

Analysis of Dietary Intake Recommendations for Specific Diseases

1. Introduction

The establishment of precise nutritional guidelines plays a crucial role in the effective management of chronic health conditions, including diabetes, obesity, hypertension, and high cholesterol. These guidelines, based on extensive research and expert consensus, provide a framework for individuals and healthcare professionals to make informed dietary choices that can positively impact health outcomes. The increasing utilization of artificial intelligence in health-related applications necessitates the development of AI systems grounded in accurate and evidence-based nutritional information. This report aims to analyze the correctness of dietary information, intended for AI development, concerning the recommended daily intake of key nutrients for individuals with the aforementioned diseases, based on a review of available research.

2. Recommended Daily Sugar Intake

2.1. General Population vs. Individuals with Diabetes

Recommendations regarding daily sugar intake have been established by various health organizations for both the general population and individuals with diabetes. The American Heart Association (AHA) suggests a daily limit of 36 grams (9 teaspoons) of added sugar for men and 25 grams (6 teaspoons) for women, and these recommendations are consistent for individuals with and without diabetes¹. Similarly, the World Health Organization (WHO) recommends a more general limit of no more than 25 grams (6 teaspoons) of sugar per person per day². These guidelines serve as important benchmarks for overall health and the prevention of chronic diseases.

In the context of preventing type 2 diabetes, Action on Sugar proposes reducing sugar intake to a maximum of 6 teaspoons (25g) per day for the general population³. Furthermore, the Scientific Advisory Committee on Nutrition (SACN) in the UK suggests a further reduction to 5% of daily energy intake, which approximates to 30g of sugars³. In the United Kingdom, the maximum recommended daily amount of total sugar for adults is 30g, equivalent to about seven teaspoons⁴. These recommendations highlight the growing awareness of the detrimental effects of excessive sugar consumption on public health.

While some organizations like the AHA provide the same sugar intake recommendations for both the general population and individuals with diabetes, others offer more specific guidance for those living with the condition. Diabetes Canada recommends limiting the intake of free sugars to less than 10% of total daily calorie intake, which is roughly 50 grams (12 teaspoons) based on a 2000-calorie diet. They also suggest that a further reduction to below 5% (about 6 teaspoons) of total energy intake could provide additional health benefits, aligning with the WHO's more stringent recommendation ⁵. Specifically for individuals with diabetes, Diabetes Canada's 2013 Clinical Practice Guidelines recommend limiting sucrose intake to 10% or less of total daily energy, as higher intakes may negatively impact blood glucose and triglyceride levels in some individuals with type 2 diabetes ⁵. The Centers for Disease Control and Prevention (CDC) recommends that no more than 10% of total daily calories should come from added sugar, which equates to 50 grams on a 2,000-calorie diet ⁶.

It becomes evident that while a general consensus exists around limiting daily sugar intake to approximately 25-30 grams (6-7 teaspoons) for overall health and diabetes prevention, some organizations offer more tailored recommendations for individuals with diabetes, often expressed as a percentage of total daily caloric intake. This percentage-based approach allows for greater individualization of dietary advice, taking into account varying energy needs. It is also important to note the distinction between "total sugar," "added sugar," and "free sugars." Free sugars encompass both added sugars and sugars naturally present in honey, syrups, fruit juices, and fruit concentrates ⁵. This distinction is critical for accurate dietary assessment and guidance.

To provide a clearer overview, the following table summarizes the recommended daily sugar intake from various organizations:

Organization	Target Group	Recommended Daily Sugar Intake	Units
American Heart Association (AHA)	Men	36	grams / 9 teaspoons

American Heart Association (AHA)	Women	25	grams / 6 teaspoons
World Health Organization (WHO)	General Population	25	grams / 6 teaspoons
Action on Sugar	General Population (for prevention)	25	grams / 6 teaspoons
SACN (UK Suggestion)	General Population (for prevention)	~30 (5% of energy)	grams
UK Guidelines	Adults	30	grams / 7 teaspoons
Centers for Disease Control and Prevention (CDC)	General Population	≤50 (≤10% of 2000 kcal)	grams
Diabetes Canada	General Population	<50 (≤10% of energy)	grams / 12 teaspoons
Diabetes Canada	General Population (further reduction)	<30 (≤5% of energy)	grams / 6 teaspoons
Diabetes Canada	Individuals with Diabetes	≤10% of total daily energy (sucrose)	-

2.2. Implications for AI Development

For AI systems designed to provide dietary recommendations, it is crucial to incorporate guidelines based on both absolute amounts and percentages of total calories to cater to diverse user needs and preferences. The AI should also be equipped to differentiate between various sugar terminologies, such as total, added, and free sugars, to ensure accurate interpretation of food labels and nutritional information. Furthermore, the AI should acknowledge the varying recommendations from different health organizations and potentially provide a range or the most widely accepted guidelines while emphasizing the importance of personalized advice from healthcare professionals.

3. Recommended Daily Protein Intake for Individuals with Diabetes

3.1. General Recommendations and Diabetes-Specific Considerations

The amount of protein recommended for individuals with diabetes is generally consistent with the guidelines for the general population ⁷. A common recommendation is a minimum of 0.8 grams of protein per kilogram of body weight per day, which typically falls within the range of 10-35% of total daily caloric intake ⁷. For instance, an individual weighing 150 pounds (approximately 68 kilograms) should aim for at least 55 grams of protein daily ⁷.

The American Diabetes Association (ADA) reports that the average protein intake among people with diabetes is between 1 and 1.5 grams per kilogram of body weight per day, which corresponds to 15-20% of total calories and is considered acceptable ⁷. This range provides a more typical intake level observed in this population. To illustrate, a person weighing 170 pounds (77 kg) might aim for 77-116 grams of protein per day, while a 200-pound (90 kg) individual could target 90-136 grams ⁸. The USDA Dietary Guidelines recommend consuming 5.5 ounces of protein-rich foods each day as part of a healthy diet ⁹.

However, a critical consideration for individuals with diabetes is kidney health. While a protein intake of 15-20% of total daily calories is generally recommended for all populations, including those with diabetes and normal kidney function, protein intake exceeding 20% of total calories might accelerate the development of kidney disease ¹⁰. For individuals who develop diabetic nephropathy (kidney disease related to diabetes), a slightly lower protein intake of about 1 gram (or less) per kilogram of body weight per day is often recommended ⁹. It is therefore essential for people with diabetes, particularly those with kidney complications, to consult with their healthcare provider to determine their individualized protein needs ⁸.

The emphasis across various sources is that individuals with diabetes do not require a "special" amount of protein compared to the general population, provided their kidney function is healthy ⁷. The recommendations often present a range, acknowledging that individual needs can vary based on factors such as activity level, weight management goals, and overall health status ⁷.

3.2. Implications for AI Development

AI systems should be designed to consider kidney health as a significant factor when generating protein intake recommendations for individuals with diabetes. The AI should be capable of calculating protein needs based on both body weight (using the 0.8 g/kg formula and potentially the 1-1.5 g/kg average intake range) and percentage of total calories (10-35%, with a general average of 15-20%). Importantly, the AI should strongly advise users with diabetes, especially those with known kidney issues,

to seek personalized guidance from a healthcare professional regarding their optimal protein intake.

4. Recommended Daily Fat Intake for Individuals with Diabetes

4.1. Types of Fats and Their Proportions

For individuals with diabetes, the focus of fat intake recommendations extends beyond just the total quantity to emphasize the importance of the types of fats consumed¹⁰. The general recommendation for total fat intake is between 20% and 35% of total daily calories¹⁰. However, within this range, specific limits are advised for different categories of fats.

Saturated fat intake should be limited to less than 7% of total daily calories¹⁰. These fats, commonly found in meats, lard, and high-fat dairy products, can negatively impact cholesterol levels and increase the risk of cardiovascular disease, which is already elevated in individuals with diabetes¹⁰. Polyunsaturated fats should be limited to less than 10% of total calories¹⁰. Monounsaturated fats, on the other hand, are considered healthier and should make up a larger proportion of fat intake, ideally up to 20% of total calories¹⁰. Sources of monounsaturated fats include olive oil, canola oil, and nuts¹¹.

Furthermore, it is generally recommended that individuals with diabetes limit their daily intake of dietary cholesterol to less than 200 mg¹⁰. This recommendation is linked to the increased risk of heart disease and stroke associated with both diabetes and obesity¹⁰. Choosing lean cuts of meat, opting for low-fat or fat-free dairy products, and using vegetable oils instead of animal fats are practical strategies to manage fat and cholesterol intake¹¹.

The emphasis on the quality of fat intake, rather than solely the total amount, is a key aspect of dietary guidance for individuals with diabetes. Prioritizing unsaturated fats while minimizing saturated and trans fats is crucial for managing blood lipids and reducing cardiovascular risk.

4.2. Implications for AI Development

AI systems should be capable of differentiating between various types of dietary fats and understanding their respective impacts on health, particularly in the context of diabetes. The AI should incorporate the recommended percentage ranges for total fat, saturated fat, polyunsaturated fat, and monounsaturated fat when providing dietary advice. Additionally, the recommendation to limit dietary cholesterol intake to

less than 200 mg per day should be integrated into the AI's guidance for individuals with diabetes.

5. Recommended Daily Carbohydrate and Fiber Intake for Individuals with Diabetes

5.1. Carbohydrate Intake - Quantity and Quality

Managing carbohydrate intake is a cornerstone of diabetes management due to its direct impact on blood glucose levels ¹¹. While a standard recommendation often suggests that 50-60% of total daily calories for individuals with type 2 diabetes should come from carbohydrates ¹¹, it is increasingly recognized that a more individualized approach is necessary ¹³.

Some research indicates that lower carbohydrate diets, ranging from 20 to 225 grams per day, may lead to more significant improvements in blood sugar control ¹⁴. Very low carbohydrate diets typically involve 20-60 grams of carbs daily, while low carbohydrate diets range from 120 to 225 grams ¹⁴. Reducing carbohydrate intake from a typical American diet, which provides around 275 grams per day, can often result in lower post-meal blood glucose levels ¹⁴.

The American Diabetes Association (ADA) emphasizes an individualized approach to nutrition for people with diabetes, acknowledging that the optimal amount of carbohydrates can vary based on factors such as weight, activity levels, age, and individual preferences ¹³. The ADA suggests prioritizing high-quality, nutrient-dense carbohydrates that are rich in fiber and minimally processed, regardless of the specific amount consumed ¹³. Low-carb meal patterns, where carbohydrates constitute 26% to 45% of total calories, may be beneficial for some individuals with diabetes ¹³. Practical strategies for managing carbohydrate intake include carbohydrate counting, where one serving typically equals 15 grams of carbohydrates, and portion control at meals and snacks ¹¹.

5.2. Fiber Intake

Adequate fiber intake is particularly important for individuals with diabetes due to its role in improving blood sugar control, promoting satiety, and supporting overall cardiovascular health ¹⁵. General recommendations for adults suggest a minimum of 14 grams of fiber per 1,000 calories consumed ¹⁶.

The American Diabetes Association (ADA) aligns with this, recommending at least 14 grams of fiber per 1,000 kcal for adults with diabetes ¹⁵. The European Association for

the Study of Diabetes (EASD) suggests a higher target of at least 35 grams of dietary fiber per day, or 16.7 grams per 1,000 kcal ¹⁵. These recommendations are generally higher than the World Health Organization's (WHO) general guideline of at least 25 grams per day, underscoring the enhanced importance of fiber for individuals with diabetes ¹⁵. Some sources recommend aiming for 20-30 grams of fiber daily ¹¹. Incorporating minimally processed whole grains, vegetables, whole fruits, and legumes into the diet are effective ways to increase fiber intake ¹⁵.

5.3. Implications for AI Development

AI systems should be capable of providing carbohydrate recommendations based on both percentage of total calories and absolute amounts in grams, allowing for flexibility in dietary planning. The AI should also incorporate the principles of carbohydrate counting and emphasize the importance of portion control. A key aspect is the ability to guide users toward high-quality, high-fiber, minimally processed carbohydrate sources over refined options. Furthermore, the AI should include recommendations for daily fiber intake, considering both fixed amounts (e.g., 20-35 grams) and recommendations based on caloric intake (e.g., 14 g/1000 kcal). The potential benefits of lower carbohydrate diets for some individuals with diabetes should be acknowledged, with a strong emphasis on the need for personalized guidance from healthcare professionals to determine the most appropriate carbohydrate intake level.

6. Recommended Daily Intake for Individuals with Obesity

6.1. Macronutrient Ratios for Weight Management

For individuals with obesity aiming for weight management, the Dietary Guidelines for Americans 2020-2025 provide general macronutrient recommendations that can serve as a starting point ¹⁷. These guidelines suggest that adults should obtain 45-65% of their daily calories from carbohydrates, 20-35% from fat, and 10-35% from protein ¹⁷. These ranges represent acceptable macronutrient distribution ranges for overall health.

While these general ratios are important, the primary driver for weight loss is achieving a calorie deficit, meaning consuming fewer calories than the body expends ¹⁷. Manipulating macronutrient intake can support this goal. For instance, research suggests that a higher protein intake, in the range of 1.2-2 grams per kilogram of body weight, may be beneficial for weight loss and preserving muscle mass during calorie restriction ¹⁷. Protein can also enhance satiety, potentially leading to reduced overall

calorie intake ¹⁷.

6.2. Sugar and Fiber Intake in Obesity

Similar to general healthy eating guidelines, it is recommended that individuals with obesity limit their intake of added sugars to less than 10% of their total daily calories ²⁰. Excessive consumption of added sugars can contribute to increased calorie intake without providing essential nutrients, potentially hindering weight loss efforts ²⁰.

Adequate fiber intake is also crucial for weight management in obesity. A daily intake of 25–30 grams of fiber is generally recommended for adults ²². Fiber promotes feelings of fullness, can help regulate blood sugar levels, and supports overall digestive health, all of which are beneficial in the context of weight loss ¹⁵.

6.3. Implications for AI Development

AI systems designed to assist individuals with obesity in weight management should be able to calculate personalized macronutrient targets based on individual calorie needs and the recommended percentage ranges. The AI should also incorporate the recommendation to limit added sugar intake and ensure adequate daily fiber intake. Furthermore, the AI could acknowledge the potential role of higher protein intake in promoting weight loss and satiety, while emphasizing the importance of overall calorie balance for effective weight management.

7. Recommended Daily Intake for Individuals with Hypertension

7.1. DASH Diet Principles

The Dietary Approaches to Stop Hypertension (DASH) diet is a well-established dietary pattern specifically designed to help manage and lower blood pressure ¹². This dietary approach emphasizes the consumption of fruits, vegetables, whole grains, low-fat dairy products, and lean meats, while limiting saturated fat, cholesterol, and sugar-sweetened beverages ¹².

A typical serving guide for a 2000-calorie DASH diet includes about 4–5 servings of vegetables per day, 4–5 servings of fruits, 6–8 servings of grains (primarily whole grains), 2–3 servings of low-fat dairy products, and no more than six 1-ounce servings of lean meats, poultry, or fish per day ²⁵. Nuts, seeds, or dry beans and peas are recommended 4–5 times per week, and fats and oils should be limited to 2–3 servings per day ²⁵. Sweets and added sugars should be consumed sparingly, no more than 5 servings per week ²⁵.

Key nutrient goals of the DASH diet include limiting sodium intake to no more than 2,300 mg per day, with an even more effective goal of 1,500 mg¹². Saturated fat should be restricted to no more than 6% of daily calories, and total fat to around 27% of daily calories¹². Dietary cholesterol should be limited to less than 150 mg per day¹². Carbohydrate intake is typically around 55% of daily calories, and protein intake is in modest amounts, no more than 18% of total daily calories¹². The DASH diet also emphasizes the importance of consuming at least 30 grams of fiber per day¹².

7.2. Fiber Intake and Hypertension

Research suggests that adequate dietary fiber intake plays a significant role in managing hypertension. The minimum recommended daily dietary fiber intake for adults with hypertension is greater than 28 grams per day for women and greater than 38 grams per day for men²⁷. Studies indicate that each additional 5 grams of daily fiber intake may contribute to a reduction in both systolic and diastolic blood pressure²⁷. The adequate intake levels for fiber for adults over 19 years are generally 30 g/day for men and 25 g/day for women, with suggested dietary targets of 38 g/day for men and 28 g/day for women to optimize cardiovascular health²⁷.

7.3. Implications for AI Development

AI systems should be well-informed about the principles and specific guidelines of the DASH diet to provide effective dietary recommendations for individuals with hypertension. The AI should be able to translate the food group serving recommendations into practical meal planning guidance based on individual calorie needs. It is crucial for the AI to incorporate the specific nutrient targets of the DASH diet, particularly regarding sodium, saturated fat, total fat, cholesterol, carbohydrate, protein, and fiber intake. Additionally, the AI should emphasize the importance of achieving adequate fiber intake, potentially providing gender-specific recommendations for individuals with hypertension based on current evidence.

8. Recommended Daily Intake for Individuals with High Cholesterol

8.1. General Dietary Recommendations

Managing high cholesterol levels often involves dietary modifications to reduce the intake of cholesterol-raising foods, particularly saturated and trans fats²³. A general recommendation is to limit total fat intake to less than about 28% of daily total calories, with saturated fats comprising less than 8%²¹. Additionally, limiting the consumption of added sugars to less than 10% of total daily calories is advised²¹. The American Heart Association (AHA) recommends limiting added sugar intake to no

more than 25 grams (6 teaspoons) per day for most females and no more than 36 grams (9 teaspoons) per day for most males ²². The FDA's Daily Value for added sugars is 50 grams ²⁸.

8.2. Fiber Intake and High Cholesterol

Adequate dietary fiber intake is beneficial for managing high cholesterol, as it can help lower LDL cholesterol levels ¹⁵. The general recommendation for fiber intake for adults ranges from 20 to 35 grams per day ²³. The FDA's Daily Value for dietary fiber is 28 grams ²⁸. Consuming foods rich in soluble fiber, such as oats, beans, and certain fruits, is particularly helpful in lowering cholesterol ¹⁵.

8.3. Carbohydrate Intake

The Dietary Guidelines for Americans recommend that carbohydrates should make up 45-65% of total daily calories ²⁰. For individuals with high cholesterol, it is important to prioritize complex carbohydrates from whole grains, fruits, and vegetables over refined carbohydrates and sugary foods ²¹.

8.4. Protein Intake

General recommendations suggest that adults need about 60 grams of protein per day, which equates to approximately 0.8 grams per kilogram of body weight or 10-15% of total calories ²¹. Including lean sources of protein in the diet is important for overall health.

8.5. Added Sugar Intake

As mentioned earlier, limiting added sugar intake is crucial for managing high cholesterol and overall cardiovascular health ²¹. Excessive sugar consumption can contribute to weight gain and negatively impact lipid profiles.

8.6. Implications for AI Development

AI systems should incorporate recommendations for limiting total fat and, more specifically, saturated fat intake for individuals with high cholesterol. The AI should also include guidance on limiting added sugar intake, potentially using the AHA guidelines for men and women. Emphasizing the importance of adequate daily fiber intake, ideally within the range of 20-35 grams, should also be a key component. The AI should provide general guidance on carbohydrate and protein intake within the recommended percentage ranges, with a focus on nutrient-dense, whole food

sources.

9. Understanding Nutritional Information (CHOCDF)

9.1. Definition of CHOCDF

The term "CHOCDF" is a technical designation in nutritional analysis that stands for "Total carbohydrate by difference" ²⁹. It represents the total amount of carbohydrates in a food product, calculated by subtracting the weight of water, protein, fat, alcohol, and ash from the total weight of the food (expressed as grams per 100 grams of food) ²⁹. This method is a common approach used in food composition analysis and labeling to determine the total carbohydrate content, which includes dietary fiber ²⁹. While there are other methods for analyzing carbohydrates, such as direct analysis by summation of individual carbohydrates, the "by difference" method (CHOCDF) is considered acceptable for energy evaluation of conventional foods ³¹. It is important to note that this definition differs significantly from "Chondroitin sulphate," which is a chemical found in cartilage ³².

9.2. Relevance to the User's Query

If the image provided by the user includes a nutritional label or information listing "CHOCDF," it indicates the total carbohydrate content of the food item. Understanding this term is crucial for accurately interpreting nutritional information and for the AI system to effectively process and utilize this data in generating dietary recommendations.

9.3. Implications for AI Development

AI systems designed to analyze nutritional information from various sources, including images of food labels, should be trained to recognize and correctly interpret common nutritional terms and abbreviations such as "CHOCDF." The AI should understand that CHOCDF represents the total carbohydrate content, including fiber. This knowledge will enable the AI to accurately assess the carbohydrate content of foods and provide appropriate guidance based on the dietary recommendations for specific health conditions. It is also important for the AI to have a robust understanding of nutritional terminology to avoid misinterpretations, such as confusing CHOCDF with unrelated terms like Chondroitin sulphate.

10. Conclusion

The analysis of dietary intake recommendations for diabetes, obesity, hypertension,

and high cholesterol reveals a complex landscape with both general agreements and condition-specific nuances. For sugar intake, while general recommendations for the population exist, individuals with diabetes often benefit from more stringent, personalized guidance based on both absolute amounts and percentages of total calories. Protein intake recommendations for diabetics largely align with those for the general population, with a critical consideration for kidney health. Fat intake guidelines for diabetes emphasize not just the total amount but also the type of fat, prioritizing unsaturated fats and limiting saturated and trans fats. Carbohydrate management for diabetes is highly individualized, with a growing recognition of the potential benefits of lower carbohydrate approaches alongside the importance of carbohydrate quality and adequate fiber intake.

For obesity, general macronutrient ratios provide a framework, but achieving a calorie deficit is paramount, and higher protein intake may offer benefits. Managing sugar and ensuring sufficient fiber intake are also important. Hypertension management heavily relies on the DASH diet, which provides specific recommendations for various food groups and nutrients, including a strong emphasis on sodium restriction and adequate fiber intake. Dietary recommendations for high cholesterol focus on limiting saturated fat, trans fat, and added sugars, while promoting adequate fiber intake and a balanced intake of other macronutrients.

It is crucial to recognize that these are general guidelines, and individual needs can vary significantly based on a multitude of factors, including overall health status, activity level, medications, and personal preferences. Therefore, while AI systems can be valuable tools for providing dietary information, they should always emphasize the importance of personalized advice from healthcare professionals, particularly registered dietitians or physicians. The field of nutritional science is continuously evolving, and staying updated with the latest research and guidelines is essential for ensuring the accuracy and effectiveness of dietary recommendations, whether provided by healthcare professionals or AI systems.

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