Total fat intake for the prevention of unhealthy weight gain in adults and children

WHO guideline summary
Note

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Guideline summary

Background

Escalating rates of overweight and obesity\(^1\) are a threat to the health of billions of people across the globe. In 2016, more than 1.9 billion adults aged 18 years and older were overweight (\(1\)), of which more than 600 million were obese. In 2020, more than 38 million children under 5 years of age were overweight – an increase of nearly 6 million since 2000 (\(2\)). High body mass index (BMI) was responsible for an estimated 4 million deaths in 2015 (\(3\)), with greater increases in BMI in the overweight and obesity range leading to a greater risk of mortality (\(4\)). Obesity is also a risk factor for many noncommunicable diseases (NCDs) including cardiovascular diseases (CVDs), type 2 diabetes and certain types of cancers. NCDs are the leading causes of death globally and were responsible for an estimated 41 million (71%) of the 55 million deaths in 2019 (\(5\)). Obesity and certain NCDs also increase the likelihood of becoming severely ill from COVID-19 infection (\(6–8\)).

Among other lifestyle and dietary factors, macronutrient distribution of the diet (i.e. the percentage of carbohydrates, protein and fats) has been explored as a possible contributor to unhealthy weight gain,\(^2\) which may in turn lead to the development of overweight and obesity. Although BMI is increasing in almost every country, rates of overweight and obesity are growing most rapidly in low- and middle-income countries (LMICs) (\(15–17\)) – settings where undernutrition is also still widely prevalent – thus fuelling growth of the double burden of malnutrition (\(18\)). Concurrent with this increase in unhealthy weight gain is a transition to diets higher in fat, salt and sugars (i.e. the “nutrition transition”), which has been extensively documented over the past two decades in numerous LMICs (\(19–23\)). Although the causes of increasing rates of overweight and obesity in LMICs are many and varied, an increase in total fat intake (primarily through increased consumption of animal fat and vegetable oils) has been described as a potential contributor (\(20, 24–28\)).

Fats consumed by humans are generally in the form of triglycerides, which comprise three fatty acids attached to a glycerol molecule. The percentage of fat in the diet can be referred to as “total fat” and is the sum of all dietary fats, comprising monounsaturated and polyunsaturated fatty acids, saturated fatty acids and trans-fatty acids (without distinguishing between the different types of fat in terms of any associated health effects). Common sources of fat in the human diet are meat, fish, dairy products, plant- and animal-based oils and fats, nuts and seeds and highly processed foods.

In addition to being an important source of energy in the diet, fats and fatty acids play various roles in human physiology. They serve as a carrier for the fat-soluble vitamins A, D, E and K, and support their absorption in

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1 Overweight and obesity are defined as follows:

- **Children (<5 years):**
  - Overweight: weight for height ≥2 standard deviations (SD) of the World Health Organization (WHO) child growth standards median

- **School-aged children and adolescents (5–19 years):**
  - Overweight: BMI-for-age ≥1 SD of the WHO growth reference for school-aged children and adolescents (equivalent to BMI
    25 kg/m\(^2\) at 19 years)
  - Obesity: ≥2 SD of the WHO growth reference for school-aged children and adolescents (equivalent to BMI 30 kg/m\(^2\) at 19 years)

- **Adults (≥20 years):**
  - Overweight: BMI ≥25 kg/m\(^2\)
  - Obesity: BMI ≥30 kg/m\(^2\)

2 In this context, unhealthy weight gain refers to unintentional weight gain (i.e. increase in body fatness) that contributes to the progression towards overweight and obesity, but excludes appropriate weight gain during pregnancy (\(9, 10\)) and as part of normal growth and development in childhood (\(11\)). Other exceptions include weight gain resulting from activities that increase muscle mass without increasing fat mass, such as weight-lifting and other strength-building exercise. For the development of this guideline, unhealthy weight gain was assessed as an increase in, or greater measures of, body fatness as reported in the systematic reviews underpinning the recommendations (\(12–14\)).
the intestine. Fatty acids are also an integral structural component of cell membranes and can differentially affect membrane function, depending on the nature of the individual fatty acids included therein. Many fatty acids have hormone-like or inflammatory properties and may be involved in diverse physiological processes such as immune function, wound healing and regulation of gene expression. Certain fatty acids are important for growth and development of the nervous system in utero and through the first months of life, and others may affect the risk of developing certain NCDs later in life.

Although dietary fats are essential for normal physiological function, they are the most energy dense of the macronutrients, supplying 9 kcal (37.7 kJ) of energy per gram. Because foods rich in fat are highly palatable, they may have a weaker effect on short-term satiety than foods with low or no fat content, particularly those containing greater amounts of protein or dietary fibre, although there is some evidence to suggest that dietary fat may help to promote longer term satiety (29, 30). Thus, higher fat intakes can lead to increased total energy intake (31–41), which in turn may lead to energy imbalance and unhealthy weight gain (42–44).

Several recent studies have shown either no association between higher fat diets consisting predominantly of unsaturated fat of plant origin and weight gain, or decreased risk of weight gain (45–48), suggesting that quality of dietary fat may also be a factor in the impact of dietary fat on body weight. Additionally, evidence for the role that percentage of fat in the diet may play in helping to reach and maintain a healthy body weight in individuals actively pursuing weight loss is inconsistent, with some studies reporting lower body weight with higher fat diets, others reporting lower body weight with lower fat diets, and still others reporting equivalent weight loss regardless of fat percentage when total energy intake is reduced (49–54).

Despite longstanding dietary advice to limit total fat intake because of its potential role in the risk of developing NCDs as well as overweight and obesity, fat intake remains high in many parts of the world (55), exceeding values recommended by several expert meetings and consultations convened by World Health Organization (WHO) including the 2002 Joint WHO/Food and Agriculture Organization of the United Nations (FAO) Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases (56). Furthermore, emerging evidence suggests a potential future trend of increasing fat intake in the near term (57).

Objective, scope and methods

The objective of this guideline is to provide updated guidance on the intake of total fat, to be used by policymakers, programme managers, health professionals and other stakeholders in efforts to promote healthy diets. The guidance was formulated based on evidence for unhealthy weight gain only. The guideline was developed by the WHO Nutrition Guidance Expert Advisory Group (NUGAG) Subgroup on Diet and Health following the WHO guideline development process, as outlined in the WHO handbook for guideline development (59). This process includes a review of systematically gathered evidence by an international, multidisciplinary group of experts; assessment of the quality of that evidence via the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework; and consideration of additional, potentially mitigating factors when translating the evidence into recommendations. The guideline was reviewed by a group of external experts and feedback was solicited from interested stakeholders during public consultations. The guidance in this guideline replaces previous WHO guidance on total fat intake, including that from the 1989 WHO Study Group on Diet, Nutrition and the Prevention of Chronic Diseases (60) and the 2002 Joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases (56).

1 Unhealthy weight gain was selected as the priority outcome for the development of this guideline owing to conclusions drawn and recommendations made by the 2008 Joint FAO/WHO Expert Consultation on Fats and Fatty Acids in Human Nutrition (“Expert Consultation”) (58). The Expert Consultation concluded that from the available evidence reviewed at the time of the consultation there was little evidence to suggest a link between total fat intake and coronary heart disease or cancer. However, as a result of limited evidence and conflicting interpretation of the results regarding an association between total fat intake and body fatness, the Expert Consultation was unable to reach a consensus conclusion and therefore maintained the recommended level of total fat intake established by the 2002 Joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases (56). It was also noted that further research was needed, including a systematic review of available evidence on the effects of total fat intake on body fatness, to develop globally applicable guidance on total fat intake. Therefore, in developing the WHO guideline on total fat intake, including the undertaking of a new systematic review, the NUGAG Subgroup on Diet and Health focused on unhealthy weight gain (as an indication of unhealthy increase in body fatness) as the priority outcome.

2 http://www.gradeworkinggroup.org/

3 These include desirable and undesirable effects of the intervention, priority of the problem that the recommendation addresses, values and preferences related to the recommendation in different settings, the cost of the options available to public health officials and programme managers in different settings, feasibility and acceptability of implementing the recommendation in different settings, and the potential impact on equity and human rights.
The evidence

Evidence from a systematic review of randomized controlled trials (RCTs) conducted in non-dieting adults (12, 13) found that reducing intake of total fat led to lower body weight, body mass index (BMI), waist circumference and percentage of body fat (high certainty evidence overall). Results of subgroup analyses and meta-regression suggest that greater reductions in total fat intake were associated with greater differences in body weight, and that those consuming less than 30% of total energy intake as fat had less body fatness than those consuming 30% or more of total energy intake as fat. There was no suggestion of undesirable effects associated with reduced fat intake that might mitigate any benefits on body fatness, including undesirable changes in blood lipids or blood pressure or negative effects on quality of life. In fact, a small improvement in total cholesterol, low density lipoprotein (LDL) cholesterol and blood pressure was observed with reduced fat intake.

Because of differences in methodology and data reporting across the studies, meta-analyses of identified prospective cohort studies could not be reliably conducted. Of the 39 reported analyses in 14 cohort studies on the association between total fat intake and measures of body fatness in adults, 12 suggested a positive association, three suggested a negative association and one was unclear. The remaining 23 analyses did not show statistically significant associations.

Three RCTs conducted in children were identified (14), but due to differential reporting of outcomes at different points of follow-up they were not considered suitable for meta-analysis. Results of RCTs on measures of body fatness were inconsistent but there was no suggestion of undesirable effects associated with reduced fat intake in terms of blood lipids or linear growth.

Recommendations and supporting information

These recommendations should be considered in the context of other WHO guidelines on healthy diets, including those on saturated fatty acids and trans-fatty acids (62), polyunsaturated fatty acids (56), sugars (63), carbohydrates (64), non-sugar sweeteners (65), sodium (66) and potassium (67). An explanation of the strength of WHO recommendations can be found in Box 1.

WHO recommendations

1. To reduce the risk of unhealthy weight gain, WHO suggests that adults limit total fat intake to 30% of total energy intake or less (conditional recommendation).

2. Fat consumed should be primarily unsaturated fatty acids, with no more than 10% of total energy intake coming from saturated fatty acids and no more than 1% of total energy intake coming from trans-fatty acids (strong recommendation).

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1 Because the focus of this guideline is on prevention of unhealthy weight gain, and not on the management of existing overweight or obesity, trials were excluded from the systematic review if the aim was intentional weight loss of participants in the intervention arm, or if participants were selected for higher body weight, BMI or body weight classification (as most appeared to have weight loss goals, even when this was not explicitly stated). Such trials were potentially confounded by the implicit objective of reducing energy intake to produce weight loss and might therefore lead to an overemphasis on trials carried out exclusively in highly selected overweight and obese populations, which may have limited applicability in non-overweight populations, including those in some LMICs. The decision to exclude studies with intentional weight loss goals was carefully considered because it was realized that doing so would exclude many studies assessing the effect of reducing total fat intake on body weight. However, it was determined that the inclusion of studies with intentional weight loss would not only skew the analysis to highly selected overweight and obese individuals but would also likely introduce bias that would decrease confidence in the results. This is because weight loss studies conducted in free-living individuals are frequently confounded by numerous, complex behavioural factors, including variability in motivation to adhere to a particular diet over time – which can be influenced by popular perception of its efficacy – as well as guilt if participants are unsuccessful in adhering to a particular diet, both of which could affect reporting of dietary intake. Results of weight loss studies in some cases could therefore reflect popularity of a particular diet more so than the body weight-altering effects of the macronutrients contained therein (62).

2 The evidence from cohort studies was reviewed but was not formally assessed for quality using GRADE methodology, given the inability to pool the effects of the identified cohort studies via meta-analysis, that the qualitative results from the cohort studies were consistent with those from the RCTs and that the data from the RCTs were robust and of higher certainty.

2 WHO guidance on polyunsaturated fatty acids is currently being updated.
Rationale and remarks

The following provides the reasoning (rationale) behind the formulation of the recommendations, as well as remarks designed to provide context for the recommendations and facilitate their interpretation and implementation.

Rationale for recommendation 1

- This recommendation is based on evidence of high certainty\(^1\) from a systematic review of RCTs of dietary fat reduction in adults in which weight loss was not an explicit goal \((12, 13)\). All measures of body fatness assessed in the review (i.e. body weight, BMI, waist circumference and percentage body fat) were lower in adult participants randomized to a lower fat intake versus usual or moderate intake, with the most commonly reported measure being body weight. The evidence further suggests that the greater the difference in fat intake between those reducing fat intake and those not doing so, the greater the difference in body weight (i.e. a dose–response relationship), regardless of the final level of total fat intake achieved. Overall, the evidence suggests that a lower fat intake has the potential to help reduce the risk of unhealthy weight gain.\(^2\)

- The threshold of 30% was selected because most of the trials included in the analyses reported total fat intakes of 30% or more at baseline (range: 29–43% of total energy intake) and most studies achieved intakes of 30% or less in the intervention arms (range: 14–35% of total energy intake). When compared directly via subgroup analysis, there was a greater difference in body weight in trials where total fat intake was reduced to a final level of less than 30% of total energy intake in the intervention arms than in trials where total fat intake was reduced to a final level that was 30% of total energy intake or more in the intervention arms. In addition, the observed dose–response relationship indicates a cumulative effect of lower fat intake across the range of baseline intakes, with a greater reduction in fat intake resulting in a greater difference in body weight. Therefore, although an effect on body weight is anticipated with

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\(^1\) Based on the grades of evidence set by the GRADE Working Group: high certainty, we are very confident that the true effect lies close to that of the estimate of the effect; moderate certainty, we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different; low certainty, our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect; very low certainty, we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of the effect.\(^59\)

\(^2\) Given the inability to pool the effects of the identified cohort studies via meta-analysis, the qualitative results from the cohort studies being not inconsistent with those from the RCTs, and the data from the RCTs being robust and of higher certainty, the evidence from cohort studies was reviewed, but was not formally assessed for quality using GRADE methodology or directly used in decision-making with respect to formulating the recommendation or assigning strength.
reducing total fat intake regardless of the level of total fat intake achieved, the greatest effect may be achieved with a reduction to 30% of total energy intake or less.

The recommendation was assessed as conditional because some individuals who reduce their fat intake might replace some of the energy from dietary fat with energy from foods that are undesirable from a dietary quality perspective (e.g. free sugars), reducing the net benefit. It is therefore important to consider this recommendation in the context of other WHO dietary recommendations, including those on free sugars (63) and carbohydrates (64), the latter of which provides guidance on carbohydrate quality. The evidence did not suggest any undesirable effects with respect to serum lipids, blood pressure or quality of life from lower total fat intake, but rather of small benefits or no effect (all high certainty evidence, except for quality of life, which was assessed as low certainty evidence). No mitigating factors were identified that would argue against limiting total fat intake to 30% of total energy intake or less.

Remarks for recommendation 1

This recommendation is relevant for individuals aged 20 years or older.

The goal in developing this guideline was to provide recommendations for both adults and children. However, the evidence was considered insufficient to support the formulation of a recommendation for children owing to the limited number of studies and inconsistent results identified for children (14), and the conclusion that the adult data could not reasonably be extrapolated to children given the unique energy requirements for optimal growth and development throughout childhood and adolescence. Previous expert consultations on dietary fats have concluded that for children aged 6 months and above and adolescents, total fat intakes of up to 35% of total energy are appropriate to meet growth demands without leading to excess energy intake (59).¹

The threshold of 30% in this recommendation should not be interpreted as an upper value of intake to be achieved by increasing fat intake among those with nutritionally adequate total fat intakes that are already less than 30% of total energy intake.

Evaluation of the evidence suggests that the observed effect of reducing total fat intake on measures of body fatness is mediated, at least in part, by dietary behaviours that affect energy balance. In most trials, those who reduced their total fat intake also decreased their total energy intake (even though that was not intended in the trial design), and this led to decreasing weight. This finding suggests that there may be a tendency for those habitually consuming greater amounts of total fat to also consume more energy than needed, resulting in excess energy intake and subsequent weight gain. However, individuals who can maintain energy balance (or otherwise prevent excess energy intake) at higher fat intakes may be able to consume total fat at levels greater than 30% of total energy intake without increasing their risk of unhealthy weight gain.

The scope of this guideline was limited to developing recommendations for the prevention of unhealthy weight gain, not for the management of existing overweight or obesity. Therefore, studies conducted with overweight participants actively pursuing weight loss (i.e. “weight loss studies”) were not included in the systematic review used to inform the recommendation. The recommendation may therefore not apply to individuals actively pursuing weight loss through modification of the diet, although current evidence does suggest that lower fat, restricted-calorie diets may be one of several effective, short-term strategies for losing excess body weight (50, 69).

This recommendation should not be interpreted as implying that total fat is the only risk factor for unhealthy weight gain and that reducing total fat intake alone is sufficient to prevent unhealthy weight gain. The etiology of unhealthy weight gain is complex and can involve many different inputs. Therefore, this recommendation should be considered in the context of other relevant WHO guidance, including that on the intake of free sugars (63), carbohydrates (64), non-sugar sweeteners (65), energy requirements (70) and physical activity (71).

¹ Infants should be exclusively breastfed for the first 6 months of life to achieve optimal growth, development and health. Thereafter, to meet their evolving nutritional requirements, infants should receive nutritionally adequate and safe complementary foods, while continuing to breastfeed for up to 2 years or beyond (9, 68).
Dietary fat, including essential fatty acids (which cannot be synthesized by the human body), is necessary for proper physiological function. To ensure an adequate intake of energy and essential fatty acids, and to facilitate the absorption of lipid-soluble vitamins, total fat intake in most adults should be at least 15–20% of total energy intake (58).

The decision to implement this recommendation must be made in the context of achieving or maintaining nutritional adequacy and avoiding excess energy intake. In populations where undernutrition is not prevalent, the recommendation can generally be safely implemented as needed, provided that individual energy requirements are met (70), and recognizing that energy requirements are increased in pregnant and lactating women (9, 10, 70). Consideration must be given to populations in which prevalence of undernutrition is a concern and where total fat intake may already be low. In such settings, maintaining or even increasing total fat intake of individuals (in line with guidance on fat quality in recommendation 2) may be important to achieve adequate energy intake, as well as maintain or improve the overall diet.

Rationale for recommendation 2

This recommendation is taken from recommendations found in the WHO guideline, Saturated fatty acid and trans-fatty acid intake for adults and children (62) which are based on effects of these nutrients on mortality and CVD outcomes.

Remarks for recommendation 2

This recommendation is relevant for all individuals aged 2 years and older.

This recommendation, taken together with recommendation 1, acknowledges that both quantity and quality of fat consumed are important for health and nutritional well-being.

Further remarks may be found in the WHO guideline, Saturated fatty acid and trans-fatty acid intake for adults and children (62).

Translation and implementation

These recommendations should be considered in the context of other WHO guidelines on healthy diets to guide effective policy actions and intervention programmes to promote healthy diets and nutrition, and prevent obesity and diet-related NCDs.

A detailed discussion of how the recommendations on total fat intake might be implemented is beyond the scope of this guideline, however they can be considered by policy-makers and programme managers when discussing possible measures, including:

- assessing current intake of total fat in their populations relative to a benchmark;
- developing policy measures to reduce intake of total fat, where necessary, through a range of public health interventions, many of which are already being implemented by countries, including:
  - nutrition labelling (i.e. mandatory nutrient declaration) and front-of-pack labelling systems
  - regulation of marketing food and non-alcoholic beverages that are high in total fat, including bans on marketing of food that contains industrially produced trans-fat
  - restricting the sales and promotion of food and beverages that are high in total fat in and around schools
  - fiscal policies targeting foods and beverages that are high in total fat
  - consumer education
- developing strategies to reformulate food products; and
- translating at the country-level into culturally and contextually specific food-based dietary guidelines that take into account locally available food and dietary customs.

The recommendations in this guideline acknowledge that both quantity and quality of fat consumed are important for maintaining health. Public health interventions should therefore aim to reduce total fat intake.
where necessary, while reducing saturated fatty acid and trans-fatty acid intake, through replacement with unsaturated fatty acids or carbohydrates as needed (62), and without increasing free sugars intake (63).

Providing overall dietary guidance is outside the scope of this guideline because such guidance should be based on overall dietary goals that consider all required nutrients. However, it is feasible to achieve the recommendations in this guideline while respecting national dietary customs, because a wide variety of fresh foods are naturally low in fat, and reduced fat versions of whole foods such as reduced fat dairy foods and lean cuts of meat are available in many countries. Highly processed foods that are high in fat should be replaced with whole foods where possible, because many highly processed fat-free and low-fat products contain free sugars and may contain as many calories as full-fat versions.

The decision to implement this recommendation must be made in the context of achieving or maintaining nutritional adequacy and avoiding excess energy intake. In populations where undernutrition is not prevalent, the recommendation can generally be safely implemented as needed, provided individual energy requirements are met (70), recognizing that energy requirements are increased in pregnant and lactating women (9, 10, 70). Consideration must be given to populations in which prevalence of undernutrition is a concern and where total fat intake may already be low. In such settings, maintaining or even increasing total fat intake of individuals (in line with guidance on fat quality in recommendation 2) may be important to achieve adequate energy intake, and to maintain or improve the overall diet.
References

References for which a URL is listed were last accessed on 25 May 2023.


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