

Research Progress on the Role of Nutrition and Dietary Intervention in the Management of Obesity

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Abstract. The aim of this article is to summarize the current evidence regarding nutritional, dietary associations with the prevention and treatment of obesity, highlighting the relevance of what we eat during our lifetime with regard to developing or losing weight, thus providing the scientific basis for drafting dietary advice in obese individuals. Methods: Using terms like obesity, diet, nutrition we did a systematic literature search on both CNKI and PubMed. A review on the role of nutrition & diet in Obesity: It is noted that there is a strong connection between proteins, carbohydrates, fats and the occurrence and progress of obesity; micronutrient deficiency is common in people who are obese; some plant substances like polyphenols, ketone bodies, fibers could be used as additively therapeutic approaches for managing obesity; custom dietary plans need to take into account an individual's unique characteristics. Summarize, in short, diet and nutrition are key parts of overall care for obese patients and good nutritional advice is an important part of treating obesity.

Keywords: Obesity, Nutrition, Dietary Intervention

1. Introduction

Diet is an important environmental factor that affects energy equilibrium, metabolism [1], and gut microbiota structure [2] and is associated with the occurrence and progression of obesity and even its management. The paper looks at the links between diet, nutrition and getting obesity, making it better, and managing it from an epidemiological point of view [3]. It will help form dietary suggestions for people who have obesity.

2. Macronutrients and obesity

2.1. Protein

Dietary protein intake and obesity is still not clear. On the other hand, a high protein diet might have an effect on obesity. Take increasing the amount of protein in altered low carb diets and low GI low carb diets that help with body fat metabolism and intestinal wall barrier functions that might have something to do with feeling full due to lots of protein [4, 2]. But some studies worry us about eating much protein being safe over many years. And long-term high protein will cause pressure on

our kidney and also have some effect in terms of gut microbe which can influence the metabolism for obesity as well. And it might be a double-edged sword [5]. Also, what kind of proteins affect obesity as well. The animal protein can also change the gut microflora which has something to do with getting fatter, but plant protein full of fiber may make things easier when you are trying not to get fatter [6]. In addition, there are also differences in people because different people have varying metabolic rates of proteins and requirements for protein intake [7]:

2.2. Carbohydrate

What kind of carbs you eat and how much can affect your weight. Low carb diets reduce insulin and secrete more fat. They make your body burn off weight as well as body fat [8, 9] The quality of the carbohydrates matters too. A high-fiber, Low-Gi carbohydrate can be good for metabolism [1] Low-GI diet combined with probiotics is even more effective for improving the structure of our gut bacteria and help lose weight [4]; Additionally, it could regulate the gut microbiota as well as make people feel fuller and improve insulin sensitivity to manage obesity [1]. Therefore, adjusting the kinds and intakes of carbohydrates, increasing the proportion of dietary fiber and low GI carbohydrates is also a very important nutritional intervention strategy to treat obesity.

2.3. Fats

What kind of fat and how much you eat is important for getting and being obese. Nowadays people have more consumption of saturated fatty acids and trans fatty acids than necessary. And at the same time they lack in their food of omega-3 PUFAs, which can also be called one reason for the increase rate of obesity. Saturated fatty acids are mainly found in animal fat, palm oil, coconut oil, etc. Excess intake will lead to increased fat storage in the body, causing obesity. Trans fatty acids which can be seen on processed foods like margarine and bakes have strong relationship with getting fat and cardiovascular and metabolic problems. On the contrary, omega-3 PUFAs such as EPA and DHA have the opposite effect of inflammation and metabolism regulation. They could regulate lipids metabolism and inflammation reaction in fat cell, reduce fat amount, make obesity related metabolic disease better. Eating too much omega-6 PUFAs like linoleic acid can take the place of omega - 3 in metabolism and cause inflammation, increase risk of obesity. So it's necessary to keep a proper ratio between ω -6 and ω -3 PUFAs in order to prevent and control obesity. Both Research Progress on the Impact of Dietary Management on Overweight and Obese Patients [1], and Dietary management of obesity [6] mention that adjusting the proportion of fat intake is one of the strategies of nutritional intervention to reduce obesity, increase the intake of ω -3PUFA and decrease the intake of saturated fatty acids and trans-fatty acids. In terms of treatment, we generally recommend that overweight people should eat more foods with a lot of omega - 3PUFAs such as deep sea fish and eat less foods with saturated and trans fat to help them manage their weight and metabolic problems.

3. Micronutrients and obesity

In recent studies there is an association between micronutrients and being obese. And obese people usually also have low vitamin D deficiency (about 60-80%) which controls how fat cells form, how sensitive to insulin you are, and inflammation. So PPIs for insulin resistance, inflammation condition: 1] B Vitamins are essential for energy metabolism and Obese people tend to have low B12 and B6. S can help fat breakdown 6; And there's also some minerals like zinc, iron, selenium. Zinc can affect the growth and differentiation of fat cells, iron can improve anemia, selenium has

antioxidant effects. Can supplementation improve Metabolism & Oxidative Stress [10]? So we need to take care about the amount of micronutrients in obese persons, give some supplements if needed and improve medical treatment.

4. Phytochemicals and obesity

Phytochemicals like polyphenols and flavonoids etc., have a big chance to help stop getting fat. They change these kinds of things like changes in the gut bacteria, fixing problems with metabolism and preventing weight gain. Polyphenols can change the gut bacteria. It helps obese people's intestine become better, then make their bodies do something with burning fat [4]. Additionally it can also activate brown adiposity tissue's heatproduction and use more energy such as to ward off obesity. From clinical researches we know that the intake of high-protein calorific restricted diets can change the gut microflora's structure in obesity patients, and also consuming phytochemicals has the same effect [5]. Although we have made some progress, but it is still in the early stages of development, and more clinical studies should be conducted to study the value of application.

5. Obesity and specialized dietary plans

5.1. Gut microbiota modulators combined with modified low-carbohydrate diet

Gut microbiota has something to do with the onset and development of obesity. There are studies showing that an imbalance in the composition of the gut microbiota is likely to cause an abnormality of metabolic and inflammatory activities which might induce obesity [2]. Modified low carb diet is helping patient improve their blood sugar and insulin sensitivity by restricting amount of carbohydrate but also eating more high quality protein & dietary fibre in order to regulate the population of gut microbiota. And the use of gut microbiota modulators like probiotics and prebiotics together will also reinforce it. Promote the growth of good bacteria, inhibit the reproduction of bad ones. So we will improve our gut barriers and try to decrease endo toxemia and this could help us alleviate chronic inflammatory states in obesity [4]. Combined diet is seen to have good fat loss effect and metabolic improvement as per the study [1]:

5.2. Ketogenic diet

Ketogenic diet: It's a kind of eating with lots of fats, fewer carbs, and not too much proteins. Carbs intake is limited so that the body enters into ketosis and fat begins to be broken down and used by the body. A number of studies show that the ketogenic diet can help obese patients lose more body weight and body fat within a short period of time, and improve blood glucose and lipids at the same time [9]. And also, it could regulate the composition of the gut microbiome, improve its barrier function, and lower inflammation caused by obesity that is chronic [11]. But the long term safety of the ketogenic diet is debatable and has also been found to have negative effects like abnormal lipid levels, constipation etc [3]. Therefore, if we want to use a ketogenic diet as an intervention method to deal with obese people, we must seek advice from professionals and regularly check related data.

5.3. Time-restricted eating

Time restricted feeding is an eating behavior which control how much energy is taking in by controlling when we eat, for example, "16/8" time restricted feeding, means limit your daily eating to 8 hours and fast the rest of the 16 hours. And studies show that it's possible with time restricted

eating for reducing the bodyweight and body fat rate of obesity people as well as improving metabolism like glucose and lipid in human [8]. Its mechanism maybe is to control circadian clock gene expression, make body more sensitive to insulin and increase breaking down fat [6]. Also it helps in reducing the effect of night feedings on the gut microbiota by doing time restricted feeding which improves the gut barrier and reduces chronic inflammation linked with obesity [12]. Time restricted feeding's advantage is that it is simple, long term easy to follow. But when it's carried out we must keep away from overindulgence and malnutrition.

5.4. "5+2" intermittent fasting diet pattern

In the "5+2" intermittent fasting diet mode, it is normal feeding for five days a week. And then on two other days (for example, 500Kcal for woman & 600Kcal for man). It has shown some positive effects on weight loss and metabolism improvement for obesity [13]: It could be because it is activating autophagy and breaking down the fats, improving insulin resistance [14]. And the "5+2" intermittent food diet might also affect the structure of the intestinal microorganisms, enhance the integrity of the gastrointestinal tract, decrease continuous inflammation connected with overweight. But pay attention that we shouldn't do too much dieting or suffer from nutrition deficiency. It's better to do this under the guidance of a professional doctor.

5.5. High-protein diet

High-protein diet is an eating pattern which contains a higher percentage of protein intake. It increases the feeling of fullness and expenditure of protein to help control appetite and reduce calorie intake [5]. From study it is proved that with the help of more protein in your food you will lose weight and also reduce body fat and increase the metabolic rates like glucose and lipid. Also a high protein diet might alter the gut microbe community composition, increase the integrity of gut lining, and lessen inflammation that comes with obesity [16]. But long term effects of a very high protein diet have yet to be studied much, with some showing they may add strain on your kidneys [17]. Therefore, when using a high-protein diet to intervene in obesity, we should also make some adjustments according to our own kidneys and regularly check some items.

6. Conclusion

And it is important to manage diet and nutrition. But now it mostly pays attention to reduce the weight of body and body fat content, and ignores improve metabolism health and change of intestinal bacteria. Future study will delve more on how diet and nutrition would play a role on keeping weight off long-term and treating metabolic disorder [1]. Specialized diets such as keto diet, TRF and high protien will be useful in certain people only. Personalized dietary plan, nutritional advice is an important direction for weight reduction [3]. Furthermore, precision nutrition according to gut microbiota may be another possibility however more studies and practices need to be done for this idea [7].

References

- [1] Qi, P., Chen, Y., Song, Y., et al. (2023). Research progress on the impact of dietary management on overweight and obese patients. *Modern Medical Journal*, 39(9), 1571-1575.
- [2] Liu, J., Pan, Y., Li, H., et al. (2021). Analysis of the effect of gut microbiota modulators combined with modified low-carbohydrate diet on body fat metabolism and intestinal barrier function in patients with obesity (in English).

Chinese Journal of Tissue Engineering Research, 25(29), 4672-4679.

- [3] Ulusoy-Gezer, H. G., & Rakicioglu, N. (2024, Sep). The future of obesity management through precision nutrition: Putting the individual at the center. *Current Nutrition Reports*, 13(3), 455-477. doi: 10.1007/s13668-024-00550-y
- [4] Feng, B., Zeng, G., Yu, H., et al. (2023). The effect of probiotics combined with low-GI low-carbohydrate diet therapy on fat loss in patients with obesity. *Chinese Journal of Microecology*, 35(4), 440-444+449. doi: 10.13381/j.cnki.cjm.202304012
- [5] Dong, T. S., Luu, K., Lagishetty, V., Sedighian, F., Woo, S. L., Dreskin, B. W., Katzka, W., Chang, C., Zhou, Y., Arias-Jayo, N., Yang, J., Ahdoon, A., Li, Z., Pisegna, J. R., & Jacobs, J. P. (2020, Oct 21). A high protein calorie restriction diet alters the gut microbiome in obesity. *Nutrients*, 12(10), 3221. doi: 10.3390/nu12103221
- [6] Lee, S. H., Kim, S. H., & Park, S. C. (2024, Mar 25). Dietary management of obesity. *Korean Journal of Gastroenterology*, 83(3), 87-93. doi: 10.4166/kjg.2024.004
- [7] Mehta, N. H., Huey, S. L., Kuriyan, R., Pena-Rosas, J. P., Finkelstein, J. L., Kashyap, S., & Mehta, S. (2024). Potential mechanisms of precision nutrition-based interventions for managing obesity. *Advances in Nutrition*, 15(3), 100186. <https://doi.org/10.1016/j.advnut.2024.100186>
- [8] Qi, Z., Hao, Z., Tao, B., et al. (2022). Meta-analysis of the impact of time-restricted feeding on body weight and metabolism. *Chinese Journal of General Surgery*, 31(10), 1324-1338.
- [9] Xiao, Y., Xue, K., Dang, Z., et al. (2022). Meta-analysis of the effectiveness and safety of very-low-calorie ketogenic diet for weight loss intervention in overweight/obese population. *Chinese Journal of Evidence-Based Medicine*, 22(4), 403-410.
- [10] Sochacka, K., Kotowska, A., & Lachowicz-Wisniewska, S. (2024). The role of gut microbiota, nutrition, and physical activity in depression and obesity-interdependent mechanisms/co-occurrence. *Nutrients*, 16(7), 1039. <https://doi.org/10.3390/nu16071039>
- [11] Wan, L., Wei, D., Liu, C., et al. (2024). Clinical study of ketogenic diet therapy for T2DM combined with obesity. *Clinical Journal of Integrated Traditional and Western Medicine*, 24(16), 98-100+104. <https://doi.org/10.13638/j.issn.1671-4040.2024.16.028>
- [12] Voruganti, V. S. (2023). Precision nutrition: Recent advances in obesity. *Physiology (Bethesda)*, 38(1), 0. <https://doi.org/10.1152/physiol.00014.2022>
- [13] Liu, J., & Ni, D. (2023). Intervention analysis of "5+2" intermittent fasting diet pattern - based nutritional therapy for obese population. *Chinese Journal of Diabetes Mellitus*, 15(9), 852-856. <https://doi.org/10.3760/cma.j.cn115791-20221207-00703>
- [14] Morsali, M., Poorolajal, J., Shahbazi, F., Vahidinia, A., & Doosti-Irani, A. (2021). Diet therapeutics interventions for obesity: A systematic review and network meta-analysis. *Journal of Research in Health Sciences*, 21(3), e00521. <https://doi.org/10.34172/jrhs.2021.63>
- [15] Chao, A. M., Quigley, K. M., & Wadden, T. A. (2021). Dietary interventions for obesity: Clinical and mechanistic findings. *Journal of Clinical Investigation*, 131(1), e140065. <https://doi.org/10.1172/JCI140065>
- [16] Reguero, M., Gomez de Cedron, M., Wagner, S., Reglero, G., Quintela, J. C., & Ramirez de Molina, A. (2021). Precision nutrition to activate thermogenesis as a complementary approach to target obesity and associated-metabolic-disorders. *Cancers (Basel)*, 13(4), 866. <https://doi.org/10.3390/cancers13040866>
- [17] Muscogiuri, G., El Ghoch, M., Colao, A., Hassapidou, M., Yumuk, V., Busetto, L., & Obesity Management Task Force (OMTF) of the European Association for the Study of Obesity (EASO). (2021). European guidelines for obesity management in adults with a very low-calorie ketogenic diet: A systematic review and meta-analysis. *Obesity Facts*, 14(2), 222-245. <https://doi.org/10.1159/000515381>