

# Thyroidectomy effects on weight and body mass index: A systematic review and meta-analysis

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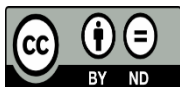


## Keywords:

Thyroidectomy, weight, body mass index, thyroid malignancy, hyperthyroidism.

## ABSTRACT

Thyroidectomy is common and is performed for malignancy, goiters with pressure symptoms, and certain types of Grave's disease. Weight and body mass index (BMI) following thyroidectomy were discussed controversially. This meta-analysis aimed to assess weight and MBI following thyroidectomy. A systematic literature search was conducted in PubMed, Medline, and Google Scholar with interest in articles that assessed body weight and body mass index following total or subtotal thyroidectomy. The search engine was limited to the period from inception up to October 2022. The keywords total thyroidectomy, subtotal thyroidectomy; Graves' disease, multinodular goiter, differentiated thyroid carcinoma, and toxic nodules were used. Out of the 634 articles retrieved, 89 full texts were screened, and only six studies (five retrospective and one prospective cohort) fulfilled the inclusion and exclusion criteria. No differences were evident regarding weight and BMI before and after thyroidectomy (odd ratio, -0.63, 95% CI, -1.50-0.24, P-value for overall effect, 0.15 and -0.12, 95% CI, -0.41-0.16, P-value for overall effect, 0.40 respectively. No heterogeneity was observed,  $I^2$  for heterogeneity, 0.0%. No association between thyroidectomy (when performed for differentiated thyroid carcinoma and hyperthyroidism), weight, and body mass index. Further studies assessing thyroid stimulating hormone levels, radioactive iodine therapy, and thyroxine dose are needed.



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## 1. INTRODUCTION

Thyroidectomy (total or subtotal) is usually performed for malignancy, toxic multi-nodular goiter, Graves' disease, and goiter with pressure symptoms. In the United States of America, more than seventy-five thousand thyroidectomies are performed annually [1]. Patients may complain of weight gain following thyroidectomy due to the rapid transition to complete reliance on exogenous thyroxine [2]. Weight gain may be present even after reaching the targets of thyroid hormone replacement [3]. Weight gain is common among patients with hypothyroidism and is a major cause of poor quality of life and patient dissatisfaction [4], [5]. The knowledge of the effects of thyroidectomy on weight is vital for patients' shared decisions and informed consent [6]. Data on body weight and body mass index after thyroidectomy is scarce. Therefore, this meta-analysis aimed to

assess weight and body mass index changes following thyroidectomy.

## **2. Subjects and Methods**

### ***2.1 Eligibility Criteria according to PICOS:***

All prospective and retrospective cohorts, case-control studies, and cross-sectional studies assessing body weight and body mass index following thyroidectomy were approached. Studies were eligible if they were published in English from the first published article up to October 2022. Case reports, animal studies, or otherwise published in a language other than English were not included.

### ***2.2 Outcome measures:***

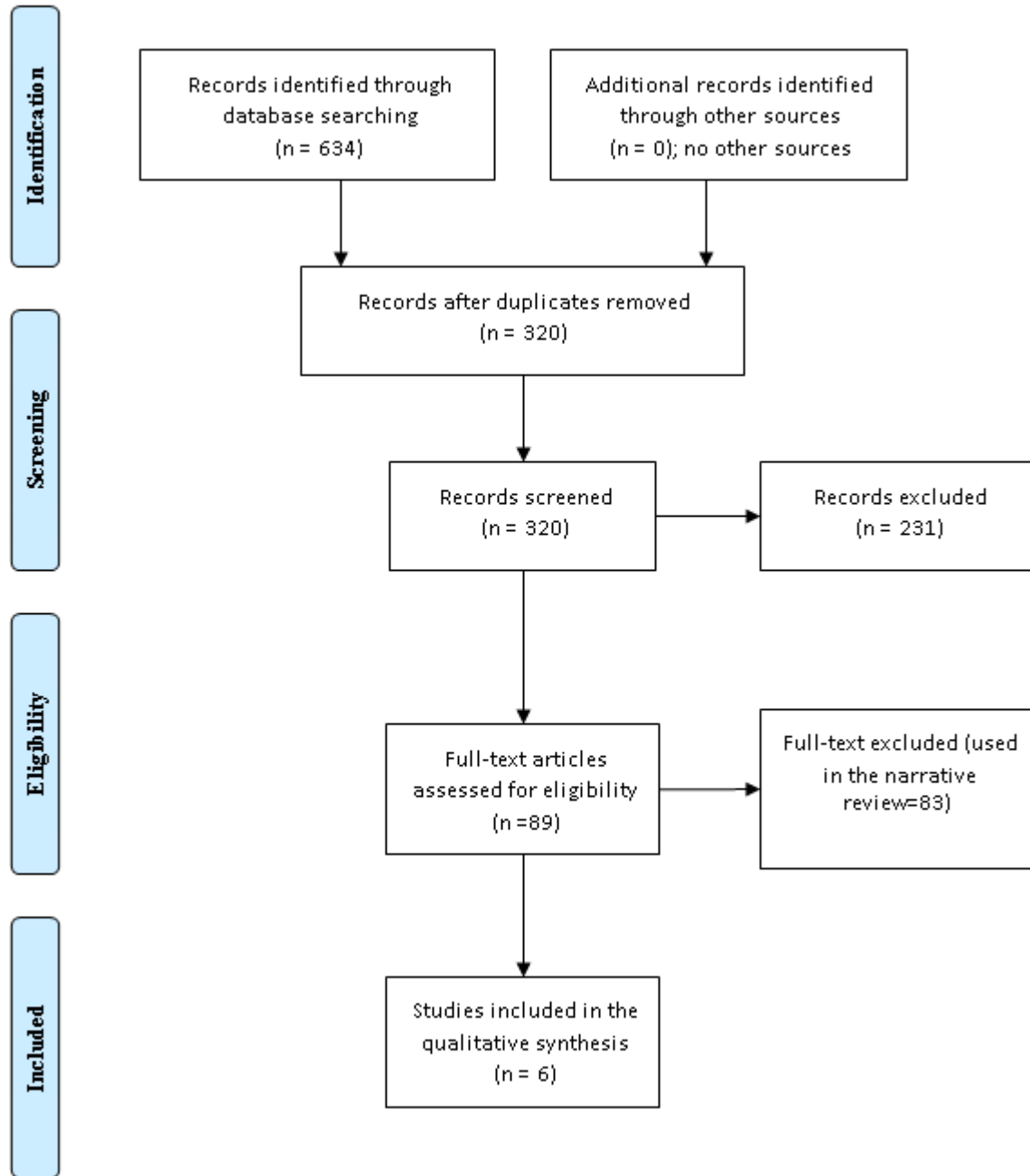
The primary outcomes were body weight and body mass index following total or subtotal thyroidectomy and when indicated for differentiated thyroid carcinoma, Graves' disease, or multinodular goiter. Studies that investigated body changes after thyroidectomy among euthyroid patients without the above-mentioned diseases were excluded.

### ***2.3 Information sources and search:***

Two researchers (H. M and I. A) undertook a systematic literature search; the search was conducted in PubMed, Medline, and Google Scholar with interest in articles that assessed body weight and body mass index following total or subtotal thyroidectomy. In addition, the references list was searched for additional relevant studies. The search engine was limited to the period from inception up to October 2022. The keywords total thyroidectomy, subtotal thyroidectomy; Graves' disease, multinodular goiter, differentiated thyroid carcinoma, and toxic nodules were used. Out of the 634 articles retrieved, 89 full texts were screened, and only six studies fulfilled the inclusion and exclusion criteria.

The data were entered in a structured table detailing the author's name, year of publication, country, patient's number, age, sex, type of study, duration of follow-up, and type and indication of thyroidectomy. The two authors cross-checked the collected data for any errors and discrepancies. Any discrepancies were solved by consensus. Newcastle-Ottawa Scale was used to assess the risk of bias in the included studies [7]. Figure 1, and tables 1-3.

Data analysis: The RevMan system for meta-analysis (version 5.4) was used, and the data were all continuous. Because no heterogeneity was observed, the fixed effect was used to compare body mass index and weight before and after thyroidectomy. A P-value of  $<0.05$  was considered significant.



**Figure 1.** Weight and body mass index change following thyroidectomy

**Table 1.** Basic characteristics of the included studies

| Author | Country   | Age         | Sex              | Type of Study                  | Operation and patients |
|--------|-----------|-------------|------------------|--------------------------------|------------------------|
| [2]    | Australia | 55.8 ± 15.7 | 73.4%<br>females | Retrospective,<br>107 patients | Miscellaneous          |
| [8]    | Turkey    | 45.8        | 77.3%<br>females | Prospective, 22<br>patients    | Hyperthyroid           |

|      |       |             |                  |                                |                 |
|------|-------|-------------|------------------|--------------------------------|-----------------|
| [9]  | Korea | 48.2 ± 11.5 | 86.3%<br>females | Retrospective,<br>227 patients | Cancer          |
| [10] | USA   | 43          | 72%<br>females   | Retrospective,<br>153 patients | Cancer          |
| [6]  | Italy | NA          | NA               | Retrospective,<br>267 patients | Hyperthyroidism |
| [11] | Korea | 50.1±10.3   | 71.4%<br>females | Retrospective,<br>700 patients | Cancer          |

**Table 2.** Body weight and body mass index following thyroidectomy

| Author | Weight before | Weight after | BMI before | BMI after | Follow-up          |
|--------|---------------|--------------|------------|-----------|--------------------|
| [2]    | 78.8±17.5     | 78.9±17.6    | NA         | NA        | Eighteen months    |
| [8]    | 78.25±12.9    | 79.75±13.7   | 28.9±4.1   | 29.45±4.5 | Six months         |
| [9]    | 62.4 ± 11.6   | 62.5 ± 11.7  | 24.4±3.4   | 24.4±3.4  | 28.3 months        |
| [10]   | 76 ± 21       | 79 ± 23      | 26.9±5.8   | 27.9±6.6) | Sixty months       |
| [6]    | 70.8 ± 16.0   | 72.5 ± 16.4  | NA         | NA        | Nine months        |
| [11]   | 61.3±10.1     | 61.8±10.2    | 24.1±3.2   | 24.2±3.2  | Forty-eight months |

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

| Author | Country   | Selection bias | Comparability bias | Outcome | Total score |
|--------|-----------|----------------|--------------------|---------|-------------|
| [2]    | Australia | 4              | 2                  | 2       | 8           |
| [8]    | Turkey    | 4              | 2                  | 2       | 8           |
| [9]    | Korea     | 4              | 2                  | 2       | 8           |
| [10]   | USA       | 4              | 2                  | 3       | 9           |

|      |       |   |   |   |   |
|------|-------|---|---|---|---|
| [6]  | Italy | 4 | 2 | 2 | 8 |
| [11] | Korea | 4 | 2 | 2 | 8 |

### 3. Results

In the present meta-analysis, six studies [2], [8- 10], [6], [11] comparing weight gain among patients with total or subtotal thyroidectomy were pooled using the random effect (1472 patients were included). Two studies were from Asia, one from the USA, one from Europe, and one from Australia, all were retrospective except one which was prospective. No differences between the two groups were evident (odd ratio, -0.63, 95% CI, -1.50-0.24, P-value for overall effect, 0.15). No heterogeneity was observed (P-value for heterogeneity, 0.87, and  $I^2$  for heterogeneity, 0%). Figure 2.

Regarding the body mass index, no difference was found after thyroidectomy, four studies were included with 2204 patients [8- 11], odd ratio, -0.12, 95% CI, -0.41-0.16, P-value for overall effect, 0.40). No heterogeneity was observed (P-value for heterogeneity, 0.61, and  $I^2$  for heterogeneity, 0.0%). Figure 3. It is interesting to note that the results of two studies [9], [11] showed a significant TSH reduction following thyroidectomy. Figure 4.

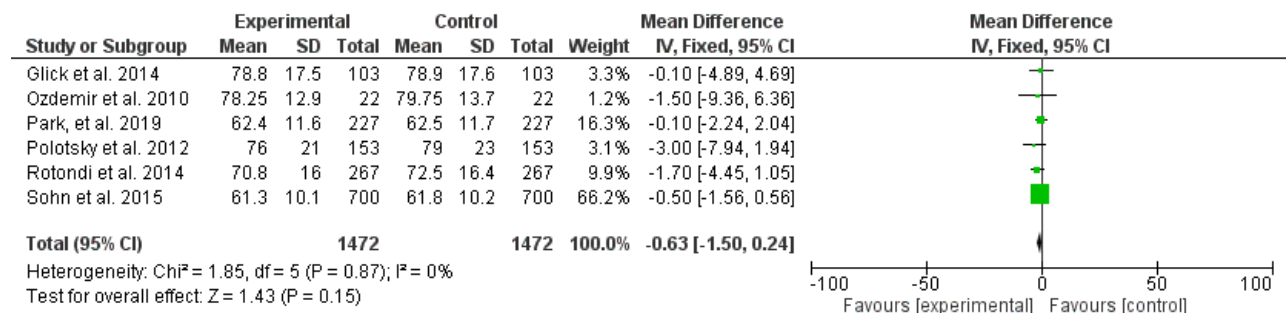


Figure 2. Weight change after thyroidectomy

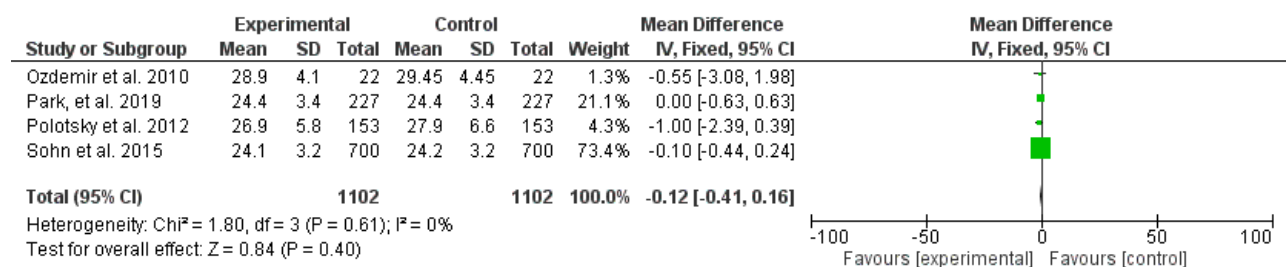


Figure 3. Body mass index change after thyroidectomy

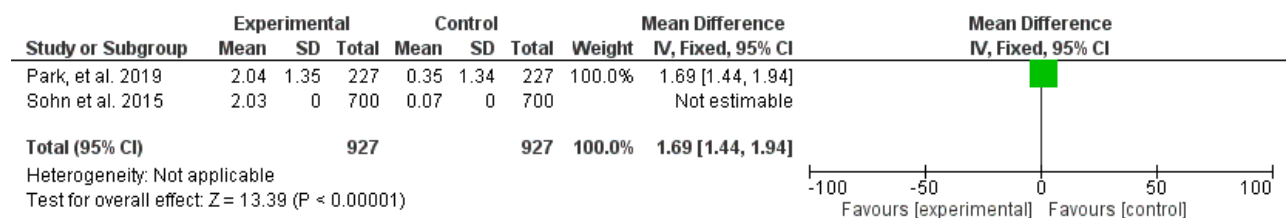


Figure 4. Thyroxine-releasing hormone levels pre and post-thyroidectomy

### 4. Discussion

Few meta-analyses assessed weight changes following thyroidectomy with conflicting results [12], [13]. In the current meta-analysis, no weight or body mass index was observed. Our findings are similar to [13] in their review and meta-analysis found that thyroidectomy did not contribute significantly to weight gain, the authors stated that patients with thyroid cancer and benign thyroid nodules gain weight of 1.07 kg and 1.5kg respectively. The current findings were not in line with Huynh and colleagues who found a significant weight gain following thyroidectomy in particular among young patients with thyrotoxicosis [12]. Previous studies found that post-menopausal women undergoing thyroidectomy gain more weight than their counterparts [14]. Post-operative dietary intervention might affect weight following surgery [15]. It is interesting to note that early weight change at 2-three months highly predicts weight at six months post-operatively [6].

Many factors were suggested as weight and body mass index changes following thyroidectomy including age, sex, T3 deficiency, TSH levels, and thyroid hormone withdrawal before radioactive iodine administration [16], [2]. In the present meta-analysis, the majority of the patients were females of different ages (ranging from 43-55.8 years). It is interesting to note that, no weight or MBI, the following thyroidectomy even though TSH was significantly lower before thyroidectomy.

An interesting study followed thyroidectomized patients for three years and found no difference in weight between those with sub-clinical hyperthyroidism (induced by thyroxine replacement) and their counterparts who were euthyroid [17].

The underlying cause for thyroidectomy might affect weight change, [15] found more weight gain after severe hyperthyroidism, especially Graves' disease. In the present meta-analysis, we included thyroid cancer (9-11), and hyperthyroidism [6], [8], while one stud included miscellaneous [2]. The base-line thyroid hormone and young age were predictors of weight gain rather than the extent of thyroid surgery [16], [17]. In our previous meta-analysis, we found no effect of thyroidectomy on body weight and body mass index. However, our previous study was limited by the high heterogeneity observed and the fact that we included some studies using different thyroid treatments [18].

The strength of the current meta-analysis is that we included age, sex, and indication for surgery. In addition, we assessed the TSH levels before and after thyroidectomy. The small number of the included studies, and including only observation studies limited the current study.

## 5. Conclusion

No change in body weight and body mass index following thyroidectomy for different thyroid diseases. Physicians may need to educate their patients on this important believe for better decision-making.

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