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Dose-dependent effect of coconut oil supplementation on obesity indices: a systematic review and dose-response meta-analysis of clinical trials

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Abstract

Background Coconut oil has been suggested as a potential dietary intervention for weight management. However, the evidence regarding the effects of coconut oil supplementation on anthropometric measures (body weight, body mass index (BMI) and waist circumference (WC)) remains inconclusive.

Objective we aimed to assess the overall effect of coconut oil supplementation on these anthropometric parameters and explore potential sources of heterogeneity.

Methods We comprehensively searched electronic databases using appropriate keywords. We included 15 studies with the following criteria: (1) clinical trials in adults, with parallel or cross-over design, (2) evaluated the effect of coconut oil on body weight, BMI or WC, (3) compared the effect of a specific dose of coconut oil against a coconut oil-free diet or other types of oils, (4) considered the change in anthropometric parameters as the primary or one of the secondary outcomes, (5) provided mean and standard deviation (SD) of change in anthropometric parameters across study arms, (6) reported the number of participants in each study arm.

Results The trials included 620 participants and assessed the effects of coconut oil supplementation on body weight, BMI and WC. Our meta-analysis revealed statistically significant effects of coconut oil supplementation on weight and BMI, with mean differences of 0.04 kg (95% CI: 0.01 to 0.08 kg) and 0.01 kg/m2 (95% CI: 0.00 to 0.02). However, the effects were not clinically meaningful. There was no significant effect of coconut oil on WC. Subgroup analyses suggested that the duration of the intervention may influence the effect of coconut oil on body weight. In the sensitivity analysis, we found that the result of one study influenced the associations between coconut oil supplementation and weight or BMI.

Conclusions Overall, our findings suggest no clinically significant effects of coconut oil supplementation on weight loss. Further research is needed to clarify the issue.

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Significance

The prior published meta-analyses in this field, investigated the association between coconut oil supplementation and cardio-metabolic risk factors, no systematic review and meta-analysis has been conducted for the dose-response associations.

Keywords Coconut oil, Weight, Body mass index, Waist circumference

Introduction

In recent years, coconut oil, which is more than 90% saturated fatty acids (SFA), has gained popularity as a potential dietary intervention for managing obesity, diabetes, and lipid disorders [1–5]. Although dietary guidelines generally recommend limiting SFA intake to prevent cardio-metabolic disorders, the results of the current meta-analyses have shown no significant association between dietary SFA and risk of type 2 diabetes [6] or cardiovascular disease (CVD) [7]. Coconut oil is also rich in medium-chain triglycerides (MCTs), metabolized differently than long-chain triglycerides (LCTs) found in other dietary fats. MCTs are rapidly absorbed and metabolized in the liver, leading to increased energy expenditure, and may influence body weight [8].

Despite the potential benefits of coconut oil supplementation for humans, the evidence regarding its effects on anthropometric parameters, such as body weight, body mass index (BMI), and waist circumference (WC), remains inconclusive. Several randomized clinical trials (RCTs) have investigated the effects of coconut oil supplementation on these parameters, but the results must be consistent. Some studies have reported significant effects on weight, BMI, or WC, while others have reported no significant effects. Moreover, the optimal dose of coconut oil required to achieve these effects remains to be determined.

Since there is no dose-response meta-analysis to determine the optimal dose of coconut oil required to achieve significant effects on weight and other anthropometric parameters, we performed a systematic review and dose-response meta-analysis of clinical trials to assess the overall effect of coconut oil supplementation on body weight, BMI, and WC. We also explored the dose-response relationship between coconut oil supplementation and these anthropometric parameters.

Materials & methods

This meta-analysis was reported according to the Preffered Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement [9].

Search strategy

We searched all papers in PubMed, Scopus, and Embase databases, using appropriate keywords including "coconut oil", "coconut", "clinical trial", "controlled trial", "randomized clinical trial", "anthropometric", "obesity", "weight", "waist circumference", "body mass index", "fat mass", up to 26 March 2025. Gray literature was also searched using Google Scholar. Reference lists of all existing related reviews were also checked. We did not limit our search to any period.

Eligibility and study selection

The PICOS (Population, Intervention, Comparator, Outcome, Study design) was applied to define our meta-analysis's inclusion and exclusion criteria (Table 1). Published interventional studies with the following criteria were included: (1) clinical trials in adults (≥ 18 y of age), with parallel or cross-over design, (2) evaluated the effect of coconut oil on body weight, BMI or WC, (3) compared the effect of a specific dose of coconut oil (g/day or ml/day) against a coconut oil-free diet or other types of oils, (4) considered the change in body weight, BMI or WC as the primary or one of the secondary outcomes, (5) provided mean and standard deviation (SD) of change in body weight, BMI or WC across study arms or reported enough information to estimate the mean (± SD), (6) reported the number of participants in each study arm. Trials with an active control group (compared the effects of two or three types of oil on obesity indices) were also included.

To clarify, we included clinical trials where coconut oil supplementation was either the sole intervention or a key component combined with other agents, provided that the coconut oil dosage was clearly specified and distinguished. Trials where coconut oil was part of a mixed intervention without specific quantification were excluded. Two authors (ZG and ZB) independently assessed studies eligibility based on initial inclusion and exclusion criteria, final relevant full-text articles were included into the meta-analysis and retrieved for data extraction.

The protocol of the study registered in PROSPERO (CRD420251031291). Quality assessment for each study was conducted using the Cochrane Risk of Bias tool [10]. The tool includes 6 domains of bias: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, and selective outcome reporting. The trials were categorized as good (≤ 1.5 items were unknown, and none were high), fair (≤ 2.5 items were unclear or at least one high), and poor (≥ 2.5 items were

Table 1 Criteria used for inclusion of randomized clinical trials

Participants	Men and women adults, 18 years and above, with any sample size
Intervention	Oral supplementation of coconut oil, with any intervention duration
Comparator	Placebo or other types of oil
Outcome	Body weight, body mass index, waist circumference
Study design	Randomized clinical trials with parallel or cross-over design
Time/ date	Studies published up to Jan 2023
other	English only Full-text only

high) (Supplementary Table 1). Disagreements were solved by consulting the principal investigator (PM).

Data extraction

Data extraction was conducted by HM and double-checked by ZB and ZG to ensure that all data were extracted correctly. The following data were extracted from eligible trials: publication details (author's name, publication year, country, and study design), characteristics of the subjects (age, gender, health status), trial characteristics (duration of intervention, total sample size, dose of coconut oil as intervention, comparison group, calorie restriction, behavioral support), and outcomes (mean (± SD) for baseline, change and post-intervention values of body weight, BMI and WC). Possible conflicts and disagreements between the two reviewers were resolved by discussion.

Data synthesis and statistical analysis

Weighted mean differences (MD) and 95% confidence intervals (CI) of change in mean body weight, BMI, and WC were considered the effect size for inclusion in the meta-analysis. Several studies reported changes from baseline of body weight, BMI, or WC in each study arm; for the remaining studies which did not report the changes, we calculated these values by using reported values of outcomes before and after the intervention, according to the guidelines of the Cochrane Handbook [11]. Then we calculated MD and its corresponding SD of changes in obesity indices for each 5 mL/day increment in coconut oil consumption in the intervention group relative to the control group in each trial, using the method introduced by Crippa and Orsini [12]. The method requires a dose (mL/day) of coconut oil consumption in each study arm, the mean (± SD) of change in body weight, BMI, and WC in each study arm, and the number of participants in each arm. We performed a random-effects model to pool the trial-specific results.

We performed subgroup analyses by gender (male, female), geographical region (USA & Europe, Asia), presence of calorie restriction (yes, no, not reported), duration of intervention (≤ 4 weeks, > 4 weeks), type of intervention (coconut oil, virgin coconut oil, extra virgin coconut oil), baseline health status of participants (healthy, unhealthy), baseline weight status of participants (normal, overweight and obese), and study quality (good, fair, poor). Also, influence analysis was conducted to evaluate the potential influence of each trial on the pooled effect size. We evaluated between-study heterogeneity by using the I^2 statistic (specific categories such as low = 25%, moderate = 50%, and high = 75%) and Cochran's Q test of heterogeneity (P-value < 0.10 considered as significant) [13]. The potential for publication bias was tested using funnel plots and Egger's regression test asymmetry [14].

Moreover, we performed a non-linear dose-response meta-analysis to clarify the shape of the effect of different doses of coconut oil on obesity indices [15]. Finally, we assessed the certainty of the evidence using the GRADE approach [16]. Minimal clinically significant difference (MCSD) for body weight, BMI, and WC were defined as 4.0 kg, 1.0 kg/m^2, and 4.0 cm, respectively. All analyses were conducted using Stata software, version 17 (Stata Corp, College Station, TX), P < 0.05 was considered statistically significant.

Results

Selection of studies for inclusion in the meta-analyses

The primary search yielded 684 studies from 3 databases (PubMed, Scopus, and Web of Sciences). After removing duplicates, 635 identified trials remained, of which 598 were excluded during the review of the title and abstract (Fig. 1). Full texts of the remaining 37 studies were obtained and assessed. Of those, 15 studies met our inclusion criteria. Finally, we conducted the dose-response meta-analysis with 13 eligible trials on body weight, 12 on BMI, and 8 on WC. The between-reviewer agreement for including studies was near perfect (Cohen's kappa = 0.87) at the full-text screening step. The excluded studies at the full-text level, along with the reasons for their exclusion are shown in Supplementary Table 2.

Characteristics of included primary trials

Table 2 summarizes the general characteristics of 15 studies [1, 17–30] with 620 participants included in this dose–response meta-analysis. In brief, the included RCTs had parallel [17–19, 21, 22, 24–28, 30] or cross-over [1, 20, 23, 29] designs and were published from May 2009 to June 2022. Of the 15 included studies, 6 studies were conducted in Asia [1, 22, 23, 25, 28, 29], 3 were conducted in Europe [18, 21, 27], and 6 were conducted in the United States [17, 19, 20, 24, 26, 30]. Also, 9 trials included healthy adults [1, 17, 20–24, 30, 31], and 6 trials included unhealthy subjects [18, 19, 25–28], including

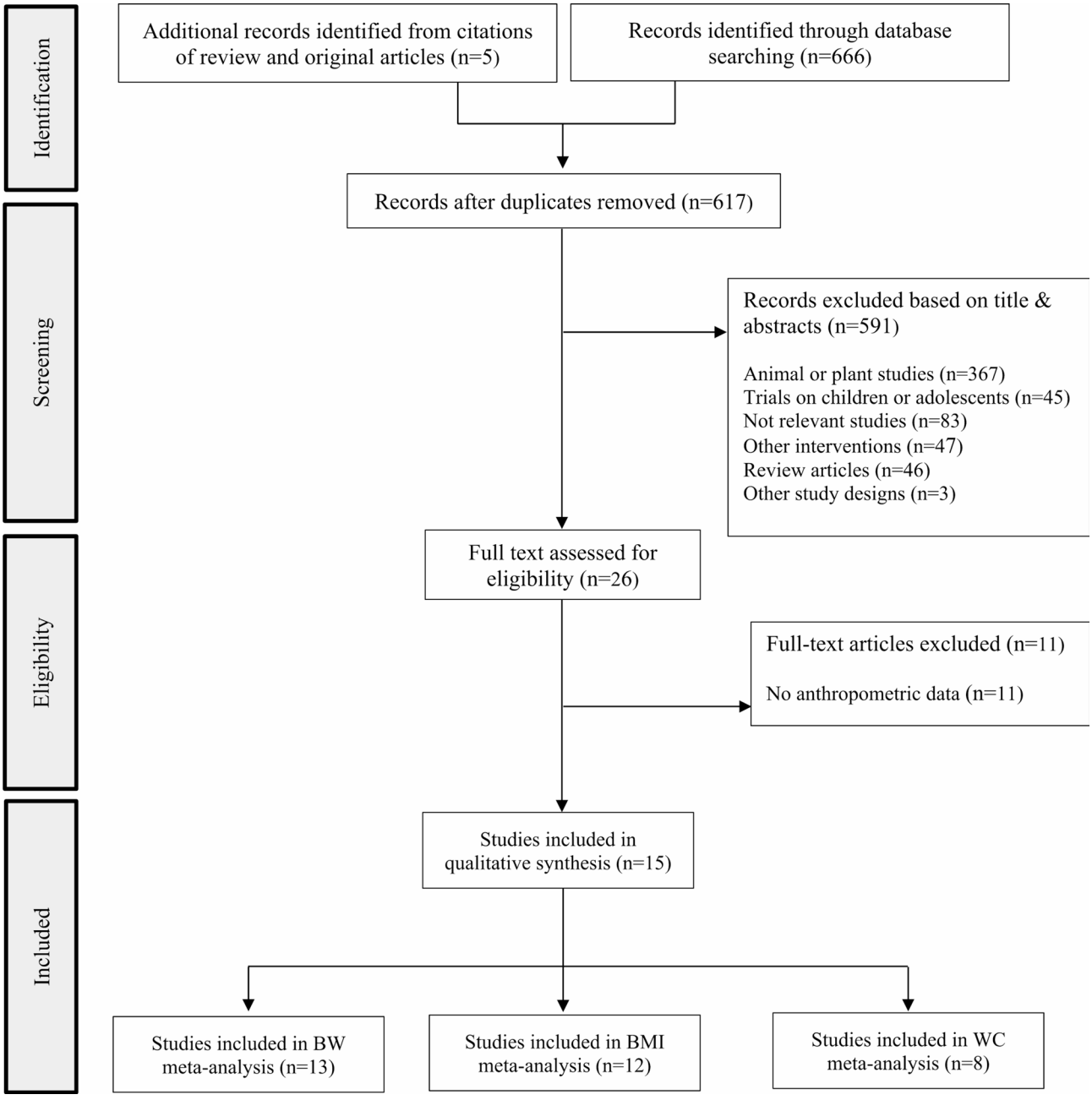

Fig. 1 Flow chart of the literature search. BW; Body Weight, BMI; Body Mass Index, WC; Waist Circumference

multiple sclerosis patients, breast cancer patients, metabolic syndrome and type 2 diabetes patients, coronary artery disease patients, and acute coronary syndrome patients. The intervention duration ranged from 5 days [29] to 4 months [27]. The median sample size was 40 participants (range 9–114). In all, 12 studies reported the mean change in body weight [1, 17, 19–26, 28, 29], 11 studies reported the mean change in BMI [1, 17–19, 21–25, 27, 30], and 8 studies reported the changes in WC [17, 19–22, 24, 25, 30]. The participants of 8 studies had normal weight status [1, 18, 21, 22, 26–29], while 7 studies included overweight or obese subjects [17, 19, 20, 23–25, 30]. In 5 studies, coconut oil was prescribed as an intervention [17, 23, 24, 26, 29], while virgin coconut oil and extra virgin coconut oil were the prescribed intervention in 5 [1, 20, 22, 25, 28] and 5 [18, 19, 21, 27, 30] trials, respectively. Only 3 studies implemented calorie restriction and programmed physical activity alongside coconut oil supplementation [19, 23, 24]. The daily doses of coconut oil ranged from 5 mL/day to 60 mL/day.

Table 2 Characteristics of trials included in dose-response meta-analysis of coconut oil supplementation obesity indices

Reference, country	Participants (*n* intervention/ *n* control)	Age (mean ± SD or range)	Dietary & lifestyle recommendation	Study design (duration)	Intervention(dose)	Control
Koc B M, 2022, Turkey [23]	Healthy overweight subjects (23/21)	19–30	Diet therapy to lose weight	Cross-over (4 weeks)	CO (20 mL/day)	Placebo
Abdullah S, 2021, Malaysia [28]	Patients with stable ACS with T2DM (30/31)	25–65	Diabetic diet	Parallel (30 days)	VCO (5 mL/day)	Placebo
Candido TLN, 2021, Brazil [24]	Healthy overweight women (16/17)	26.81 ± 0.74	Energy restricted, normofat diet	Parallel (9 weeks)	CO (25 mL/day)	Soybean oil or olive oil (25 mL/day)
Nikooei P, 2021, Iran [25]	MetS patients (22/22)	36.2 ± 7.6	Usual diet	Parallel (4 weeks)	VCO (30 mL/day)	Placebo
Pereira PTVT, 2020, Brazil [26]	Breast cancer patients (13/15)	30–59	NR	Parallel (12 weeks)	CO (20 mL/day)	Placebo
Benlloch M, 2020, Spain [18]	MS patients (21/25)	Over 18	Isocaloric diet	Parallel (4 months)	CO (60 mL/day)	Placebo
Vogel CE, 2020, Brazil [30]	Obese men (15/14)	20–59	Isoenergetic balanced diet	Parallel (45 days)	EVCO (12 mL/day)	Soybean oil (12 mL/day)
Platero JL, 2020, Spain [27]	MS patients (27/24)	Over 18	Isocaloric Mediterranean diet	Parallel (4 months)	CO (60 mL/day)	Placebo
Korrapati D, 2019, India [22]	Healthy normal weight men (9/9)	36.7 ± 1.4	Lacto-vegan diet	Parallel (8 weeks)	CO (35 gr/ day)	Peanut oil (35 gr/ day)
Khaw KT, 2018, England [21]	Healthy men and women (28/30)	50–75	Usual diet	Parallel (4 weeks)	EVCO (50 gr/day)	Extra virgin olive oil (50 gr/day)
Tan SY, 2017, Singapore [31]	Healthy men (16/16)	21–45	Usual diet	Cross-over (5 days)	CO (22.25 gr/day)	Placebo
Chinwong S, 2017, Thailand [1]	Healthy men and women (16/16)	21.0 ± 0.74	Usual diet	Cross-over (8 weeks)	VCO (15 mL/day)	CMC solution (15 mL/day)
Harris M, 2017, USA [20]	Postmenopausal women (12/12)	58.8 ± 3.7	Usual diet	Cross-over (28 days)	VCO (30 mL/day)	Safflower oil (30 mL/day)
Cardoso DA, 2015, Brazil [19]	CAD patients (92/22)	62.4 ± 7.7	Diet therapy for dyslipidemia	Parallel (3 months)	EVCO (13 mL/day)	Placebo
Assuncao M L., 2009, Brazil [17]	Women with abdominal obesity (20/20)	20–40	Balanced diet & physical activity program	Parallel (12 weeks)	CO (30 mL/day)	Soybean oil (30 mL/day)

CO, coconut oil; ASC, acute coronary syndrome; T2DM, type 2 diabetes mellitus; VCO, Virgin coconut oil; MetS, metabolic syndrome; NR, not reported; MS, multiple sclerosis; EVCO, extra Virgin coconut oil; CMC, carboxymethylcellulose; CAD, coronary artery disease

Risk of bias

Detailed results of the assessment of risk of bias are summarized in Supplementary Table 1. All included studies were at low risk of bias in terms of selective reporting of the results. Fourteen out of 15 studies were at low risk of bias in terms of random sequence generation and incomplete outcome data. Also, 6 out 15 were at low risk in terms of allocation concealment and blinding of participants and personnel, and 8 out of 15 were at low risk in terms of blinding of the outcome assessment. The overall quality of trials is rated as good, fair, or poor quality.

Findings from this meta-analysis.

Effects of coconut oil supplementation on body weight

Coconut oil supplementation resulted in an increase in body weight for each 5 mL/day increase in the intervention group compared with the control group based on the analysis of 13 studies with 572 participants, which was clinically not significant (MD: 0.04%; 95% CI: 0.01 to 0.08, $P = 0.005$) (Supplementary Fig. 1). There was no evidence of between-study heterogeneity ($I^2 = 0.0\%$, tua2 = 0.0, $P = 0.844$). In the sensitivity analysis, we found that this association was influenced by the results of only one study [24]. When this study was excluded from the analysis, the respective pooled effect size became statistically nonsignificant (Supplementary Table 3). There was a credible subgroup difference, where trials with more than 4 weeks duration showed a significant increase in body weight (MD: 0.10; 95% CI: 0.04 to 0.17, $P = 0.002$), but trials with an intervention duration less than 4 weeks did not (P for subgroup difference = 0.039, Supplementary Table 4).

Effects of coconut oil supplementation on body mass index

Pooled results from the random-effects model on 12 RCTs with 553 participants showed that each 5 mL/day increase in coconut oil supplementation could result in a statistically significant, but clinically not significant

Table 3 Summary of the effects of coconut oil supplementation (each 5 mL/day) on obesity indices

Outcome	Participants (studies)	Mean difference (95% CI)	MCID value	Clinically important? (≥ MCID)	GRADE certainty
Body weight (kg)	572 (13)	0.04 (0.01 to 0.08)	4.0 kg	No	Moderate
BMI (kg/m^2)	553 (12)	0.01 (0.00 to 0.02)	1 kg/m^2	No	Moderate
WC (cm)	360 (8)	-0.01 (-0.14 to 0.11)	4 cm	No	Low

BMI, body mass index; WC, waist circumference; MCID, minimal clinically important difference

increase in BMI (MD: 0.01 kg/m2; 95% CI: 0.00 to 0.02, $P = 0.023$), with no evidence of heterogeneity between the eligible studies ($I^2 = 0.0\%$, tua2 = 0.0, $P = 0.639$) (Supplementary Fig. 2). In the sensitivity analysis, we found that this association was influenced by the results of one study [24]. When this study was excluded from the analysis, the pooled effect size was not statistically significant (MD: 0.01, 95% CI: −0.00, 0.02) (Supplementary Table 5). In the subgroup analyses, we observed no significant differences in meta-analysis results between the categories of studies based on sex, geographical location, intervention duration, calorie restriction, type of coconut oil, baseline health and weight status of participants, and quality of studies (Supplementary Table 6).

Effects of coconut oil supplementation on waist circumference

We did not observe any statistically significant effect on WC for each 5 mL/day increase in coconut oil supplementation (MD: −0.01 cm; 95% CI: −0.14 to 0.11, $P = 0.816$) (Supplementary Fig. 3), with substantial heterogeneity between the eligible studies ($I^2 = 66.6\%$, tua2 = 0.0146, $P = 0.004$), based on the analysis of 8 studies with 360 participants. The lack of association of coconut oil with WC persisted in sensitivity analyses excluding one study at a time (Supplementary Table 7). There was no credible difference across subgroups (Supplementary Table 8).

Publication bias

Funnel plots and Egger's regression tests indicated no evidence of substantial publication bias for body weight ($P = 0.820$), BMI ($P = 0.848$) and WC ($P = 0.254$). The results for funnel plots are indicated in Supplementary Figs. 4, 5, 6.

Non-linear dose-response meta-analyses

We performed a nonlinear dose–response meta-analysis using a restricted cubic spline. There was no evidence of a U- or J-shaped association between coconut oil supplementation and body weight ($P_{\text{nonlinearity}} = 0.425$), BMI ($P_{\text{nonlinearity}} = 0.084$) and WC ($P_{\text{nonlinearity}} = 0.799$) (Supplementary Figs. 7, 8, 9).

Grading the evidence

We applied the GRADE rating tool to rate the certainty of evidence (Table 3 and Supplementary Table 9). The certainty of the evidence was rated moderate for body weight and BMI, while it was rated low for WC. The effects of coconut oil supplementation on body weight and BMI were smaller than thresholds settled as MCSD, suggesting small and unimportant effects.

Adverse events

We extracted the potential adverse events of coconut oil supplementation which reported in the included clinical trials (Supplementary Table 10). Mild diarrhea was reported by a study [1], nausea, vomiting, and diarrhea reported by another study [26]. One person had adverse reactions to virgin coconut oil and increased inflammation, in the study of Harris [20]. Two studies reported no adverse events [22, 30], and remained 10 studies had reported no information regarding the adverse events.

Discussion

This meta-analysis incorporated 15 clinical trials involving 620 participants to assess the dose-response effects of coconut oil supplementation on obesity indices, including body weight, BMI, and waist circumference. While we observed statistically significant but clinically unimportant effects of coconut oil supplementation on body weight and BMI, no significant impact on waist circumference was found. These findings are consistent with previous studies that have reported similar outcomes for coconut oil supplementation. However, despite these statistically significant results, the effects were smaller than the minimal clinically significant differences (MCSD), which challenges the practical relevance of coconut oil in weight management.

The neutral effect of coconut oil supplementation on WC was in line with the results of the previous meta-analyses [32, 33], which similarly reported no significant influence on this anthropometric parameter. In contrast to our results, some of the previous meta-analyses reported a neutral or beneficial effect of coconut oil supplementation on weight and BMI. Duarte and colleagues, in a meta-analysis of 7 RCTs, reported a non-significant reduction in body weight (MD -0.24 cm, 95% CI -0.83 cm to 0.34 cm) due to coconut oil supplementation [32]. In a recent meta-analysis of 9 clinical trials by Swarnamali and colleagues, coconut oil supplementation resulted in a statistically significant reduction in body weight and BMI by 0.75 kg and 0.28 kg/m^2, respectively [33], but the effects were not clinically significant. The different

inclusion criteria may explain inconsistencies observed between our findings and the previous meta-analyses and differences in the number of trials included in the meta-analysis, which is lower in the previous meta-analyses compared to our study. For instance, non-RCTs and trials with short intervention duration were excluded from the two meta-analyses [32, 33]. We included all clinical trials (randomized and non-randomized) with any follow-up duration from 5 days to 4 months. Furthermore, unlike other meta-analyses [32, 33], we excluded the studies in which coconut oil was prescribed as a regular cooking oil and the daily consumed coconut oil had not been specified.

Although we found statistically significant effects of coconut oil supplementation on weight and BMI, these effects were smaller than MCSD thresholds, suggesting small and unimportant effects. The effect was 0.04 kg (0.01 to 0.08) for body weight, which was lower than the MCSD thresholds of 4 kg for body weight. Similarly, for BMI, the effect was 0.01 kg/m^2 (0.00 to 0.02), which was lower than the MCSD thresholds of 1 kg/m^2 for BMI. These findings aligned with previous meta-analyses, which also failed to demonstrate any clinical effectiveness of coconut oil supplementation on weight and BMI, despite statistical significance [32, 33]. Coconut oil is rich in medium-chain triglycerides (MCTs), which are metabolized differently than long-chain triglycerides (LCTs) found in other fats. MCTs are rapidly absorbed and oxidized in the liver, potentially increasing energy expenditure [34]. Previous studies have suggested that MCTs may contribute to weight loss by promoting fat oxidation [35, 36]. However, in this analysis, we found that the effects on body weight and BMI were modest and below the MCSD thresholds, indicating that any potential thermogenic effects of MCTs are likely insufficient to produce meaningful weight loss over the short durations typically used in these trials. This highlights the need for further research on the long-term effects of MCTs in the context of coconut oil, particularly when combined with other dietary interventions, such as calorie restriction or increased physical activity.

The lack of a clinically significant impact on obesity indices from coconut oil supplementation also aligns with the broader debate surrounding the role of dietary fats in weight management. Despite the fact that coconut oil is high in SFAs, some studies have proposed that the specific metabolic properties of MCTs could counterbalance the potential adverse effects of SFAs, such as insulin resistance or increased cholesterol levels [8, 37]. However, our findings suggest that the potential benefits of coconut oil may not outweigh the negative metabolic consequences of its high SFA content. This observation is consistent with a growing body of research showing that diets high in SFAs are linked to adverse metabolic outcomes, including increased risk of cardiovascular disease [38, 39]. These findings emphasize the need for a nuanced approach when evaluating the role of specific fats in the diet, particularly in relation to weight management and cardiovascular health.

Additionally, our study highlights the influence of study duration on the observed effects of coconut oil supplementation. Subgroup analyses revealed that trials with longer durations (>4 weeks) showed more significant changes in body weight, suggesting that the duration of intervention may play a key role in the outcomes. This observation is consistent with the theory that chronic interventions may be required for the full metabolic effects of dietary fats to manifest, particularly when it comes to weight management. This is an important consideration for future research, as longer-term trials may provide a clearer picture of the potential benefits (or lack thereof) of coconut oil supplementation in weight loss and obesity management.

In terms of the quality of the evidence, the moderate certainty for body weight and BMI, and low certainty for waist circumference, reflects the overall quality of the studies included in our analysis. Although most studies had a low risk of bias, several were limited by small sample sizes, short durations, and a lack of detailed reporting on key variables, such as the exact doses of coconut oil consumed. These limitations suggest that the current body of literature on coconut oil supplementation remains inconclusive and warrants further investigation, particularly with well-designed studies that include longer follow-up periods and more rigorous reporting.

In summary, while coconut oil supplementation appears to have some statistically significant effects on body weight and BMI, these effects are not clinically meaningful. The findings do not support the widespread use of coconut oil for weight management, and we suggest that alternative oils rich in unsaturated fats may be more beneficial for clinical and public health recommendations. Future studies should focus on evaluating the long-term effects of coconut oil supplementation, exploring potential dose-response relationships in greater depth, and considering the impact of coconut oil in combination with other dietary interventions.

This systematic review and dose-response meta-analysis has some limitations that should be considered when interpreting our findings. First, the sample sizes of the included studies were relatively small, and the duration of the interventions varied significantly. These factors can influence the statistical power and generalizability of the results. Furthermore, the included studies exhibited considerable heterogeneity, particularly concerning participant characteristics such as health status (healthy vs. unhealthy) and baseline weight (normal weight vs. overweight/obese). Geographical variation in the studies also

contributed to this heterogeneity. Despite these differences, we attempted to control for potential confounders by performing subgroup analyses based on factors such as intervention duration, baseline health status, and geographical location.

Second, while we aimed to investigate the dose-response relationship between coconut oil supplementation and obesity indices, several studies did not provide precise data regarding the exact daily dose of coconut oil consumed. This lack of consistency in reporting could have affected our ability to accurately assess the dose-response relationship. To address this, we conducted a non-linear dose-response meta-analysis using restricted cubic splines, which helped to provide a clearer picture of the relationship between coconut oil intake and obesity indices.

Third, we did not include studies in which coconut oil was prescribed as part of a regular cooking oil regimen or in the preparation of snacks such as muffins or crackers. This exclusion limits the generalizability of our findings to those who use coconut oil in typical dietary contexts. Additionally, the potential impact of coconut oil supplementation on waist circumference was not well-supported due to the limited number of studies and high heterogeneity across the trials assessing WC.

Finally, based on the ROBINS-I quality assessment, the overall quality of the included studies varied. Although most studies had a low risk of bias, several had weak methodological quality, which could have influenced the results.

Conclusions

Despite the general belief regarding the ability of coconut oil for weight loss, it has not clinically significant effects on body weight and BMI. Thus, our findings do not support coconut oil use in clinical practice for overweight or obese subjects. Societies should encourage it to consume PUFA- and MUFA-rich oils with well-established health promotions instead of coconut oil. Further well-designed clinical trials with large sample sizes and long intervention duration are warranted to clarify the effectiveness of coconut oil supplementation for weight loss.

Clinical implications

Clinicians and researchers have suggested numerous dietary intervention approaches for weight loss. Overweight or obese people may consider various dietary supplements, including coconut oil, despite the lack of substantial evidence supporting their clinically essential effects. In this comprehensive dose-response meta-analysis of clinical trials, we found that using coconut oil supplementation may have small and unimportant effects on obesity indices. Consequently, based on the current evidence, the weight loss recommendation does not endorse coconut oil supplementation.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40795-025-01090-6.

Supplementary Material 1

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Author contributions

Z.G designed the study. Z.G, H.M and Z.B collected data. Z.B and P.M analyzed data. Z.G and H.M wrote the manuscript. Z.B corrected the manuscript. All authors read and approved the final manuscript, and P.M had primary responsibility for final content.

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Data availability

Data described in the manuscript will be made available from the corresponding author on reasonable request.

Declarations

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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