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Research Article

Efficacy of Garcinia Cambogia (HCA) in Reducing Body Weight in Overweight and Obese Adults: A Scoping Review

Daniel Cool *, William Theile

Princess Alexandra Hospital, QLD, Australia.

Corresponding author: Daniel Cool, Princess Alexandra Hospital, QLD, Australia.

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Abstract:

Aim: This scoping review investigates the weight loss claims made by listed products containing Garcinia Cambogia (from which hydroxycitric acid (HCA) is thought to be the active component). Examples include Garcinia Max (AUST L 266921) and Thinco Garcinia Supreme (AUST L 213557).

Materials and Methods: Only studies which compared Garcinia Cambogia to placebo were included and the variables of weight change and BMI change were analysed. Double-blinded RCT's and systematic reviews of RCT's were included in the analysis.

Results: Of the 14 included studies, all failed to demonstrate a clinically significant decrease in weight or BMI. Thus, none of the included studies provides sufficient evidence to support the claims made by listed weight-loss products containing Garcinia Cambogia (HCA).

Conclusion: In addition, it is clear that there is a large problem with the standardisation of herbal products in general. Future trials, if done, need to have parameters matching those set out in the TGA evidence guidelines and the CONSORT guidelines for reporting randomised, controlled trials of herbal interventions.

Key words: garcinia cambogia; hydroxycitric acid; hca; weight loss; body mass index; overweight; obesity

Introduction

The use of so-called "fat burner" supplements has been increasing over recent years in attempts to combat the ever-growing issue of obesity. US data from 2007 showed that among people trying to lose weight 16 percent of people reported that they used herbal supplements to attempt to aid weight loss in the past year [1]. Consumers expect that medicine available for purchase over-the-counter will have their quality, safety and efficacy assured by the Therapeutic Goods Administration (TGA). Between 1996 and 2006 over 1000 new complementary medicines were listed in Australia, with a primary indication of weight loss; however, many did not have clear evidence of efficacy [2]. The Therapeutic Goods Administration (TGA) regulates medicines as registered products (labelled AUST-R) and listed products (labelled AUST-L) [3]. Listed medicines can be purchased off the shelf from pharmacies, health shops, and supermarkets and their efficacy does not need to be assessed before approval. This contrasts with registered products, which are assessed for safety, quality, and efficacy before they go on sale. Registered products are generally prescription-type medicines [3].

The TGA Evidence Guidelines state that "medicines targeting obese populations are required to demonstrate an absolute reduction in weight loss of at least 10% over one year" or 5% in six months. Regarding weight loss in overweight individuals, the supporting evidence must demonstrate:

- A mean overall loss of at least 5% initial body weight in the treatment group, which is at least 3% greater (for RCT) OR 5% greater (for non-RCT) than that of the placebo group. In both cases the difference must be statistically significant ($p<0.05$); and
- At least 50% of participants in the treatment group must have achieved a loss of at least 5% of initial body weight [3]; and
- The study duration is a minimum of 6 months [3].

A common ingredient in complementary medicines marketed for weight loss is Garcinia Cambogia (TGA-approved name: Garcinia gummi-gutt), the believed active ingredient in this product being hydroxycitric acid (HCA). There are currently around 58 products containing Garcinia or HCA found on the Australian Register of Therapeutic Goods (ARTG) [4]. Products containing HCA often claim that they reduce body weight and reduce feelings of hunger [5]. in turn resulting in weight loss. However, recent systematic reviews of RCTs have demonstrated mixed results in

determining the efficacy of Garcinia compared to placebo as per the above TGA guidelines and the methods of some of these studies appear questionable [6,7].

Given a systematic review was conducted recently on this topic in 2020 [6]. a scoping review was determined to be the best way to further analyse the conclusions from both RCTs and the published reviews and provide a clearer answer to the question of garcinia's efficacy as a fat loss supplement. We aim to assess the efficacy of Garcinia Cambogia (HCA) as a weight-loss supplement in overweight and obese adults.

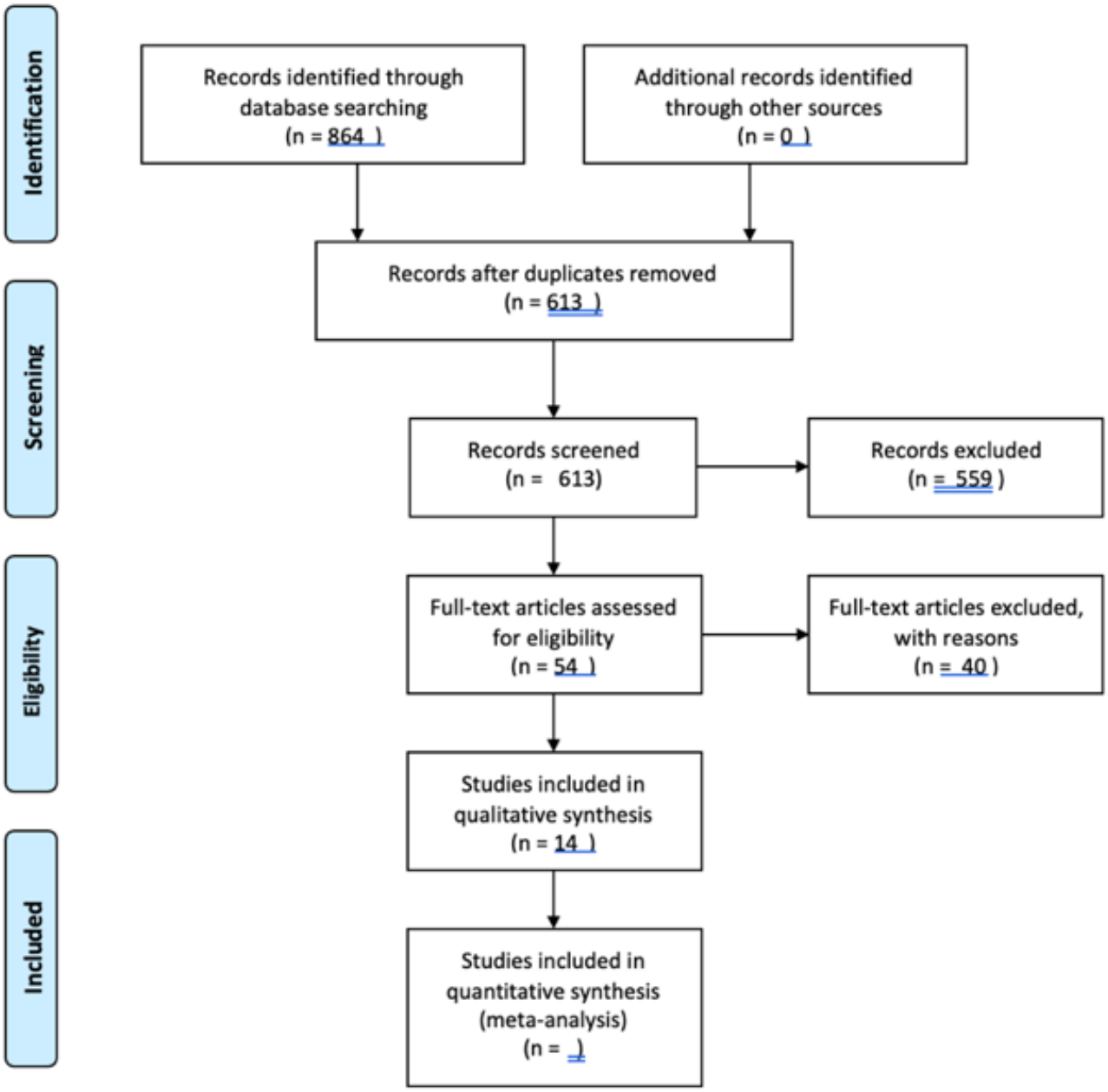
Material and Methods

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and adhered to all relevant institutional and national research ethics guidelines. Ethical approval was obtained from the appropriate institutional review board, and informed consent was obtained from all participants prior to data collection. Data confidentiality and participant anonymity were maintained throughout the study, and all research procedures complied with applicable healthcare regulations. This review was also conducted in accordance with the PRISMA 2020 guidelines for systematic reviews and meta-analyses. The study methodology, including the selection process, data extraction, and synthesis, follows the recommended standards to ensure transparency and reproducibility. A completed PRISMA 2020 checklist and a PRISMA flow diagram have been provided as supplementary materials. The PICOT fomat (Population, Intervention, Comparator, Outcome, type of study) was used as a template to determine relevant criteria.

We included articles that evaluated adults of normal or above normal BMI and exclude articles that only examine participants that were under 18 years of age or below normal BMI. Articles using "Garcinia Cambogia" OR "Hydroxycitric acid" OR HCA as the intervention, with placebo control will be included. We will include articles with or without diet/exercise as a co-intervention in both groups but exclude articles that include concomitant use of other weight loss supplements or active ingredients in either intervention or control group. We will include articles with objective and measurable outcomes (weight, BMI, circumference); studies with subjective results will not be included. Only double-blinded randomised placebo-controlled studies and systematic reviews of RCTs were included in this paper. There will be no exclusion or inclusion criteria based on the date of publication, language, or time. The literature was searched for in the following databases: PubMed, Embase, CINAHL, and Cochrane Library. A forward and backward search was conducted. Grey literature, including unpublished work on Open Science Forum (OSF) and research conducted by private companies, was also searched and appropriate bodies contacted for data or clinical trial results.

The search terms included were: ("Garcinia Cambogia"[Title/Abstract] OR "Hydroxycitric acid"[Title/Abstract] OR HCA[Title/Abstract] AND Weight loss[Title/Abstract] OR BMI[Title/Abstract] OR "Body Mass Index"[Title/Abstract] OR Body composition[Title/Abstract] OR Waist circumference[Title/Abstract] OR Lean body mass[Title/Abstract] OR Body fat percentage[Title/Abstract] OR Weight change[Title/Abstract] OR Weight gain[Title/Abstract] OR Fat mass[Title/Abstract] OR Antiobesity[Title/Abstract]) OR (Obese[Title/Abstract] OR Overweight[Title/Abstract] OR Increased BMI[Title/Abstract] OR Obesity[Title/Abstract]).

All databases will be searched from inception until October 2020.



Prior to screening, all references were placed in an EndNote database for deduplication using the Endnote function. Title and abstracts screening was conducted by two independent reviewers (WT and DC). Full-text screening occurred in the same fashion. All screening was done on independent EndNote files using SRA-Helper [8]. Disputes were resolved using Disputatron, and online dispute resolution software [9]. Within the data trends relating to weight loss in relation to Garcinia Cambogia. Only data from RCTs and systematic reviews was observed. The independent variable is Garcinia Cambogia/hydroxycitric acid (HCA) consumption. Assumptions being that this was the only oral intervention given. The dependent variables are weight, BMI, waist circumference, and other objective measurements of weight loss, such as body fat percentage. The time frame for follow-up will be a minimum of 6 months.

There were a variety of reasons why the 559 (figure 1) records were excluded at title and abstract screening. These included issues such as, incorrect study type (ie. observational study or literature review), focus on combination therapy only, not human studies, studies looking at adverse effects of garcinia or studies were on an unrelated area of study (ie hepatocellular adenoma – included within the HCA search term). The reasons for exclusion at full-text screening have been described in the table below.

Table 1 (see appendix)

Reason for Exclusion at full-text screening	Amount Excluded for the given reason
Incorrect Study Type (Ie literature review, proposal for RCT or Prospective study)	22
Co-intervention only	5
Unable to obtain study	10
Full article not published	1
English translation unavailable	1
Incorrect outcomes measured	1

Table 1: Reasons for Full Text Exclusion

The Cochrane risk of bias tool was used to critically appraise all the RCTs included in the study. The AMSTAR 2 tool was used to critically appraise all systematic reviews. Results are based on studies that were deemed to be high quality. The extracted data was then be analysed to compare the mean and standard deviation of weight change, BMI change, body fat percentage change and waste circumferences change from the beginning of the trials, as well as the effects of dose. The results of individual studies and syntheses were tabulated using structured summary tables that presented key study characteristics, outcome measures, and effect estimates. Data was organised to include study design, sample size, intervention details, comparator groups, and primary weight-related outcomes (e.g., weight change, BMI, body fat percentage, and waist circumference).

Results

14 studies were included for final analysis. These are summarised in Table 2, with specific intervention discussed in Table 3.

FirstAuthor	StudyName	Year	StudyType	Country	SampleSize	% Female	Age
Golzarand	Effect of Garcinia cambogia supplement c	2020	SR	Iran	530	NA	Intervention: 36(4.3) Control: 38.9(3.9)
Maunder	Effectiveness of herbal medicines for wei	2020	SR	Australia	285	NA	?
Onakpoya	The Use of Garcinia Extract (Hydroxycitric	2010	SR	United Kingdom	459	NA	?
Payab	Effect of the herbal medicines in obesity	2018	SR	Iran		NA	
Hayamizu	Effects of Garcinia cambogia (hydroxycitr	2003	RCT	Japan	44	45	44(1.8)
Heymsfield	Garcinia cambogia (hydroxycitric acid) as	1998	RCT	?	135	86	Intervention: 38.6(7.7) Control: 39.4(7.2)
Kim	Does Glycine max leaves or Garcinia Cam	2011	RCT	Korea	86	47	Intervention: 34.07(2.3) Control: 33.8(2.97)
Kovacs	The effects of 2-week ingestion of (−)-hyc	2001	RCT	Netherlands	11	0	47(16)
Lu	Clinical evaluation of garcinia cambogia a	2012	RCT	Taiwan	114	Intervention: 63 Control: 62	27.01(1.02)
Mattes	Effects of (-)-hydroxycitric acid on appetit	2000	RCT	USA	89	100	42.7 (10) mean
Preuss	Effects of a natural extract of (−)-hydroxy	2004	RCT	India	60	?	21-50
Roongpisuthipong	Reduction of adipose tissue and body wei	2007	RCT	Thailand	50	100	40.0 ± 10.0 (HCA) 36.0 ± 10.0 (PLA)
Vasques	Hypolipemic Effect of Garcinia cambogia	2013	RCT	Brazil	43	100	25-60

Table 2: Included Studies

FirstAuthor	INTERVENTION_Drug	INTERVENTION_DoseComment	CONTROL_DoseComment	Cointerventions	Extration Method Specified
Golzarand	Garcinia	166-4667mg OPD	Placebo	NA	N
Maunder	Garcinia	300-4667mg daily	Placebo	NA	N
Onakpoya	HCA	1000-2800mg daily	Placebo	NA	N
Payab	Garcinia	1,667, 2,400, and 3,000 mg/day (1,000, 1,200, and 1,500 mg hydroxycitric acid)			N
Hayamizu	HCA	1000mg OPD, 60% concentration	Cellulose	Diet and exercise	N
Heymsfield	HCA	1500mg OPD, 50%	Inert ingredients	high fibre, low energy diet	N
Kim	Garcinia	2g OPD, 60%	Starch 2g OPD	None	N
Kovacs	HCA	500mg OPD, 85.81%	Placebo	None	N
Lu	Garcinia	2800mg OPD, 49.3%	Maltodextrin 2800mg	None	N
Mattes	Garcinia	1.2g OPD, 50%	Placebo	1200kcal/day diet	N
Preuss	HCA	2799mg daily	Placebo	2000kcal/day diet + supervised walking	N
Roongpisuthipong	Garcinia	3.45g daily	Placebo	1000kcal/day diet	N
Vasques	Garcinia	2400 mg daily of garcinia extract (50% of HCA)	Placebo	1523 ±185 kcal/day diet	N

Table 3: Included Studies Intervention

The determination of the quality of description of how extracts of HCA were obtained from Garcinia Cambogia was done in accordance with the proposed CONSORT checklist by Gagnier et al [10]. Confidence intervals of 95% give the best estimate of the true effect of the reported variable in each study and will be used to judge the statistical significance of studies where possible to do so. Systematic Reviews are listed below. Table 4, Table 6 and Table 8 summarise the information from these.

First Author	Year Published	Weight Change - Intervention (Kg)	Weight Change - Control (Kg)	Weight Change - Point Estimate (Kg)
Golzarand	2020	N/A	N/A	-1.34 (95% CI -2.62,-0.07)
Maunder	2020	N/A	N/A	0.04 (95% CI -0.33, 0.41)
Onakpoya	2010	N/A	N/A	-0.88 (95% CI -1.75,0)
Payab	2018	N/A	N/A	0.13 (95% CI -0.09, 0.34)

Table 4: Systematic Reviews Weight Change

First Author	Year Published	Weight Change - Intervention (Kg)	Weight Change - Control (Kg)	Weight Change - Point Estimate (Kg)
Hayamizu	2003	-1.45 (95% CI -2.33, -0.57)	-0.5 (95% CI -0.84, -0.16)	N/A
Heymsfield	1998	-3.2 (95% CI not calculated, P < 0.001)	-4.1 (95% CI not calculated, P > 0.001)	Between groups P = 0.14
Kim	2011	0.65 (95% CI -0.19, 1.49)	0.68 (95% CI 0.02,1.34)	N/A
Kovacs	2001	-1.5 (95% CI -2.48,-0.52)	-1.0 (95% CI -1.78, -0.22)	N/A
Lu	2012	-0.2 (95% CI -4.9,4.5)	0.5 (95% CI -4.4, 5.4)	N/A
Mattes	2000	-3.7 (95% CI not calculated, P < 0.001)	-2.4 (95% CI not calculated, P < 0.001)	Between groups (95% CI not calculated, P = 0.026)
Preuss	2004	-4.53 (95% CI -10.83, 1.77)	-1.6 (95% CI -6.1, 2.9)	N/A
Roongpisuthipong	2007	2.8 (95% CI 2.6, 2.99)	-1.4 (95% CI 1.2, 1.60)	-1.4 (95% CI not calculated, P < 0.05)

Table 5: RCTs Weight Change

First Author	Year Published	BMI Change - Intervention	BMI Change - Control	BMI Change - Point Estimate (95% CI
Golzarand	2020	N/A	N/A	-0.99 (95% CI -1.48,-0.49)

Table 6: Systematic Reviews BMI

First Author	Year Published	BMI Change - Intervention	BMI Change - Control	BMI Change - Point Estimate (95% CI
Kim	2011	0.24 (95% CI -0.05,0.794)	0.24 (95% CI 0.02, 0.45)	N/A
Lu	2012	0 (95% CI -1.57, 1.57)	0.2 (95% CI -0.98, 1.376)	N/A
Preuss	2004	-1.72 (95% CI -3.93, 0.49)	-0.65 (95% CI -1.7, 0.4)	N/A
Roongpisuthipong	2007	0.9 (95% CI 0.5, 1.292)	0.6 (95% CI 0.2, 0.99)	N/A
Vasques	2013	0.17 (95% CI not calculated, P=?)	-0.24 (95% CI not calculated, P=?)	N/A

Table 7: RCTs BMI

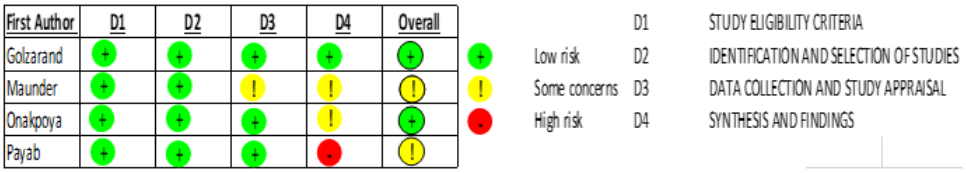


Table 8: Systematic Reviews Risk of Bas

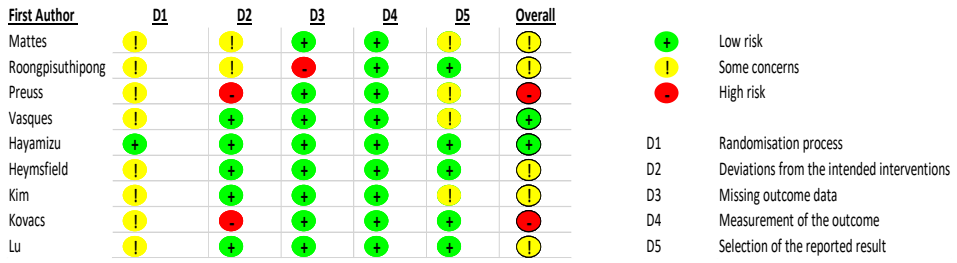


Table 9: RCTs Risk of Bias (see appendix)

Systematic Reviews

Golzarand et al., 2020 (6) – Systematic review of 8 RCTs (n = 530). Compared Garcinia cambogia extract (166–4667 mg/day, unknown HCA) vs placebo for 8–12 weeks. Pooled weight change: −1.34 kg (95% CI −2.62, −0.07). Reported statistically but not clinically significant (TGA guidelines). BMI change: −0.99 kg (95% CI −1.48, −0.49). Limitations include heterogeneous dosing/follow-up, unclear sourcing/extraction, no funding, high or unclear risk of bias in several included trials. The methods were clear but <10 studies and no publication bias assessment. No study met the Therapeutic Goods Administration (TGA) duration requirement of ≥6 months for clinically meaningful weight-loss evidence.

Maunder et al., 2020 (11) – Review of 5 RCTs (n = 285). Garcinia (300–4667 mg/day, unknown HCA) vs placebo for 8–17 weeks. Weight change: +0.04 kg (95% CI −0.33, 0.41)—statistically and clinically insignificant. Potential conflict (author active in supplement promotion). Methods reproducible.

Onakpoya et al., 2010 (7) – Review of 9 RCTs (n = 459). HCA (1000–2800 mg/day) vs placebo for 2–12 weeks. Mean weight loss: −0.88 kg (95% CI −1.75, 0)—borderline statistical, clinically negligible. Sensitivity analysis rendered results non-significant. Poor quality of included trials. No conflicts noted.

Payab et al., 2018 (12) – Review of 5 RCTs. Garcinia (1667–3000 mg/day) vs placebo for 12–16 weeks. Mean weight change: +0.13 kg (95% CI −0.09, 0.34)—statistically/clinically insignificant. Did not specify included trials, limiting reproducibility.

Randomised Controlled Trials

Hayamizu et al., 2003 (13) – RCT (n = 44). HCA 1000 mg/day + diet/exercise vs placebo, 12 weeks. Weight loss −1.45 kg (no CI or p-value)—not statistically or clinically significant. Possible author conflict (supplier/marketer).

Preuss et al., 2004 (14) – RCT (n = 60). HCA-SX 2799 mg/day + diet/walking vs placebo, 8 weeks. Weight loss −4.53 kg (95% CI −10.83, 1.77)—statistically/clinically insignificant. BMI change also insignificant. Standardised dose; extraction details lacking.

Heymsfield et al., 1998 (15) – RCT (n = 135). Garcinia 1500 mg/day + high-fiber, low-energy diet vs placebo, 12 weeks. Mean loss −3.2 kg; between-group difference NS (p = 0.14)—clinically insignificant.

Kim et al., 2011 (16) – RCT (n = 86). Garcinia 2 g/day vs placebo, 10 weeks. Weight +0.65 kg (95% CI −0.19, 1.49)—statistically/clinically insignificant. BMI +0.24 (95% CI 0.02–0.45)—statistically significant but clinically trivial.

Kovacs et al., 2001 (17) – RCT (n = 11). HCA 500 mg/day vs placebo, 2 weeks. Weight −1.5 kg (95% CI −2.48, −0.52)—statistically significant but clinically insignificant. Funded by Novartis (not an HCA distributor).

Lu et al., 2012 (18) – RCT (n = 114). Garcinia 2800 mg/day vs placebo, 8 weeks. Weight −0.2 kg (95% CI −4.9, 4.5)—not significant; BMI unchanged.

Mattes et al., 2000 (19) – RCT (n = 89). Garcinia 1.2 g/day + low-calorie diet vs placebo, 12 weeks. Weight −3.7 kg ± 3.1 vs −2.4 ± 2.9 ($p < 0.001$ within-group; between-group $p = 0.026$)—statistically but not clinically significant. Funded by Slimfast (potential conflict).

Roongpisuthipong et al., 2007 (20) – RCT (n = 50). HCA 3.45 g/day + low-calorie diet vs placebo, 8 weeks. Weight +2.8 kg (95% CI 2.6–2.99)—statistically significant weight gain, not clinically relevant for weight loss.

Vasques et al., 2013 (21) – RCT (n = 43). Garcinia 2.4 g/day + low-calorie diet vs placebo, 60 days. BMI +0.17—no significant changes in anthropometric measures. Obese-only cohort limits generalisability.

Discussion

The TGA Evidence Guidelines for registered products states that "medicines targeting obese populations are required to demonstrate an absolute reduction in weight loss of at least 10% over one year" or 5% in six months.

Regarding weight loss in mildly overweight individuals, the intended target population for listed medicines, the supporting evidence must demonstrate:

- A mean overall loss of at least 5% initial body weight in the treatment group, which is at least 3% greater (for RCT) OR 5% greater (for non-RCT) than that of the placebo group. In both cases the difference must be statistically significant ($p<0.05$); and
- At least 50% of participants in the treatment group must have achieved a loss of at least 5% of initial body weight; and
- The study duration is a minimum of 6 months. [22].

In addition to this, it is stated in the TGA guidelines that a loss of 1 BMI unit across populations equates to clinical significance as per Rose and Day [23]. Due to the parameter of a 6-month minimum duration, none of the included studies meets the TGA's weight loss criteria (despite some results being statistically significant). Other parameters, such as body fat percentage and waist circumference have been analysed but will not be discussed as, in the absence of BMI and weight change, they are not regarded as clinically significant by the TGA. In addition to this, none of the included studies outlined how they extracted HCA (the active compound in Garcinia Cambogia) from the plant or provided stability data as outlined in the CONSORT criteria. (10) This means that the participants' doses both within studies and between studies may be different and thus comparison is fraught. This affects both the validity and reproducibility of all studies included and explains why the results of the systematic reviews have a large variability. Preuss et. Al did use a standardised commercial formulation of HCA ensuring dose consistency within the study however the exact methods of extraction were still not outlined.

Of the studies, whilst the majority were statistically insignificant, all studies were clinically insignificant. Statistical significance is ideally assessed using 95% confidence intervals. Several studies used P values in the absence of confidence intervals which are inferior as they do not give the best estimate of the true effect. [24]. However, neither method is perfect nor can give a 100% impression of the true effect. One study (Vasques) had neither P values, confidence intervals or standard deviations and thus statistical significance was unable to be assessed. Studies showing statistically significant weight loss were Heymsfield, Kovacs, Mattes and Onakpoya. All these studies were clinically insignificant as per the TGA guidelines. Also of note is the fact that the Preuss study was conducted on an entirely Indian population. The question of whether this is a comparable population to that of Australia should be raised. The TGA evidence guidelines state that "the meaningfulness of the observed effect to the general Australian population should also be assessed. (4)" The results of study performed on subjects on a sub-continental diet and lifestyle may not be able to be similarly replicated on an Australian population. Four studies (Maunder, Roongpisithipong, Vasques and Payab) showed a gain in weight despite garcinia supplementation. It is clear from these results that Garcinia Cambogia/ HCA supplementation is not effective in helping weight loss. Products such as Garcinia Max (AUST L 266921) and Thinco Garcinia Supreme (AUST L 213557) are two of many Garcinia Cambogia containing products listed by AUST-L that claim to reduce body weight. The claims made include promotion of weight loss and maintenance of a healthy weight, both of which have been now shown to be false claims. Both are listed on the ARTG as AUST-L products. AUST-L products are listed over the counter medications and unlike AUST-R prescription medications, without evaluation by the TGA prior to marketing to see if they are efficacious. The TGA does undertake limited post-marketing surveillance of listed products and has consistently found a high level of regulatory non-compliance over the last 5 years [25]. Despite this the ARTG should still have investigated the product's efficacy and monitored their advertising for false claims such as these. These disingenuous claims to the public have no evidence to support them and should be removed from retailers and the ARTG.

Conclusion

This scoping review found no clinically meaningful evidence that Garcinia Cambogia or its active compound hydroxycitric acid (HCA) reduces body weight or BMI in overweight or obese adults. Across 14 high-quality studies, any statistically significant differences were small, inconsistent, and well below the Therapeutic Goods Administration (TGA) thresholds for clinical relevance. None of the trials met the TGA's minimum duration or weight-loss criteria, and most lacked adequate standardisation of HCA extraction or stability data, undermining reproducibility. These findings indicate that the weight-loss claims made by listed Garcinia-containing products, such as Garcinia Max and Thinc Garcinia Supreme, are unsupported by robust evidence. The inconsistency and methodological shortcomings across studies highlight

the urgent need for well-designed, long-term RCTs that follow the TGA Evidence Guidelines and CONSORT recommendations for herbal interventions. Until such evidence exists, Garcinia Cambogia should not be promoted as an effective weight-loss supplement, and regulatory bodies should ensure that marketing claims for listed products accurately reflect the current evidence base.

Author Contributions

Daniel Cool and William Theile contributed substantially to the conception and design of the study, as well as the acquisition, analysis, and interpretation of data. Daniel Cool drafted the initial manuscript. William Theile critically revised the manuscript for important intellectual content. Both authors approved the final version of the manuscript to be published and agree to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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