Effects of Green Tea Consumption on Body Weight: A Meta-Analysis

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Objective

- To perform a meta-analysis testing the hypothesis that consuming Green Tea (GT) or Green Tea Extract (GTE) for over 4 weeks could lead to a reduction in body weight in human subjects.

Introduction

- Obesity is a leading cause of many chronic morbidities such as cardiovascular diseases and diabetes[1].
- Green tea *(Camellia sinensis)* contains the catechin (-)-epigallocatechin-3-gallate (EGCG), which increases fat metabolism and energy expenditure, and could contribute to weight loss[1] (Fig. 1).
- Our results provide an updated guidance on dietary recommendations and offer insight into effect size translatable to the general population.

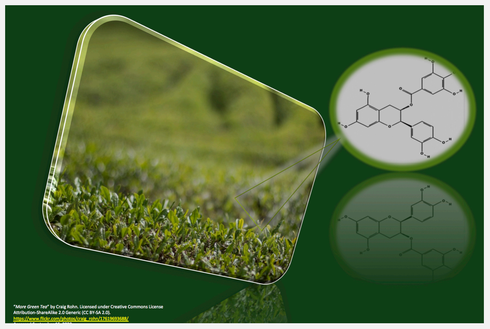

Fig. 1 *Camellia sinensis* with its active constituent, EGCG

Methods

- A literature search for parallel-design, randomized, double-blind, controlled trials published in English and between 2010-2020 was done across 5 databases using the PICO approach (Fig. 2):
  - P = non-pregnant adults
  - I = consumption of green tea (GT) or green tea extract (GTE) supplement ≥ 4 weeks
  - C = GT/GTE versus control
  - O = change in absolute weight (kg)

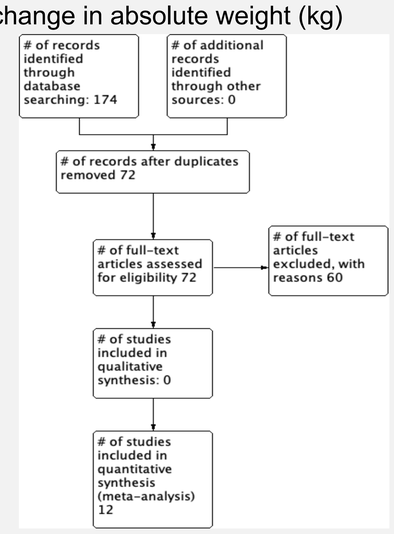

Fig. 2 – PRISMA study flow

- Three authors independently used the Cochrane tool for assessing risk of bias in the RCTs used in this study[2] (Fig. 3).
- Statistical analyses were performed using the REVMAN 5 software[3].

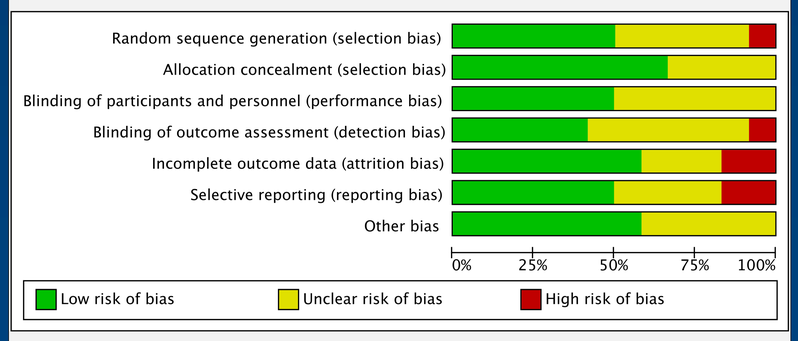

Fig. 3 Risk of bias assessment summary

Results

Study or Subgroup	Green tea Mean [kg]	Green tea SD [kg]	Green tea Total	Control Mean [kg]	Control SD [kg]	Control Total	Weight	Mean Difference IV, Random, 95% CI
Cardoso 2013	−2.15	3.93	18	0.05	2.67	18	7.4%	−2.20 [−4.39, −0.01]
Chen 2016	−1.1	2.58	39	−2	9.4	38	5.6%	0.90 [−2.20, 4.00]
Ferreira 2017	−0.463	0.17	63	−1.167	0.135	45	10.9%	0.70 [0.65, 0.76]
Gilardini 2016	−5.9	2.99	20	−4.3	1.935	20	8.8%	−1.60 [−3.16, −0.04]
Hsu 2011	−0.1	3.102	35	1	2.821	33	9.1%	−1.10 [−2.51, 0.31]
Kobayashi 2016	−0.5	0.982	84	0.7	1.838	40	10.5%	−1.20 [−1.81, −0.59]
Mullan 2016	0.4	1.1	20	0.63	0.8	19	10.5%	−0.23 [−0.83, 0.37]
Quezada-Fernandez 2019	−0.2	4.249	10	0.2	7.357	10	2.9%	−0.40 [−5.67, 4.87]
Stendell-Hollis 2010	−1.2	4.1	23	0.2	2.5	16	7.7%	−1.40 [−3.48, 0.68]
Tehrani 2017	−3.78	1.674	30	0.09	1.557	30	10.2%	−3.87 [−4.69, −3.05]
Ventkatakrishnan 2018	−1.45	4.44	20	−0.78	5.276	19	5.7%	−0.67 [−3.74, 2.40]
Wang 2011	−1.39	1.35	139	0.1	1.941	43	10.5%	−1.49 [−2.11, −0.87]
Total (95% CI)			**501**			**331**	**100.0%**	**−1.14 [−2.19, −0.08]**

Heterogeneity: Tau² = 2.66; Chi² = 234.52, df = 11 (P < 0.00001); I² = 95%
Test for overall effect: Z = 2.11 (P = 0.03)

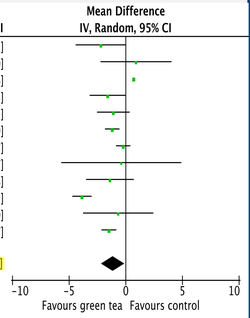

Fig. 4 Forest plot on change in body weight (kg)
(mean effect size = -1.14, 95% CI = -2.19, -0.08, p=0.03)

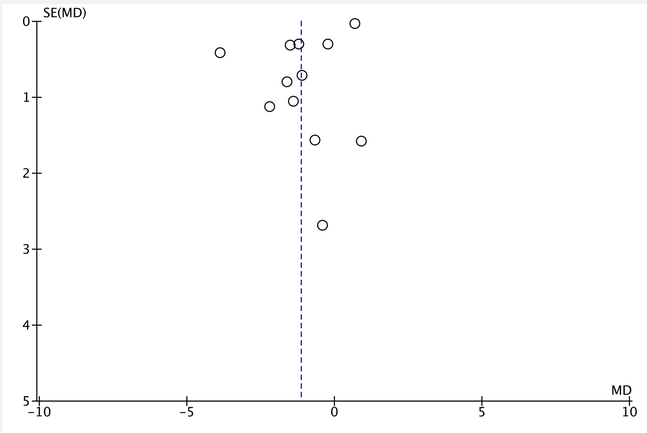

Fig. 5 Funnel plot on % change in % change in body weight

Study or Subgroup	Green tea Mean [%]	Green tea SD [%]	Green tea Total	Control Mean [%]	Control SD [%]	Control Total	Weight	Mean Difference IV, Random, 95% CI
Cardoso 2013	−2.81	0.157	18	0.06	0.074	18	9.7%	−2.87 [−2.95, −2.79]
Chen 2016	−0.85	2.13	39	−0.05	8.15	38	5.7%	−0.80 [−3.48, 1.88]
Ferreira 2017	−0.535	0.17	63	−1.355	0.135	45	9.7%	0.82 [0.76, 0.88]
Gilardini 2016	−6.257	0.146	20	−0.0474	0.696	20	9.6%	−6.21 [−6.52, −5.90]
Hsu 2011	−0.16	2.01	35	0.4	2.57	33	8.7%	−0.56 [−1.66, 0.54]
Kobayashi 2016	−0.689	0.748	84	0.951	1.359	40	9.5%	−1.64 [−2.09, −1.19]
Quezada-Fernandez 2019	−0.2587	0.1741	10	0.2558	0.2971	10	9.7%	−0.51 [−0.73, −0.30]
Stendell-Hollis 2010	−1.4652	0.2575	23	0.2571	0.1325	16	9.7%	−1.72 [−1.85, −1.60]
Tehrani 2017	−0.0436	0.108	30	0.001043	0.09879	30	9.7%	−0.04 [−0.10, 0.01]
Ventkatakrishnan 2018	−1.794	0.2481	20	−0.97	2.876	19	8.3%	−0.82 [−2.12, 0.47]
Wang 2011	−1.952	0.225	139	0.1434	0.1825	43	9.7%	−2.10 [−2.16, −2.03]
Total (95% CI)			**481**			**312**	**100.0%**	**−1.54 [−2.54, −0.53]**

Heterogeneity: Tau² = 2.71; Chi² = 9259.32, df = 10 (P < 0.00001); I² = 100%
Test for overall effect: Z = 3.00 (P = 0.003)

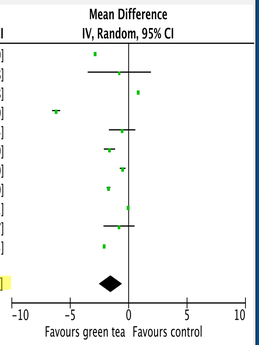

Fig. 6 Forest plot on % change in body weight
(mean effect size = -1.54%, 95% CI = -2.54%, -0.53%, p=0.003)

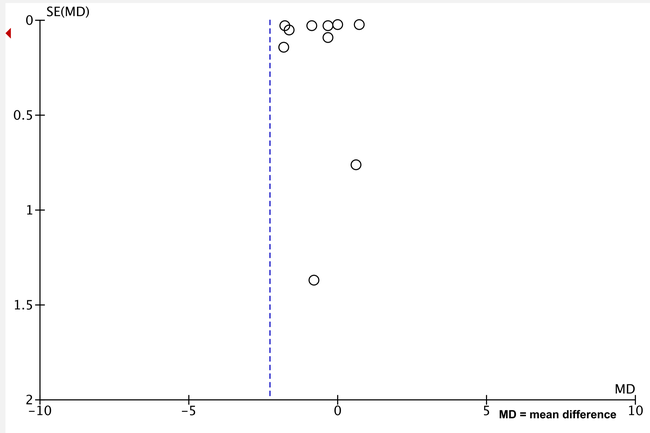

Fig. 7 Funnel plot on % change in % change in body weight

Discussion

- 12 studies were included in the meta-analysis. Consumption of GT or GTE for over 4 weeks led to a statistically significant reduction in absolute body weight and % change in body weight (Fig. 4 and 6).
- Possible publication bias because study methodology varied in patient selection, dosing, dosing strategy, and outcome measurements[4] (Fig. 5 and 7). However, the differences in patient population, dose and dosing strategy suggest a broader applicability of the results.
- Limitations of studies include lack of detailed documentation about participants' demographics. Biological sex, ethnicity, and pre-existing conditions could have an impact due to genetic polymorphism.

Conclusion

- Osteopathic physicians consider aspects of lifestyle that impact disease risk. Drinking green tea may offer an accessible, inexpensive and well-tolerated tool to promote patient wellness through its impact on body weight.
- Future studies could include large RCTs to address the public health concern of obesity and preventive medicine, and investigate additional health benefits of green tea, such as anti-inflammatory markers.

IRB Statement

- The authors received no financial support for the research. The IRB board was not consulted because the project is a clinical meta-analysis that did not involve human subjects.

References

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