

# Weight and body mass index changes following thyroidectomy: A review and meta-analysis of cohort studies.

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## Keywords:

weight gain, body mass index, thyroidectomy, differentiated thyroid carcinoma, hyperthyroidism

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## ABSTRACT

There is an increasing awareness about weight gain following thyroidectomy. Weight change following thyroid surgery is a matter of controversy. This review and meta-analysis aimed to assess weight and body mass index following thyroidectomy for differentiated thyroid carcinoma and hyperthyroidism. We systematically searched PubMed, MEDLINE, Cochrane Library, and Google Scholar for articles published in English from inception until 13 February 2022. The terms body weight, body mass index, thyroidectomy, thyroid cancer, differentiated thyroid cancer, multinodular goiter, and hyperthyroidism were used with the protean "AND" and "OR". The title and abstract revealed 569 articles, of them 18 full texts were screened and only seven fulfilled the inclusion and exclusion criteria. A datasheet was used to collect the author's name, country, year of publication, the study type, the number of patients, and the weight and body mass index before and after thyroidectomy. We pooled seven studies from six different countries. The studies included 1638 patients and showed no significant statistical difference of thyroidectomy on weight (odd ratio, -1.94, 95% CI, -4.68-0.80, P-value=0.17). A sub-analysis for patients with cancer showed no significant statistical difference (odd ratio, -0.61, 95% CI, -1.56-0.34, P-value=0.21). Regarding body mass index, no significant statistical difference was evident ((odd ratio, -0.12, 95% CI, -0.41-0.16, P-value=0.17). no heterogeneity was observed, I=0.0%, P-value for heterogeneity=0.62and the chi-square =1.80)). No significant weight or body mass changes after thyroidectomy. Further prospective studies assessing age, and sex effects on the same are recommended.

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## 1. INTRODUCTION

Thyroidectomy is performed in 75000 patients annually in the United States [1]. Thyroidectomy is indicated for thyroid disorders including malignancy, multi-nodular goiter, and hyperthyroidism and the effects of

weight and body mass on intra-operative and post-operative morbidity is largely unknown [2]. Free T3 and thyroid-stimulating hormone are typically higher among obese people compared to their counterparts with normal body mass index and the relationship is thought to be mediated through leptin levels [3]. The patient's transition from complete euthyroidism to complete reliance on levothyroxine following surgery might lead to, increase weight, patient dissatisfaction, and decreased quality of life [4- 6]. A piece of objective knowledge about the effects of thyroidectomy on weight change is important for the patients and the treating physician for the proper decision [7]. However, few studies have assessed the same [8]. Therefore, this review aimed to assess the effects of thyroidectomy on body weight and body mass index (BMI) among patients with hyperthyroidism and thyroid cancer. The most recent RevMan system version 5.4 was used for data analysis, all the results were continuous, the fixed and random effects were applied depending on heterogeneity.

## **2. Patients and Methods**

### ***2.1 Eligibility criteria***

Articles were included if they were prospective or retrospective studies, case-control studies, and controlled trials and published in English. Case reports and series were not included. The articles must compare weight change and body mass index before and after thyroidectomy.

### ***2.2 Outcomes measures***

The outcome measures were changes in body weight and body mass index following thyroidectomy.

### ***2.3 The literature search***

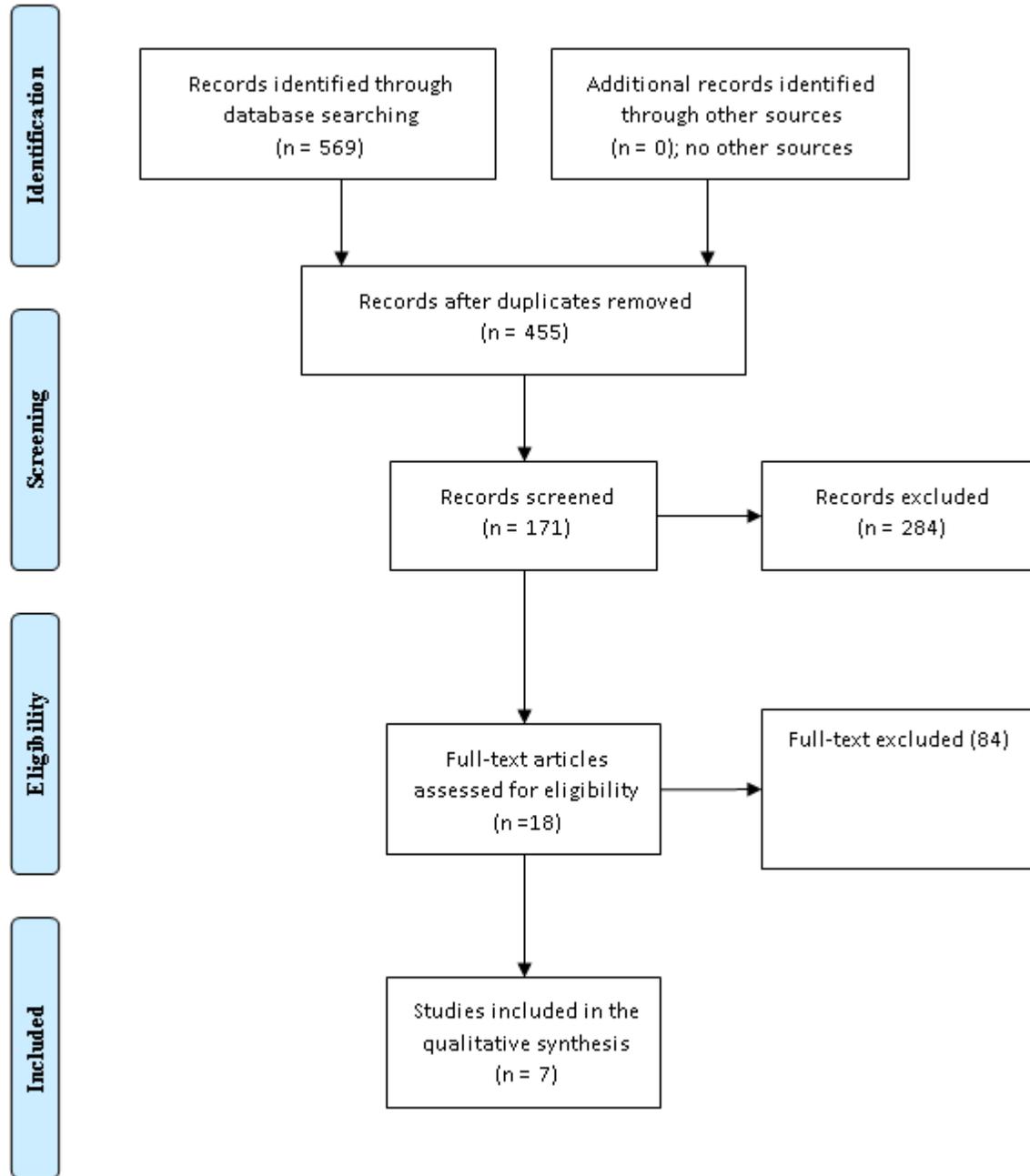
Two independent researchers searched PubMed, MEDLINE, Cochrane Library, and Google Scholar for articles published in English from inception until 13 February 2022. The terms body weight, body mass index, thyroidectomy, thyroid cancer, differentiated thyroid cancer, multinodular goiter, and hyperthyroidism were used with the protean "AND" and "OR". The title and abstract revealed 569 articles and 455 stands after duplication removal, of them 18 full texts were screened and only seven fulfilled the inclusion and exclusion criteria. A datasheet was used to collect the author's name, country, year of publication, the study type, the number of patients, and the weight and body mass index before and after thyroidectomy. Any discrepancy between the two reviewers was solved by consensus. Figures 1 and tables 1-3.

### ***2.4 The quality of the included studies***

Newcastle Ottawa Scale assessed the quality of the included studies [8].

### ***2.5 Statistical analysis***

We used the RevMan system version 5.4 for data analysis, all the results were continuous, the fixed and random effects were applied depending on heterogeneity. A P-value of <0.05 was considered significant.



**Figure 1.** Weight and body mass index changes after thyroidectomy

**Table 1.** Weight change after total thyroidectomy

Author	Country	Study	Weight before surgery	Weight after surgery	Patients
[9]	UK	Prospective	65.8 ± 1.1	71.22 ± 0.76	Thyroidectomy, 162 hyperthyroid patients
[10]	Australia	Retrospective	78.8 ± 17.5	78.9 ± 17.6	Thyroidectomy miscellaneous, 700 patients
[11]	Turkey	Prospective	78.25 ± 12.9	79.75 ± 13.7	Thyroidectomy for hyperthyroid, 22 patients
[12]	Korea	Retrospective	62.4 ± 11.6	62.5 ± 11.7	Cancer 103 sub, 124 total thyroidectomy
[13]	USA		76 ± 21	79 ± 23	Thyroidectomy, 153 thyroid cancer

[14]	Italy	Retrospective	70.8 ± 16.0	72.5 ± 16.4	Hyperthyroidism and euthyroidism, 267 patients
[15]	Korea	Retrospective	61.3±10.1	61.8±10.2	Total thyroidectomy for 700 cancer patients

**Table 2.** Body mass index change after total thyroidectomy

Author	Country	Study	BMI before surgery	BMI after surgery	Patients
[11]	Turkey	Prospective	28.9±4.1	29.45±4.5	Thyroidectomy for hyperthyroid, 22 patients
[12]	Korea	Retrospective	24.4±3.4	24.4±3.4	Cancer 103 sub, 124 total thyroidectomy
[13]	USA		26.9±5.8	27.9±6.6	Thyroidectomy, 153 thyroid cancer
[15]	Korea	Retrospective	24.1±3.2	24.2±3.2	Total thyroidectomy for 700 cancer patients

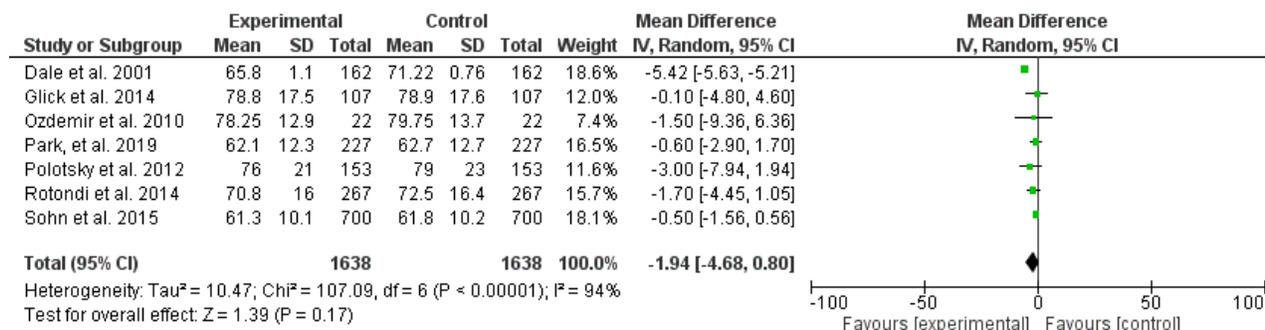
**Table 3.** Newcastle Ottawa scale risk of bias of the included studies

Author	Country	Selection bias	Comparability bias	Outcome	Total score
[9]	UK	4	1	3	8
[10]	Australia	4	1	3	8
[11]	Turkey	4	1	3	8
[12]	Korea	4	1	3	8
[13]	USA	4	2	3	9
[14]	Italy	4	1	3	8
[15]	Korea	4	2	3	9

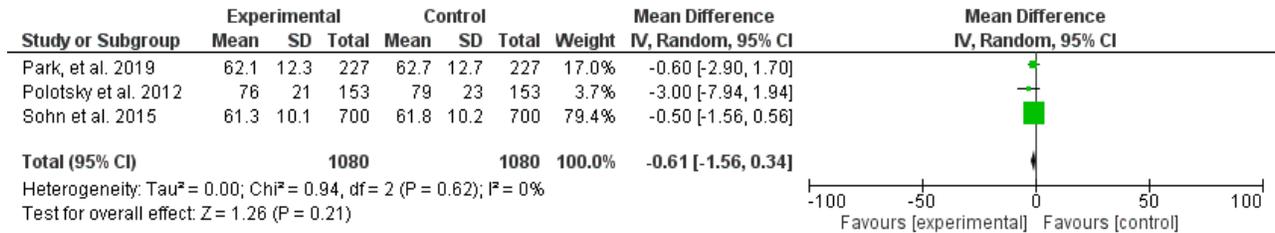
**3. Results**

In the present meta-analysis, we pooled seven studies (all-observational, five retrospectives, and two prospective). The studies included 1638 patients and showed no significant statistical difference of thyroidectomy on weight (odd ratio, -1.94, 95% CI, -4.68-0.80, P-value=0.17). However, high heterogeneity was observed, I=94%, P-value for heterogeneity <0.0001, and the chi-square =107.09). A sub-analysis for patients with cancer showed no significant statistical difference (odd ratio, -0.61, 95% CI, -1.56-0.34, P-value=0.21). However, no heterogeneity was observed, I=0.0%, P-value for heterogeneity =0.62 and the chi-square =0.94) Figure's 2 &3.

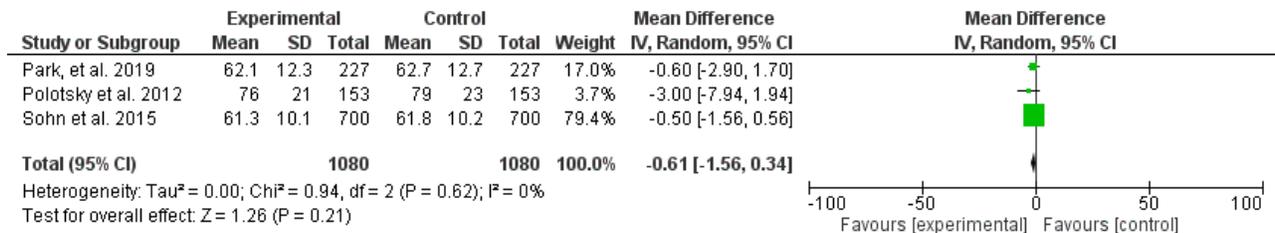
Regarding body mass index, no significant statistical difference was evident ((odd ratio, -0.12, 95% CI, -0.41-0.16, P-value=0.17). no heterogeneity was observed, I=0.0%, P-value for heterogeneity=0.62and the chi-square =1.80)). Figure 4.



**Figure 2.** Weight change after thyroidectomy (pooled)



**Figure 3.** Weight change after thyroidectomy (thyroid cancer only)



**Figure 4.** Body mass index change after thyroidectomy

#### 4. Discussion

In the present meta-analysis, thyroidectomy did not influence weight or body mass index ((odds ratio, -1.94, 95% CI, -4.68-0.80 and odds ratio, -0.12, 95% CI, -0.41-0.16 respectively). Our findings are similar to [16] who showed no significant impact of surgery on body weight. However, the current finding is in contradiction to Huynh and colleagues [17] who found a slight weight gain following thyroidectomy. The increase in weight and body mass index following thyroidectomy observed by previous studies might be explained by age, gender, and Thyroxine withdrawal before radioactive iodine [18], [19]. Thyroxine withdrawal weight-related change might be explained by the significant short-term hypothyroidism and decreased metabolic rate. An increase in fat content is another plausible explanation [19], [15]. T3 deficiency due to thyroxine releasing hormone suppression in cancer patient also contribute to weight gain. Weight changes observed among patients undergoing thyroid surgery may be no different from changes observed in the general population [16]. Weight changes observed in the first two years following surgery could be related to the indication for surgery and the follow-up period because weight regression was also observed after a longer duration of follow-up (from three years following thyroidectomy) [17].

The association of gender on weight changes following thyroid surgery was discussed controversial, some found weight changes among women [20]. While others observed more weight gain among men [5].

**Conclusion:** No significant weight or body mass changes after thyroidectomy. Further prospective studies assessing age, and sex effects on the same are recommended.

**Conflicts of interest:** The authors declare that there are no conflicts of interest.

**Funds:** This meta-analysis is self-funded and not supported by any institution or organization

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