Proceedings of ICBioMed 2025 Symposium: AI for Healthcare: Advanced Medical Data Analytics and Smart Rehabilitation
DOI: 10.54254/2753-8818/2025.AU28388

An Analysis Based on the Effects of Low-carbohydrate High-protein (LCHP) and Low-carbohydrate High-fat (LCHF) Diets on Adult Weight Management: an Analysis Based on Literature Review

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Abstract. This paper reviews the comparative effects of Low-Carbohydrate High-Protein (LCHP) and Low-Carbohydrate High-Fat (LCHF) diets on weight management and metabolic health in non-obese adults. In this work, a systematic analysis of 15 randomized controlled trials and reviews was conducted to evaluate outcomes including weight loss, body composition, and lipid profiles. The findings indicate that both LCHP and LCHF diets are effective for short-to-medium term weight reduction and improving triglycerides and HDL cholesterol. However, LCHP diets demonstrate superior lean mass preservation and a more neutral effect on LDL cholesterol, whereas LCHF diets may raise LDL if high in saturated fat. This work underscores that beyond macronutrient ratio, food quality—such as lean protein and unsaturated fat sources—plays a critical role in optimizing health outcomes. The study highlights the need for long-term, large-scale trials to further clarify sustained impacts and support personalized dietary recommendations.

Keywords: Low-carbohydrate high-protein diet (LCHP), low-carbohydrate high-fat diet (LCHF), Weight loss, Triglyceride levels, Randomized controlled trial (RCT)

1. Introduction

Low-carbohydrate, high-protein (LCHP) and low-carbohydrate, high-fat (LCHF) are 2 distinct nutritional strategies; they have gathered considerable attention due to their potential effects in weight management and metabolic health [1,2]. From the latest estimations, global trends of overweight and obesity continued from 1990 to 2022, and dietary intervention is the core method for weight management [3]. Low-carbohydrate diets have garnered widespread attention in both academic fields and public views. The are a variety of reasons why low-carbohydrate diets have gained considerable popularity. Partly due to its significant reduction of triglycerides and

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DOI: 10.54254/2753-8818/2025.AU28388

improvement in insulin sensitivity in short-term consumption. For instance, a meta-analysis in a paper by Clifton showed that a high-protein diets have positive impacts on blood triglyceride level, as well as multiple randomized controlled trials have shown their positive effects on blood glucose and blood pressure [4-5]. Compared to traditional high-carbohydrate diets, high-fat and high-protein diets show more effective results in reducing fasting triglyceride and insulin levels [6]. Additionally, under calorie restriction, both ketogenic diet and non-ketogenic LCHF diets can greatly reduce adipose tissue as well as preserving muscle strength [7]. Furthermore, a short-to-medium-term study has shown that high-protein diet enhances satiety and promotes weight loss with clear short-term benefits [4]. Therefore, multiple studies collectively demonstrate an increase in public acceptance of LCHP and LCHF diet.

Although the overall acceptance of both diets increases, LCHF diet usually faces more skepticism than LCHP diet [8]. This hesitance might come from long-term concerns about the connection between high fat intake, elevated cholesterol, and low-density lipoprotein cholesterol (LDL-C) levels, and potential increase in cardiovascular risks [6,8]. For example, some studies have found that although LCHF diet can achieve weight loss in the short term, it might also cause an increase in LDL-C level [9]. Another study found that compared to traditional low-fat diet, LCHF diet has no improvement in long-term weight management and improvement of cardiovascular risks [10]. Moreover, many studies have reported that the effects on reducing blood triglyceride are inconsistent: some found that LCHF diet can reduce triglycerides (TG) and enhance high-density lipoprotein cholesterol (HDL-C), but their effects on low-density lipoprotein cholesterol (LDL-C) are uncertain, even reporting an increase in LDL-C [9]. In contrast, other studies have suggested that LCHP diet has a greater advantage in long-term weight maintenance and improvement of body composition (such as preserving lean body mass). However, its effect on increasing the lipid profile (such as the reduction of LDL-C) might not be as significant as reported in other LCHF diet studies [4,11].

To resolve these contradictions and comprehensively compare the effectiveness of LCHP and LCHF diets, this review focuses on weight loss, and compares their improvement their strength in promoting weight loss. This review focuses on comparing the effects of the weight management LCHP diet and LCHF diet in non-obese adults. Specifically, focusing on the impacts on weight loss, waist circumference, lean body mass, fasting blood glucose, lipid, lipoprotein, and serum triglyceride levels. Given that past reviews have suggested that macronutrient might affect body composition and metabolic marker during weight loss, this review will compare the effects of the low-carbon, high protein diet (LCHP) and low-carbon, high fat diet (LCHF) on the primary and secondary outcomes of the examined study indicators, and analyze the differences in food composition of each diet across different studies [11].

2. Methodology

This review included a systematic search that focused on the narrative literature review containing definitions of diets, exclusion criteria and inclusion criteria, study variables, and conclusions of variable comparisons to the study findings. This review conducted a literature search on PubMed, Google Scholar, and Web of Science, time range from year 2002 to 2025. This review included diet-based terms: "low-carbohydrate high-protein diet", "low-carbohydrate high-fat diet", "LCHP", "LCHF", as well as outcomes-based terms: "weight loss", "weight management", "body composition", "BMI", "body fat percentage", "waist circumference", “fasting blood glucose”, “Triglyceride levels”, “lipoproteins”. The review includes 15 English randomized controlled trials (RCTs) and reviews. These papers compare the effect of weight loss on LCHP and LCHF diets in

DOI: 10.54254/2753-8818/2025.AU28388

non-obese adults. To be specific, each study must report at least one of the following outcomes: body weight, waist circumference, lean body mass or body composition (main outcomes), blood sugar, lipids, lipoproteins, and triglyceride (TG) levels (secondary outcomes).

The definition of low-carbohydrate, high-protein (LCHP) diet stratifies that ≤30% of the total energy comes from carbohydrates, and ≥25% of the total energy comes from protein; the remainder comes from fat. To be specific, high-protein foods include poultry, lean meat, egg whites, fish, and low-fat dairy products [11,12]. Moreover, high-protein diet mainly reduces fat intake by replacing refined carbohydrates with vegetables and fruits, thus reducing carbohydrate intake as well as fat consumption [13]. The high-fat food source includes animal-sourced fats and protein (such as red meat, bacon, butter, cheese), while consuming food rich in monounsaturated fats (such as avocados, nuts), and largely restricting high sugar fruit and staple carbohydrates. We collected data from each study on diet composition, follow-up time, and the outcomes mentioned above, and compared the overall effects of LCHP and LCHF diets on weight loss and metabolic health.

The examined articles were evaluated against inclusion and exclusion criteria consistent with the PICO method. Specifically, the inclusion criteria contains original research studies published in English, as well as peer-reviewed studies with inclusion of RCTs, cohort studies, meta-analyses, and reviews. Specifically, this review included research of non-diabetic adults with interventions of not simultaneously taking LCHP or LCHF diet. And we include research outcomes involving at least one primary outcome (body weight, body fat percentage, or waist circumference) or at least one secondary metabolic outcome (fasting blood glucose, triglyceride (TG) level, or lipids/lipoproteins). Every selected article was checked to confirm that the variable of interest was included. For exclusion criteria, this study excluded animal studies, pediatric, elderly, diabetic populations, studies combining diets with drug or structured exercise programs, and non-English or inaccessible full-text articles. This review extracts data in articles associated to study design, sample size, participant demographics, diet duration, macronutrient composition, outcome measures, and key findings. By summarizing the extract paragraph, this synthesis approach includes a narrative summary of trends, conflicts, and evidence strength.

3. Results

This study systematically searched and screened findings from 15 randomised controlled trials (RCTs) and systematic reviews published after 2005, aiming to compare the effects of low-carb and high-protein (LCHP) and low-carb and high-fat (LCHF) diets on weight management, body composition changes and metabolic health markers in non-obese adults. Through the comprehensive analysis of various studies, the main results are as follows:

3.1. Weight and waist circumference

Evidence from the included studies shows that both dietary strategies considerably reduced body weight and waist circumference. Across the exams, participants following either the LCHP or LCHF diets achieved moderate weight loss, ranging from 5 to 10 kg, with reductions in waist circumference of approximately 5–6 cm within 6–12 months. In long-term follow-up (12 months and above), there was a general partial recovery of body weight. The POUNDS LOST study showed that the weight of the groups with different macronutrient ratios increased by about 40% at 2 years, and the difference between groups was not significant, indicating that energy deficit rather than diet type was the main driver of weight change.

DOI: 10.54254/2753-8818/2025.AU28388

3.2. Body composition

Low-carbohydrate, high-protein (LCHP) diets were more effective at preserving lean body mass. Specifically, diets containing at least 25% of energy from protein consistently resulted in less loss of lean tissue compared to high-carbohydrate diets. For instance, individuals following high-protein diets generally experienced only a slight reduction in lean mass, ranging from 0.1 to 2.6 kg, which was significantly lower than that in control groups. In contrast, results from low-carbohydrate, high-fat (LCHF) diets were less consistent, which can be partly attributed to their moderate protein content. However, when protein intake was sufficient (at least 1.2 g per kg of body weight) and calorie intake was controlled, both LCHP and LCHF diets mainly led to a reduction in fat mass, with no major loss of lean mass.

3.3. Metabolic indicators

In terms of lipid metabolism, the LCHF diet showed more significant effects in reducing triglycerides (TG) and increasing high-density lipoprotein (HDL), while the lipid regulation effect of the LCHP diet was relatively mild. It is important to note that the LCHF diet may lead to elevated low-density lipoprotein (LDL) levels, especially when high in saturated fat. In contrast, the LCHP diet had a more neutral effect on LDL levels, showing a better lipid safety profile. Overall, the differences in the effects of the two dietary patterns on blood lipids showed that the source and quality of dietary fat were key factors in regulating blood lipid response, and the preferential intake of unsaturated fats was of positive significance for the improvement of blood lipid indicators.

3.4. Dietary composition and food quality

The results suggested that in addition to macronutrient ratios, food quality and nutrient sources also played a key role in the results. LCHP emphasized lean meat, fish, egg whites and low-fat dairy products to reduce additional added fat. On the other hand, LCHF, mostly followed the Atkins or ketogenic model and was rich in animal fat. Some studies have shown that a preference for plant protein and unsaturated fat sources could achieve more favourable lipid improvement in low-carb mode and avoid undesirable LDL elevation. This suggested that diet quality was just as important as its composition.

According to Table 1, the included studies are primarily RCTs and reviews, most of which are rated as high or moderate quality despite common limitations such as small samples, high dropout rates, and variability in adherence measurement.

Table 1. Quality of evidence and methodological characteristics of included studies

Study (Author, Year)	Design	Sample Size	Follow-up Duration	Randomization / Control	Adherence Reporting	Main Limitations	Overall Quality Rating
McAuley et al., 2005	RCT	88	24 weeks	Yes / Yes	Reported (dietary records)	Small sample, female only	Moderate
Clifton et al., 2014	RCT	118	12 months	Yes / Yes	Reported	Dropout rate high	High
Santos et al., 2012 (Meta-analysis)	Meta-analysis	17 RCTs (n=1141)	3–36 months	Yes (pooled)	Varies	Heterogeneity across trials	High

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Table 1. (continued)

Hu & Bazzano, 2014 (Review)	Systematic review	Multiple	≥6 months	Varies	Not consistent	Included observational data	Moderate
DIRECT (Shai et al., 2008)	RCT	322	24 months	Yes / Yes	Reported (urine biomarkers)	Male-dominant sample	High
POUNDS LOST (de Souza et al., 2012)	RCT	424	24 months	Yes / Yes	Reported (biomarkers + recalls)	Poor adherence	High
Brinkworth et al., 2009	RCT	118	12 months	Yes / Yes	Reported	Dropouts, limited generalizability	Moderate
Vidic et al., 2021	RCT	18	8 weeks	Yes / Yes	Reported	Very small sample, short follow-up	Low
Other smaller RCTs	RCT	20–60	6–12 months	Yes / Yes	Limited	Self-reported diet intake	Moderate

Table 1 references: McAuley et al., 2005 [6]; Clifton et al., 2014 [4]; Santos et al., 2012 [9]; Hu & Bazzano, 2014 [5]; Shai et al., 2008 [15]; de Souza et al., 2012 [20]; Brinkworth et al., 2009 [14]; Vidic et al., 2021 [7]

According to Table 2, by summarizing the 11 main references closely related to the content of this study, it can be concluded that low-carbohydrate diets (LCD) generally led to greater short-term weight loss and improved triglyceride levels compared to low-fat diets, although the effects on body composition and long-term outcomes were less consistent across studies.

Table 2. Summary of included studies

#	Study (Author, Year)	Design / Population	Intervention (diet & duration)	Weight change (kg)	Waist change (cm)	Body composition (fat / lean mass)	TG change	Notes / source
1	McAuley et al., 2005	RCT; insulin-resistant obese women	HP (LCHP) vs HF (LCHF) vs HC; 6 mo	HP ≈ −6.6; HF ≈ −7.2; HC ≈ −5.9	HP −2.8; HF −4.4; HC −2.8	Fat mass: HP −2.7 kg; HF −2.8 kg	TG ↓ in LC groups; LDL ↑ in some HF	McAuley 2005 Table 2 / figures
2	Clifton et al., 2014	Systematic review & meta-analysis (14 RCTs)	LCHP vs controls; ≥12 mo	LCHP ≈ −1.7 to −2.5 more loss at 12–24 mo	Waist: LCHP ≈ −1.1 cm greater	Fat: mixed, trend favor LCHP	TG improved in LCHP; LDL inconsistent	Clifton 2014 meta-analysis
3	Brinkworth et al., 2009	RCT; abdominally obese adults (n=69 complete)	LC vs LF; 12 mo	LC −14.5 ±1.7 ; LF −11.5 ±1.2	NR	Fat: LC −11.3 ; LF −9.4 ; Lean: LC −3.2 ; LF −2.3	TG: LC −0.58 mmol/L ; LF −0.22 mmol/L	Brinkworth 2009 Table 3–4
4	Vidic et al., 2021	RCT; trained middle-aged men (n=18 complete)	Ketogenic LCHF vs non-ketogenic LCHF; 8 wk	Both ↓ (no exact values)	NR	Fat and LBM both ↓ (Figures)	No significant change	Vidic 2021 text/figures
5	Santos et al., 2012	Meta-analysis (17 RCTs; n≈1,141 obese)	LCD vs control; 3–36 mo	−7.04 (mean change vs baseline)	−5.74	Fat/lean NR	−29.71 mg/dL	Santos 2012 Tables 4–15

DOI: 10.54254/2753-8818/2025.AU28388

Table 2. (continued)

6	Hu & Bazzano, 2014	Review (RCTs + observational)	LCD (≤45% CHO) vs LF; ≥6 mo	6 mo: LCD often superior; 12 mo: narrow	Range −2.2 to −9.5 across studies	Fat & lean both reduced; no advantage	TG: larger ↓ with LCD	Review summary
7	POUNDS LOST, 2012	RCT; overweight adults (n≈424), 2 yr	Four diets varying protein/fat/CHO; 2 yr	−6.3 at 6 mo; net −3.8 at 24 mo	Abdominal fat −2.3 kg (CT)	Fat −4.2 ; Lean −2.1 (6 mo avg)	TG NR	POUNDS LOST trial
8	DIRECT (Shai et al.), 2008	RCT; n=322, 2 yr	LF vs Mediterranean vs LC	LF −2.9 ; Med −4.4 ; LC −4.7	Med notable ↓ (tables)	Body composition NR	TG ↓ LC; HDL ↑ LC; LDL ↓ Med	DIRECT NEJM 2008
9	Wycherley et al., 2012	RCT; overweight/obese males; 52 wk	High-protein vs high-carb (isocaloric); 52 wk	Small differences	See paper	DXA measured; no consistent differences	TG/lipids reported	Wycherley 2012
10	Sackner-Bernstein et al., 2015	Meta-analysis (LCD vs LF)	Overweight/obese adults; multiple RCTs	LCD greater short-term loss	NR	Body composition NR	TG commonly ↓ with LCD	Sackner-Bernstein 2015 meta
11	Farnsworth et al., 2003	RCT; overweight/obese, hyperinsulinemic (n=57)	HP (27% kcal) vs SP (16%); 16 wk	HP −7.8 ±0.7 ; SP −7.9 ±0.6	NR	Fat ↓ both; Female lean: HP −0.1 vs SP −1.5	TG: HP −23–29%; SP −10–12%	Farnsworth 2003 tables

Abbreviations: RCT = randomized controlled trial; LCHP = low-carbohydrate high-protein; LCHF = low-carbohydrate high-fat; LF = low-fat; LC = low-carbohydrate; LCD = low-carbohydrate diet; HP = high-protein; SP = standard protein; HC = high-carbohydrate; Med = Mediterranean; LBM = lean body mass; NR = not reported.

Table 2 references: McAuley et al., 2005 [6]; Clifton et al., 2014 [4]; Brinkworth et al., 2009 [14]; Vidic et al., 2021 [7]; Santos et al., 2012 [9]; Hu & Bazzano, 2014[5]; Shai et al., 2008 [15]; Wycherley et al., 2012 [11]; Sackner-Bernstein et al., 2015 [17]; Farnsworth et al., 2003 [13]

4. Discussion

This study provides a comprehensive comparison of the effects of low-carbohydrate high-protein (LCHP) and low-carbohydrate high-fat (LCHF) diets on weight management in adults. Overall, current evidence indicates that both low-carbohydrate dietary patterns lead to significant reductions in body weight and waist circumference compared to traditional high-carbohydrate diets, demonstrating more pronounced short-term (≤6–12 months) improvements in weight loss and abdominal adiposity [9,14]. For instance, a meta-analysis by Santos et al. (2012) reported an average weight loss of approximately 7 kg and a waist circumference reduction of about 5–6 cm among participants following a low-carbohydrate diet. Among the studies included in this review, LCHP and LCHF diets generally resulted in body weight reductions ranging from 5 to 10 kg, with the extent varying based on intervention duration and population characteristics. In head-to-head comparative trials of the two low-carbohydrate diets, most studies reported similar total weight loss between groups at the 12-month mark [10,15]. For example, the DIETFITS trial conducted by Gardner et al. (2018), which compared a "healthy low-carbohydrate" diet with a "healthy low-fat" diet under isocaloric conditions, observed mean weight losses of 6.0 kg and 5.3 kg at one year, respectively, with no statistically significant difference. Similarly, Sacks et al. (2009) conducted a

DOI: 10.54254/2753-8818/2025.AU28388

large randomized controlled trial (N=811) comparing four energy-reduced diets with varying fat and protein compositions. At two-year follow-up, all groups achieved an average weight reduction of approximately 4 kg, suggesting that a negative energy balance is the primary determinant of weight loss, while macronutrient composition has limited impact on long-term outcomes [16]. It is worth noting that in some short-term trials of around six months, strictly ketogenic LCHF groups initially exhibited slightly faster weight loss compared to high-carbohydrate control groups, though this advantage generally diminished by the one-year mark [17]. In summary, both LCHP and LCHF diets can yield significant weight loss and waist circumference reduction, provided a sustained negative energy balance is maintained.

Regarding body composition, the two low-carbohydrate diets showed slight differences in their effects on lean mass. Increasing the proportion of protein intake typically helps preserve lean body tissue during weight loss [11,18]. Research indicates that increasing dietary protein energy percentage by at least 5% relative to control yields more pronounced fat loss, though the overall effect size remains modest [4]. This suggests that moderately elevating protein proportion and specifying macronutrient allocation within a low-carbohydrate framework may optimize body composition outcomes [4]. Multiple trials support the advantages of high-protein diets: Wycherley et al. (2012) conducted a 52-week isocaloric intervention in obese men, finding that the high-protein group lost only 2.6 kg of lean body mass, significantly less than the 3.8 kg lean mass loss in the high-carbohydrate group. Similarly, Farnsworth et al. (2003) compared diets with 27% vs. 16% protein. Women in the high-protein, low-carb group experienced negligible lean tissue loss (only -0.1 kg change in lean body mass), significantly outperforming the high-carb control (approximately 1.5 kg lean mass loss). In direct comparisons, McAuley's LCHF and LCHP diets both yielded greater weight and waist circumference reductions than the high-carb control. However, the “lean mass” preservation between the two low-carb approaches did not consistently favor one over the other (both groups in McAuley's study experienced some lean mass loss; conversely, Wycherley et al. showed that under isocaloric conditions, high protein was more beneficial for preserving lean mass and promoting greater fat loss). High-protein diets provide sufficient amino acids to maintain muscle synthesis, and higher protein intake during weight loss can prevent excessive muscle breakdown [11]. In contrast, the effects of the classic LCHF diet on lean body mass remain controversial due to its moderate protein content (typically 15–25% of calories) and strict carbohydrate restriction. While some researchers propose that ketone bodies exert a protein-sparing effect, potentially protecting muscle under low-carbohydrate conditions [19], empirical findings do not consistently align with theoretical studies. de Souza et al. (2012) analyzed subgroup data from the renowned POUNDS LOST trial, finding no significant differences in lean body mass loss between groups at 6 months or 2 years, even with protein ratios of 25% vs. 15% and fat ratios of 40% vs. 20% [20]. This suggests that when macronutrient differences are moderate and adherence is comparable, lean body mass changes primarily depend on the magnitude of weight loss itself. However, when protein intake differences are sufficiently large, the high-protein group demonstrates a more pronounced advantage in preserving lean body mass [11,13]. Additionally, in weight loss interventions combined with resistance training, both low-carbohydrate diets effectively maintained muscle mass and strength. Vidić et al. (2021) conducted an 8-week isocaloric fat-loss intervention in middle-aged men, comparing a strict ketogenic LCHF diet with a slightly higher-carbohydrate non-ketogenic LCHF diet. Results showed comparable lean body mass loss in both groups, with no significant muscle loss observed and maintained muscle strength [7]. Thus, under calorie-controlled conditions with adequate protein intake (e.g., ≥1.2 g/kg body weight), both LCHP and LCHF primarily achieve weight loss through fat reduction without significantly compromising lean body

DOI: 10.54254/2753-8818/2025.AU28388

mass [7]. Overall, high-protein, low-carbohydrate diets are more favorable for preserving lean body mass [11,18]. This is particularly important for fitness enthusiasts aiming to reduce body fat while maintaining muscle mass to preserve physique, as well as overweight individuals seeking to reduce fat through diet to sustain healthy metabolic function.

The results of direct comparison trials on lipid metabolism improvement indicators show that both high-fat and high-protein low-carbohydrate diets improve weight, waist circumference and triglycerides; however, there are significant differences in low-density lipoprotein (LDL): in the high-fat group, some subjects experienced an increase in LDL of more than 10% [6]. The beneficial effects of low-carbohydrate diets on triglycerides (TG) and high-density lipoprotein cholesterol (HDL) are prominent: in short-term (≤6-12 months) interventions, both low-carbohydrate strategies are often accompanied by a decrease in triglycerides and an increase in high-density lipoprotein (HDL) [5]. Particularly, a strict LCHF diet is highly effective in reducing triglycerides, while an LCHP diet also has certain benefits. This is because it is generally believed that reducing carbohydrate intake can lower insulin levels, thereby reducing liver VLDL synthesis and TG output, leading to a significant decrease in plasma triglycerides [9]. Multiple randomized controlled trials consistently report that LCHF diets can significantly reduce TG, often to a greater extent than isocaloric high-carbohydrate diets [9,14]. For instance, in a two-year study by Shai et al. (2008), the Atkins-style LCHF diet reduced TG by an average of 23 mg/dL in subjects, significantly outperforming the low-fat control group. Similarly, Brinkworth et al. (2009) found that the strict ketogenic LCHF group (with about 4% of calories from carbohydrates) had a TG reduction of 0.36 mmol/L (about 32 mg/dL) after one year, a decrease significantly greater than that of the high-carbohydrate low-fat group. In LCHP diets, due to less extreme carbohydrate restriction compared to ketogenic diets, the reduction in TG is sometimes slightly smaller than that of LCHF. Nevertheless, high-protein low-carbohydrate diets still show greater improvement in TG compared to high-carbohydrate diets [13]. In 2003, Farnsworth et al. found that a low-carbohydrate diet with increased protein proportion reduced triglycerides by an average of 23%, while a conventional high-carbohydrate diet only reduced them by about 10%. Similarly, Noakes et al. (2005) observed a significant reduction in TG and an increase in HDL in the high-protein low-carbohydrate group in their study on obese women. It is particularly important to note that if the carbohydrate intake of the two diets is not significantly different and the weight loss is similar, the difference in the degree of triglyceride improvement may be reduced. For example, Wycherley et al. (2012) reported that in their study, the high-protein group (with about 40% of calories from carbohydrates) and the high-carbohydrate group (with about 58% of calories from carbohydrates), under the same calorie intake and similar weight loss, both groups had a reduction in TG of about 24%, with no statistically significant difference. Additionally, systematic reviews and meta-analyses further support the advantages of low-carbohydrate diets in weight and lipid improvement. Mansoor et al. (2016) summarized 19 randomized controlled trials, showing that low-carbohydrate diets led to a significantly greater weight loss in the short term compared to low-fat diets, and were superior to low-fat diets in reducing triglycerides and increasing HDL cholesterol, while the differences in total cholesterol and fasting blood glucose were not significant [21]. This finding provides more solid evidence for the potential role of low-carbohydrate diets in controlling the risk of metabolic syndrome. In summary, any effective weight loss that leads to a reduction in fat can lower triglycerides, but the less carbohydrate intake, the more significant the decrease in TG is usually observed [9]. Additionally, LCHF diets are often associated with increased HDL cholesterol and improved fasting blood glucose/insulin levels, and these favorable changes in glucose and lipid metabolism have been reported in multiple studies [9,14]. However, comparative studies in non-

DOI: 10.54254/2753-8818/2025.AU28388

diabetic subjects have shown inconsistent differences in fasting blood glucose among different low-carbohydrate regimens, suggesting that for blood glucose, the impact of dietary macronutrient composition may be less significant than the effect of weight loss itself in non-diabetic populations [6].

The trade-off is that the effect of LCHF diets on low-density lipoprotein cholesterol (LDL) is heterogeneous, depending on the quality of fat sources. Certain LCHF protocols characterized by high saturated fat intake may elevate LDL. For instance, Brinkworth et al. (2009) reported an average LDL increase of 0.6 mmol/L in their LCHF group; similarly, McAuley et al. (2005) observed LDL increases exceeding 10% in some individuals within their high-fat, low-carbohydrate group. Therefore, when implementing LCHF, attention should be paid to the types of fats consumed, prioritizing monounsaturated and polyunsaturated fats (e.g., nuts, olive oil, fish) to mitigate potential adverse effects [15]. In contrast, the LCHP approach typically has a smaller impact on LDL due to moderate total fat intake and an emphasis on lean protein and low-fat dairy, resulting in lower saturated fat consumption. It also tends to lower triglycerides while reducing total cholesterol [11]. Overall, low-carbohydrate, high-fat diets demonstrate superior efficacy in lowering triglycerides and elevating HDL. High-protein, low-carbohydrate diets also significantly reduce TG, though to a lesser extent than ketogenic high-fat approaches [11,18]. Both low-carbohydrate diets significantly outperformed high-carbohydrate diets in reducing hypertriglyceridemia risk [9]. Notably, studies employing modified low-carbohydrate approaches have demonstrated the potential to maintain these benefits while avoiding LDL elevation. For example, Shai et al. (2008) emphasized selecting plant-based proteins and fats (e.g., legumes, nuts, olive oil) while restricting trans fats in their low-carb group. This plant-fat-leaning low-carb diet reduced TG without elevating LDL, and can be considered an “Eco-Atkins” approach. This demonstrates that different fat sources (saturated vs. unsaturated) yield distinct lipid responses: LCHF diets dominated by unsaturated fats typically lower TG without elevating LDL, whereas excessive saturated fat may carry a risk of increasing LDL.

Additionally, differences in specific food choices between LCHP and LCHF may also influence weight loss and metabolic outcomes. Most LCHF studies follow the classic Atkins or ketogenic dietary patterns, permitting ample intake of animal-derived fats and proteins (e.g., red meat, bacon, butter, cheese), while also including foods rich in monounsaturated fats (e.g., avocados, nuts), and strictly limiting starchy foods and high-sugar fruits. In contrast, LCHP studies typically employ a high-protein, low-fat approach, with protein primarily sourced from lean meats, poultry, fish, egg whites, and low-fat/skim dairy products [11-12]. The high-protein group typically reduces added fats, replacing refined carbohydrates with vegetables and moderate fruit portions to control total fat intake while lowering carbohydrates [13]. For example, in Wycherley et al.'s (2012) trial, the high-protein group consumed approximately 40% of total energy from carbohydrates, primarily from vegetables and low-GI grains; while the control high-carbohydrate group consumed nearly 60% of energy from carbohydrates, including more whole grains and fruits. Both groups maintained fat intake at around 25%, highlighting the difference in protein and carbohydrate sources. Although the high-protein group still consumed about 40% of energy from carbohydrates, this represented a significant reduction compared to the control group and was primarily from fiber-rich carbohydrates. This led to superior body composition changes (greater fat loss with less lean tissue loss). This phenomenon is closely linked to carbohydrate quality: at similar low-carb intake levels, prioritizing high-fiber, minimally processed carbohydrate sources typically correlates with more favorable cardiometabolic markers [5]. A recent large-scale prospective study further underscores the importance of nutrient quality: high-quality low-carbohydrate diets (rich in plant protein and

DOI: 10.54254/2753-8818/2025.AU28388

healthy fats) were associated with slower long-term weight gain, whereas low-quality low-carbohydrate diets tended to yield opposite outcomes [22]. This suggests that focusing solely on macronutrient ratios (such as carbohydrate quantity) is insufficient to determine weight loss outcomes; the quality of foods and nutrients is equally critical for long-term weight management. Similarly, the latest systematic review indicates that differences between low-carbohydrate and balanced-carbohydrate diets in average weight and most cardiovascular risk factors are generally small. However, improvements in specific indicators like blood lipids and blood pressure often depend on both the total amount and quality of carbohydrates consumed [23]. Therefore, both macronutrient ratios and food choices should be considered holistically to achieve weight loss goals while maximizing metabolic improvements.

Based on the existing evidence, both LCHP and LCHF can be effective strategies for weight management in adults. If the goal is to optimize metabolic indicators such as blood lipids, it is recommended to prioritize a higher proportion of high-quality protein and unsaturated fats within a low-carbohydrate framework, while limiting saturated fats and refined carbohydrates. Such a plan is expected to achieve weight loss while minimizing triglycerides, increasing HDL, and avoiding abnormal elevations in LDL [5-6]. A high-protein, low-carbohydrate diet, by increasing dietary protein and fiber intake, can simultaneously promote weight loss and improve body composition, potentially offering a more favorable impact on cardiovascular metabolism. It is important to note that enhancing the quality of the diet is often more crucial than merely adjusting the proportion of macronutrients [24]. The design of a low-carbohydrate diet should focus on selecting healthy sources of fats and carbohydrates to maximize health benefits.

This review also has certain limitations. First, different studies have varying definitions and intervention details for LCHP and LCHF, increasing the heterogeneity of comparative analysis. Second, most of the included RCTs have limited sample sizes and short follow-up periods (mostly 6 to 12 months), making it difficult to assess long-term effects. Poor participant compliance and high dropout rates in some trials may also weaken the demonstration of true differences between diets. Additionally, this study mainly focuses on non-diabetic normal adults and does not specifically target obese or overweight individuals. However, since a portion of the existing literature selects obese and overweight individuals as the primary target groups for experimental research, we have not excluded studies on overweight and obese individuals in our objectives, but have also included reviews of other study subjects in different research contexts; at the same time, the applicability of the results to special populations such as diabetic patients and the elderly should be interpreted with caution. Despite these limitations, the overall quality of the current evidence is acceptable and supports our main conclusions. Future research should conduct longer-term (>2 years) and large-scale randomized controlled trials to observe the sustained effects of different low-carbohydrate diets on weight and cardiovascular outcomes, and further explore the long-term effects of macronutrient composition and specific food sources on health [23,25]. At the same time, future studies should focus on methods to improve diet intervention compliance and explore strategies for customizing personalized low-carbohydrate diets based on individual metabolic characteristics. This will help to more comprehensively understand the advantages and disadvantages of the two types of low-carbohydrate diets, high-protein and high-fat, and provide more precise nutritional guidance for clinical practice and public health.

5. Conclusion

In summary, this study demonstrates that both high-protein, low-carbohydrate (LCHP) and high-fat, low-carbohydrate (LCHF) diets are effective in reducing body weight and waist circumference over

DOI: 10.54254/2753-8818/2025.AU28388

the short to medium term, as well as improving blood lipid profiles, outperforming traditional high-carbohydrate diets.

The differences between the two diets are mainly observed in the following aspects:

LCHP diets offer greater advantages in preserving lean body mass, reducing muscle loss, and avoiding abnormal increases in LDL cholesterol, making them more suitable for long-term body composition improvement and health maintenance.

On the other hand, LCHF diets, especially ketogenic approaches, are more effective in lowering triglycerides; however, if the proportion of saturated fat is too high, there may be a risk of elevated LDL cholesterol.

Therefore, sufficient protein intake and high-quality fat sources are key factors influencing the health benefits of low-carbohydrate diets.

It should be noted that current research has limitations, including small sample sizes, short follow-up periods, and inconsistent definitions of dietary patterns, leaving the long-term effects still unclear. Future studies should involve larger randomized controlled trials (RCTs) with follow-up durations of more than two years to further investigate the sustained impacts of various low-carbohydrate diets on weight, cardiovascular health, and metabolic outcomes. At the same time, more attention should be given to strategies that improve individual compliance, and personalized dietary plans based on metabolic characteristics should be developed.

Overall, both LCHP and LCHF diets can be considered practical options for weight loss and metabolic improvement in adults. However, their optimal application should be tailored according to individual health goals, dietary preferences, and risk profiles. When designing a low-carbohydrate diet, emphasizing nutrient quality—such as prioritising lean protein and unsaturated fats, while limiting saturated fats and refined carbohydrates—will help maximise health benefits.

Author contribution

Ruijia Wang, Yike Wang, Yijun Fan, Yitong zhao contributed equally to this work and should be considered co-first authors, the author sequence is as above.

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