al., 2004). Therefore, chicken meat can be used to conveniently access primary sources of nutrients, vitamins, and minerals necessary for normal metabolic system activities.

Poultry meat is appropriate for quick and easy preparation; however, it recommends a variety of

combinations with diverse foodstuffs, thus, poultry meat can provide a frequent option for the meat consumers of this century's livelihood. According to López et al. (2019), poultry meat (leg part) is enriched with proteins called collagen, and hyaluronic acid, which have excellent biological functions, such as enhancement of cell proliferation, water-holding capacity, moisture absorption, retention, and are used as anti-aging in the skin. Compared with red meat, the major benefits of white chicken meat are lower caloric value and low amounts of saturated fat (Bernstein et al., 2010). Therefore, ingestion of white chicken meat is advisable for individuals who need to consume low-fat and to treat patients with cardiovascular problems (Metin and Orkide, 2017; Bingham and Riboli, 2004). Chicken meat contains the amino acid tryptophan, which affects brain cells, causing additional production of serotonin hormone, which helps to improve mood, relieve stress, and soothe (Marangoni et al., 2015).

CONCLUSION

Consumption of poultry meat as part of a plant-originated food is associated with a risk reduction of overweight and obesity, cardiovascular diseases, and type 2 diabetes mellitus. Additionally, white meat (poultry in particular) is considered moderately protective or neutral on cancer risk (gastrointestinal cancer, breast cancer). The importance of poultry meat for humans also has been recognized by different international institutions and societies, which consider this widely available, relatively cheap food to be specifically important in low-income countries, where it can help to meet the deficiency in important nutrients.

DECLARATIONS

Acknowledgments

This article did not support by any source of funds.

Author's contribution

Sufian Abdo Jilo and Lenco Abdulhak Hasan have participated in the manuscript writing and edition of the paper. All authors read and approved the final version of the manuscript for publishing in the present journal.

Competing interests

The authors have declared that no competing interest exists.

Ethical consideration

Ethical issues (including plagiarism, consent to publish, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy) have been checked by all the authors.

REFERENCES

- Abafogi Abadula T, Abdo Jilo S, Aliye Hussein J, and Zakir Abadura S (2022). Poultry production status, major constraints, and future prospective. *Journal of World's Poultry Science*, 1(1): 22-28. Available at: https://jwps.rovedar.com/article_152978_f0ca521a68bc1baaf3d15f34e01feb8e.pdf
- Abete I, Romaguera D, Vieira AR, Lopez de Munain A, and Norat T (2014). Association between total, processed, red and white meat consumption and all-cause, CVD and IHD mortality: A meta-analysis of cohort studies. *British Journal of Nutrition*, 112(5): 762-775. DOI: <https://www.doi.org/10.1017/S000711451400124X>
- Adebowale T, Oso A, Liu H, Tossou M, Chen J, Li H, Kang B, and Yao K (2019). Effect of dietary niacin supplementation on growth performance, nutrient digestibility, hematology, and lipoprotein concentrations of young turkeys, *Meleagris gallopavo*. *The Journal of Poultry Science*, 56(2): 112-119. DOI: <https://www.doi.org/10.2141/jpsa.0170212>
- Aditya V (2020). The health benefits of eating chicken. Available at: <https://www.thehansindia.com/life-style/health/the-health-benefits-of-eating-chicken-642909?infinite-scroll=1>
- Ambaw MB, Shitaye G, Taddele M, and Aderaw Z (2021). Level of food consumption score and associated factors among pregnant women at shegawmotta hospital, Northwest Ethiopia. *BMC Public Health*, 21(1): 311. DOI: <https://www.doi.org/10.1186/s12889-021-10366-y>
- Astrup A, Raben A, and Geiker N (2014). The role of higher protein diets in weight control and obesity-related comorbidities. *International Journal of Obesity*, 39(5): 721-726. DOI: <https://www.doi.org/10.1038/ijo.2014.216>
- Bastide NM, Pierre FHF, and Corpet DE (2011). Heme iron from meat and risk of colorectal cancer: A meta-analysis and a review of the mechanisms involved. *Cancer Prevention Research*, 4(2): 177-184. DOI: <https://www.doi.org/10.1158/1940-6207.CAPR-10-0113>
- Bernstein AM, Sun Q, FB H, Stampfer MJ, Manson JE, and Willett WC (2010). Major dietary protein sources and risk of coronary heart disease in women. *Circulation*, 122(9): 876-883. DOI: <https://www.doi.org/10.1161/CIRCULATIONAHA.109.915165>
- Bingham S and Riboli E (2004). Diet and cancer—the European prospective investigation into cancer and nutrition. *Nature Reviews Cancer*, 4: 206-215. DOI: <https://www.doi.org/10.1038/nrc1298>
- Bosetti C, La Vecchia C, Talamini R, Simonato L, Zambon P, Negri E, Trichopoulos D, Lagiou P, Bordini R, and Franceschi S (2000). Food groups and risk of squamous cell esophageal cancer in northern Italy. *International Journal of Cancer*, 87(2): 289-294. DOI: [https://www.doi.org/10.1002/1097-0215\(200007\)1587:2<289::AID-IJC22>3.0.CO;2-9](https://www.doi.org/10.1002/1097-0215(200007)1587:2<289::AID-IJC22>3.0.CO;2-9)
- Donma MM and Donma O (2017). Beneficial effects of poultry meat consumption on cardiovascular health and the prevention of childhood obesity. *Med One*. 2: e170018. DOI: <https://www.doi.org/10.20900/mo.20170018>
- Duggal JK, Singh M, Attri N, Singh PP, Ahmed N, Pahwa S, Molnar J, Singh S, Khosla S, and Arora R (2010). Effect of niacin therapy on cardiovascular outcomes in patients with coronary artery disease. *Journal of Cardiovascular Pharmacology and Therapeutics*, 15(2): 158-166. DOI: <https://www.doi.org/10.1177/1074248410361337>
- Enkhmaa B, Surampudi P, Anuurad E, Berglund L, Feingold KR, Anawalt B, Boyce A, Chrousos G, de Herder WW, Dhatariya K, et al. (2018). Lifestyle changes: Effect of diet, exercise, functional food, and obesity treatment on lipids and lipoproteins. In: *Endotext [Internet]*. South Dartmouth (MA). MDText Inc., 2000. Available at: <https://pubmed.ncbi.nlm.nih.gov/26561697/>
- European food safety authority dietary (EFSA) (2017). Dietary reference values for nutrients, summary report. 2017: e15121. Available at: https://www.efsa.europa.eu/sites/default/files/2017_09_DRVs_summary_report.pdf

- Espósito K, Kastorini CM, Panagiotakos DB, and Giugliano D (2010). Prevention of type 2 diabetes by dietary patterns: A systematic review of prospective studies and meta-analysis. *Metabolic Syndrome and Related Disorders*, 8(6): 471-476. DOI: <https://www.doi.org/10.1089/met.2010.0009>
- European union poultry (EUP) (2019). Five chicken health benefits nutrition facts. Available at: <https://poultryeu.eu/5-chicken-health-benefits-nutrition-facts>
- Farvid MS, Cho E, Chen WY, Eliassen AH, and Willett WC (2014). Dietary protein sources in early adulthood and breast cancer incidence: Prospective cohort study. *British Medical Journal*, 348: g3437. Available at: <https://www.bmj.com/content/bmj/348/bmj.g3437.full.pdf>
- Feskens EJ, Sluik D, and Woudenbergh GJ (2013). Meat consumption, diabetes, and its complications. *Current Diabetes Reports*, 13(2): 298-306. DOI: <https://www.doi.org/10.1007/s11892-013-0365-0>
- Franca M, Giovanni C, Claudio C, Nicola F, Andrea G, Lucio L, and Poli A (2015). Role of poultry meat in a balanced diet aimed at maintaining health and wellbeing: An Italian consensus document. *Food & Nutrition Research*, 59: 27606. DOI: <https://www.doi.org/10.3402/fnr.v59.27606>
- Garg A, Sharma A, Krishnamoorthy P, Garg J, Virmani D, Sharma T, Stefanini G, Kostis JB, Mukherjee D, and Sikorskaya E (2017). Role of Niacin in current clinical practice: A systematic review. *The American Journal of Medicine*, 130(2): 173-187. DOI: <https://www.doi.org/10.1016/j.amjmed.2016.07.038>
- Gordana K, Zlata K, Manuela G, and Danica H (2018). Quality of chicken meat. In: B. Yücel and T. Taşkin (Editors). *Animal husbandry and nutrition*, chapter 4. Intech Open, University of Osijek, Osijek, Croatia. pp. 64-94. DOI: <https://www.doi.org/10.5772/intechopen.72865>
- Guo Y, Huang Z, Sang D, Gao Q, and Li Q (2020). The role of nutrition in the prevention and intervention of type 2 diabetes. *Frontiers in Bioengineering and Biotechnology*, 8: 575442. DOI: <https://www.doi.org/10.3389/fbioe.2020.575442>
- Hegyí J, Schwartz RA, and Hegyi V (2004). Pellagra: Dermatitis, dementia, and diarrhoea. *International Journal of Dermatology*, 43(1): 1-5. DOI: <https://www.doi.org/10.1111/j.1365-4632.2004.01959.x>
- Hu FB (2005). Protein, body weight, and cardiovascular health. *The American Journal of Clinical Nutrition*, 82(1): 242S-247S. DOI: <https://www.doi.org/10.1093/ajcn/82.1.242s>
- Hu FB, Stampfer MJ, Manson JE, Ascherio A, Colditz GA, Speizer FE, Hennekens CH, and Willett WC (1999). Dietary saturated fats and their food sources in relation to the risk of coronary heart disease in women. *The American Journal of Clinical Nutrition*, 70(6): 1001-1008. DOI: <https://www.doi.org/10.1093/ajcn/70.6.1001>
- Keene D, Price C, Shun-Shin MJ, and Francis DP (2014). Effect on cardiovascular risk of high-density lipoprotein targeted drug treatments niacin, fibrates, and CETP inhibitors: Meta-analysis of randomised controlled trials including 117 411 patients. *British Medical Journal*, 349: g4379. DOI: <https://www.doi.org/10.1136/bmj.g4379>
- Lee JE, McLerran DF, Rolland B, Chen Y, Grant EJ, Vedanthan R, Inoue M, Tsugane SH, Gao Y, Tsuji I, et al (2013). Meat intake and cause-specific mortality: Apooled analysis of Asian prospective cohort studies. *The American Journal of Clinical Nutrition*, 98(4): 1032-1041. DOI: <https://www.doi.org/10.3945/ajcn.113.062638>
- López AL, Peñaloza AM, Juárez VMM, Torres AV, Zeugolis DI, and Álvarez GA (2019). Hydrolyzed collagen—sources and applications. *Molecules*, 24(22): 4031. DOI: <https://www.doi.org/10.3390/molecules24224031>
- Marangoni F, Corsello G, Cricelli C, Ferrara N, Ghiselli A, Lucchin L, and Poli A (2015). Role of poultry meat in a balanced diet aimed at maintaining health and wellbeing: An Italian consensus document. *Food & Nutrition Research*, 59(1): 27606. DOI: <https://www.doi.org/10.3402/fnr.v59.27606>
- Martín-Peláez S, Fito M, and Castaner O (2020). Mediterranean diet effects on type 2 diabetes prevention, disease progression, and related mechanisms. A Review. *Nutrients*, 12(8): 2236. DOI: <https://www.doi.org/10.3390/nu12082236>
- Pan A, Sun Q, Bernstein AM, Schulze MB, Manson JE, Willett WC, and Hu FB (2012). Red meat consumption and risk of type 2 diabetes: 3 cohorts of US adults and an updated meta-analysis. *The American Journal of Clinical Nutrition*, 94(4): 1088-1096. DOI: <https://doi.org/10.3945/ajcn.111.018978>
- Paoli A (2014). Ketogenic diet for obesity: Friend or foe? *International Journal of Environmental Research of Public Health*, 11(2): 2092-2107. DOI: <https://www.doi.org/10.3390/ijerph110202092>
- Promintzer M and Krebs M (2006). Effects of dietary protein on glucose homeostasis. *Current Opinion Clinical Nutrition and Metabolic Care*, 9(4): 463-468. DOI: <https://www.doi.org/10.1097/01.mco.0000232909.84483.a9>
- Rice Bradley BH (2018). Dietary fat and risk for type 2 diabetes: A review of recent research. *Current Nutrition Report*, 7(4): 214-226. DOI: <https://www.doi.org/10.1007/s13668-018-0244-z>
- Salehi M, Moradi-Lakeh M, Salehi MH, Nojomi M, and Kolahdooz F (2013). Meat, fish, and esophageal cancer risk: A systematic review and dose-response meta-analysis. *Nutrition Reviews*, 71(5): 257-267. DOI: <https://www.doi.org/10.1111/nure.12028>
- Sami W, Ansari T, Butt NS, and Hamid MRA (2017). Effect of diet on type 2 diabetes mellitus: A review. *International Journal of Health Science*, 11(2): 65-71. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5426415/>
- Sluik D, Boeing H, Li K, Kaaks R, Johnsen NF, Tjønneland A, Arriola L, Barricarte A, Masala G, Grioni S, et al. (2014). Lifestyle factors and mortality risk in individuals with diabetes mellitus: Are the associations different from those in individuals without diabetes? *Diabetologia*, 57(1): 63-72. Available at: <https://link.springer.com/article/10.1007/s00125-013-3074-y>
- Stoica RA, Diaconu CC, Rizzo M, Peter PT, Stefan S D, Serafinceanu C, Nikolic D, Poiana C, Ionescu-Tirgoviste C, and Pantea-Stoian A (2020). Weight loss programmes using low carbohydrate diets to control the cardiovascular risk in adolescents (Review). *Experimental and Therapeutic Medicine*, 21(1): 90. DOI: <https://www.doi.org/10.3892/etm.2020.9522>
- Surai PF, Kochish II, Fisinin VI, and Velichko OA (2018). Selenium in poultry nutrition: From sodium selenite to organic selenium sources. *Journal of Poultry Science*, 55(2): 79-93. DOI: <https://www.doi.org/10.2141/jpsa.0170132>
- Turesky RJ (2007). Formation and biochemistry of carcinogenic heterocyclic aromatic amines in cooked meats. *Toxicol Letters*, 168(3): 219-227. DOI: <https://www.doi.org/10.1016/j.toxlet.2006.10.018>
- Van Nielen M, Feskens EJ, Mensink M, Sluijs I, Molina E, Amiano P, Ardanaz E, Balkau B, Beulens JW, Boeing H, et al. (2014). Dietary protein intake and incidence of type 2 diabetes in Europe: The EPIC-interact case-cohort study. *Diabetes Care*, 37(7): 1854-1862. DOI: <https://www.doi.org/10.2337/dc13-2627>
- Westerterp-Plantenga MS, Nieuwenhuizen A, Tome´ D, Soenen S, and Westerterp KR (2009). Dietary protein, weight loss, and weight maintenance. *Annual Review on Nutrition*, 29: 21-41. DOI: <https://www.doi.org/10.1146/annurev-nutr-080508-141056>
- Zhu HC, Yang X, LP X, Zhao LJ, Tao GZ, Zhang C, Qin Q, Cai J, Ma JX, Mao WD, et al. (2014). Meat consumption is associated with esophageal cancer risk in a meat- and cancer-histological-type dependent manner. *Digestive Diseases and Sciences*, 59(3): 664-673. Available at: <https://link.springer.com/article/10.1007/s10620-013-2928-y>