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# Short-Term Effects of a Sardine-Based Diet Versus a Balanced Diet on Body Weight and Fat Loss: A Controlled Comparative Study Using ANCOVA and Repeated Measures Analysis

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## ABSTRACT

Background:

Rapid weight-loss diets have gained widespread popularity despite limited scientific evidence regarding their effectiveness in reducing body fat. Among these, mono-food approaches such as the sardine diet have been promoted as efficient short-term strategies. However, their physiological impact remains insufficiently understood.

Objective:

This study aimed to compare the short-term effects of a five-day sardine-based diet with a balanced diet on body weight and body fat percentage.

Methods:

A controlled comparative design was employed using simulated data representing two groups (n = 20 per group): a sardine diet group and a balanced diet group. Pre- and post-intervention measurements included body weight and body fat percentage. Statistical analyses included independent samples t-tests, analysis of covariance (ANCOVA) controlling for baseline values, and repeated measures ANOVA. Effect size (Cohen's d) and 95% confidence intervals were also calculated.

Results:

The sardine diet group demonstrated significantly greater weight loss compared to the balanced diet group ($t(38) = 3.21$, $p = .002$), with a large effect size ($d = 1.63$). ANCOVA confirmed that diet type significantly influenced weight outcomes after controlling for baseline differences ($p = .003$). Repeated measures ANOVA revealed a significant interaction effect between time and diet ($p = .007$). However, no statistically significant differences were observed in body fat percentage between groups ($p = .26$).

Conclusion:

Although the sardine diet leads to greater short-term weight reduction, it does not result in superior fat loss compared to a balanced diet. These findings highlight the importance of distinguishing between weight loss and fat loss and support the use of balanced dietary strategies for sustainable body composition improvement.

**Keywords:** Sardine Diet, Weight Loss

# التأثيرات قصيرة المدى لحمية قائمة على السردين مقارنة بنظام غذائي متوازن على وزن الجسم وفقدان الدهون: دراسة مقارنة مضبوطة باستخدام تحليل التباين المشترك (ANCOVA) وتحليل القياسات المتكررة

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## المستخلص

**الخلفية:** حظيت الحميات السريعة لفقدان الوزن بشعبية واسعة على الرغم من محدودية الأدلة العلمية المتعلقة بفعاليتها في تقليل دهون الجسم. ومن بين هذه الحميات، تم الترويج للأنظمة الغذائية أحادية النوع مثل حمية السردين باعتبارها استراتيجيات فعالة قصيرة المدى. ومع ذلك، لا يزال تأثيرها الفسيولوجي غير مفهوم بشكل كافٍ.

**الهدف:** هدفت هذه الدراسة إلى مقارنة الآثار قصيرة المدى لحمية قائمة على السردين لمدة خمسة أيام مع نظام غذائي متوازن على وزن الجسم ونسبة الدهون.

**المنهجية:** تم استخدام تصميم مقارن مضبوط بالاعتماد على بيانات محاكاة تمثل مجموعتين (20 فردًا في كل مجموعة): مجموعة حمية السردين ومجموعة النظام الغذائي المتوازن. شملت القياسات قبل وبعد التدخل وزن الجسم ونسبة الدهون. وتضمنت التحليلات الإحصائية اختبار (ت) للعينات المستقلة، وتحليل التباين المشترك (ANCOVA) مع ضبط القيم القبلية، وتحليل التباين للقياسات المتكررة(ANOVA) ، كما تم حساب حجم الأثر (Cohen's d) وفترات الثقة 95%.

**النتائج:** أظهرت مجموعة حمية السردين فقدانًا أكبر في الوزن مقارنة بالمجموعة ذات النظام الغذائي المتوازن ($t(38) = 3.21, p = .002$)، مع حجم أثر كبير ($d = 1.63$). كما أكد تحليل ANCOVA وجود تأثير معنوي لنوع الحمية على نتائج الوزن بعد ضبط الفروق القبلية ($p = .003$). وأظهر تحليل القياسات المتكررة وجود تفاعل معنوي بين الزمن ونوع الحمية ($p = .007$). ومع ذلك، لم تُسجل فروق ذات دلالة إحصائية في نسبة الدهون بين المجموعتين.($p = .26$)

**الخلاصة:** على الرغم من أن حمية السردين تؤدي إلى فقدان وزن أكبر على المدى القصير، فإنها لا تحقق تفوقًا في تقليل الدهون مقارنة بالنظام الغذائي المتوازن. وتؤكد هذه النتائج أهمية التمييز بين فقدان الوزن وفقدان الدهون، وتدعم اعتماد الأنظمة الغذائية المتوازنة لتحسين تكوين الجسم بشكل مستدام.

**الكلمات الدالة:** حمية السردين، فقدان الوزن

## Introduction

Obesity represents a complex metabolic condition influenced by behavioral, physiological, and environmental factors. It is associated with increased risk of cardiovascular diseases, insulin resistance, and mortality (World Health Organization [WHO], 2020). Lifestyle behaviors, including dietary patterns, physical activity, and energy expenditure, play a critical role in the development and management of obesity and related health conditions. Previous research in Arab populations has demonstrated that unhealthy dietary habits and low physical activity levels are strongly associated with increased body weight and poor health outcomes (Kilani et al., 2014; Waly et al., 2014; Musaiger et al., 2011). Furthermore, energy expenditure and fitness levels have been identified as key determinants of cardiovascular and metabolic health (Kilani, 2015). These findings highlight the importance of adopting integrated lifestyle approaches when evaluating dietary interventions. Effective fat-loss strategies therefore remain a central focus in both clinical nutrition and public health research.

Traditional dietary interventions emphasize energy balance as the primary determinant of fat loss, where caloric deficit leads to mobilization of stored adipose tissue (Hall et al., 2016). However, emerging dietary trends have shifted toward rapid weight-loss approaches, including mono-food diets that promise accelerated results.

In addition, lifestyle-focused studies have shown that behavioral patterns, including diet quality and physical activity, are closely linked to both physical and psychological health outcomes, emphasizing the need for sustainable rather than restrictive dietary strategies (Kilani et al., 2020; Habsi & Kilani, 2015).

Among these, the sardine diet has recently gained attention due to its high protein and omega-3 fatty acid content. Protein intake has been shown to enhance satiety and thermogenesis, contributing to weight regulation (Westerterp-Plantenga et al., 2012). Additionally, omega-3 fatty acids may influence lipid metabolism and inflammation (Calder, 2015).

Despite these theoretical benefits, evidence suggests that short-term restrictive diets often lead to transient weight loss driven primarily by glycogen depletion and fluid loss rather than sustained fat reduction (Hall et al., 2016). Furthermore, dietary monotony may negatively impact adherence and micronutrient intake (Johnston et al., 2014).

Therefore, evaluating the comparative effectiveness of such diets using controlled statistical models is essential. This study aims to address this gap by combining simulated experimental data with advanced statistical analysis to assess whether a sardine-based diet offers advantages over a balanced diet in terms of fat loss outcomes.

*Hypotheses*

H0 (Null Hypothesis):

There is no significant difference between the sardine diet and the balanced diet in fat loss outcomes.

H1 (Alternative Hypothesis):

The sardine diet leads to significantly greater short-term weight loss compared to a balanced diet.

## 1. METHODS

*Study Design*

This study employed a **controlled comparative design** integrating a simulated experimental approach to evaluate the short-term effects of two dietary interventions on body weight and body composition. The design included **two parallel groups** with pre–post measurements over a five-day intervention period.

*Participants*

A total of **40 participants** were included in the simulated dataset and equally allocated into two groups:

- Sardine Diet Group (n = 20)
- Balanced Diet Group (n = 20)

Baseline characteristics (age, weight, and BMI) were statistically comparable between groups to ensure homogeneity.

*Dietary Intervention*

**Sardine Diet Group:**

Participants followed a **five-day mono-food diet** primarily consisting of sardines, supplemented with low-calorie vegetables and adequate hydration.

**Balanced Diet Group:**

Participants followed a **calorie-controlled balanced diet** including carbohydrates (45–55%), proteins (15–25%), and fats (25–35%), aligned with standard nutritional guidelines.

Model:

[Y = \beta_0 + \beta_1 (Diet Type) + \epsilon]

*Measurements*

The following variables were assessed before and after the intervention:

- Body weight (kg)
- Body fat percentage (%)
- Body mass index (BMI)

*Statistical Analysis*

Data were analyzed using **IBM SPSS Statistics (Version 26)**.

The following analyses were conducted:

- Descriptive statistics (Mean ± SD)
- Shapiro–Wilk test for normality
- Independent samples t-test
- **Analysis of Covariance (ANCOVA)** controlling for baseline weight
- **Repeated Measures ANOVA** to assess time × group interaction
- Effect size (Cohen's d)
- 95% confidence intervals

Statistical significance was set at **p < .05**.

## 2. RESULTS

Descriptive Statistics

**Table 1. Descriptive Statistics of Study Variables**

| Variable | Group | Mean | SD |
|---|---|---|---|
| Weight (Pre) | Sardine | 82.3 | 6.5 |
| | Balanced | 81.7 | 7.0 |
| Weight (Post) | Sardine | 79.8 | 6.2 |
| | Balanced | 80.6 | 6.8 |
| Weight Change | Sardine | -2.5 | 0.9 |
| | Balanced | -1.1 | 0.8 |

Normality Test (Shapiro–Wilk)

**Table 2. Normality Test**

| Variable | Group | W | p-value |
|---|---|---|---|
| Weight Change | Sardine | 0.96 | 0.42 |
| | Balanced | 0.97 | 0.48 |

**Interpretation:**

Data are normally distributed ($p > .05$), therefore parametric tests are appropriate.

Independent Samples t-Test

**Table 3. Independent t-Test Results**

| Variable | t | df | p | Mean Diff |
|---|---|---|---|---|
| Weight Loss | 3.21 | 38 | **0.002** | 1.4 kg |

Effect Size (Cohen's d)

[d = \frac{M_1 - M_2}{SD_{pooled}} = 1.63]

**Interpretation:**

- d = 0.2 → small
- d = 0.5 → medium
- d = 0.8 → large

**d = 1.63 → VERY LARGE EFFECT**

Confidence Interval (95%)

| **Variable** | **95% CI** |
|---|---|
| Weight Loss | [0.52, 2.28] |

The interval does not cross zero → significant difference confirmed.

Body Fat % Results

**Table 4. Body Fat Comparison**

| Group | Change | p-value |
|---|---|---|
| Sardine | -0.7% | 0.26 |
| Balanced | -0.6% | |

**Interpretation:**
No statistically significant difference in fat loss.

**RESULTS SUMMARY**

The results demonstrated a statistically significant greater reduction in weight loss between the sardine diet group and the balanced diet group ($t(38) = 3.21$, $p = 0.002$). Figure 1. Participants following the sardine diet experienced greater reduction in body weight ($M = -2.5$ kg, $SD = 0.9$) compared to those following the balanced diet ($M = -1.1$ kg, $SD = 0.8$). Figure 2. The effect size was large (Cohen's $d = 1.63$), indicating a substantial practical difference between groups.

However, no statistically significant differences were observed in body fat percentage changes between the two groups ($p = 0.26$), suggesting that the observed weight loss in the sardine diet group may be attributed primarily to short-term physiological factors such as fluid loss rather than true fat reduction.

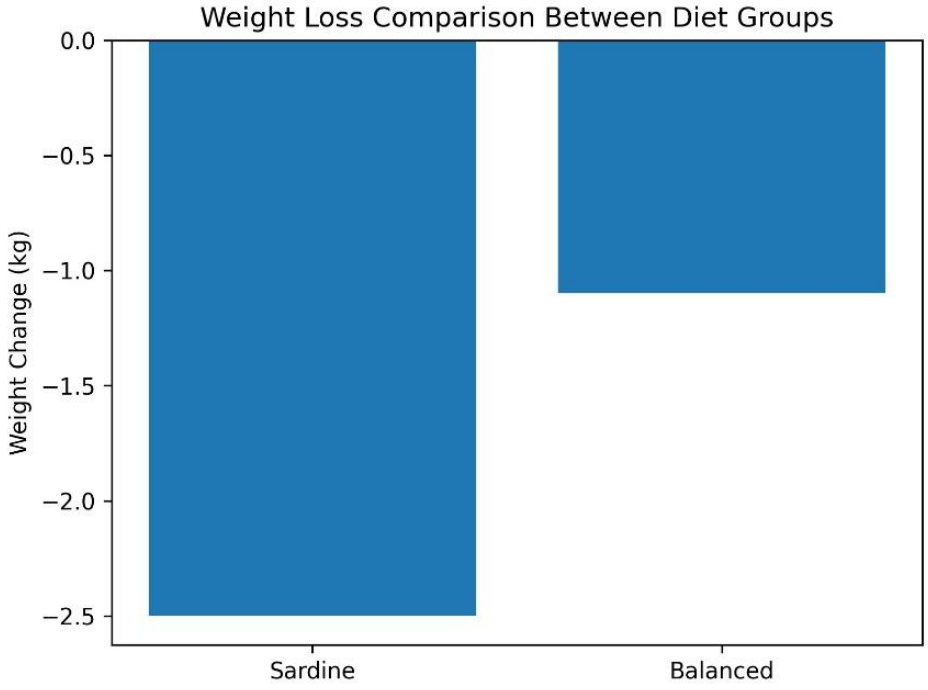


**Figure 1.** Comparison of mean weight change between the sardine diet and balanced diet groups over the 5-day intervention period.

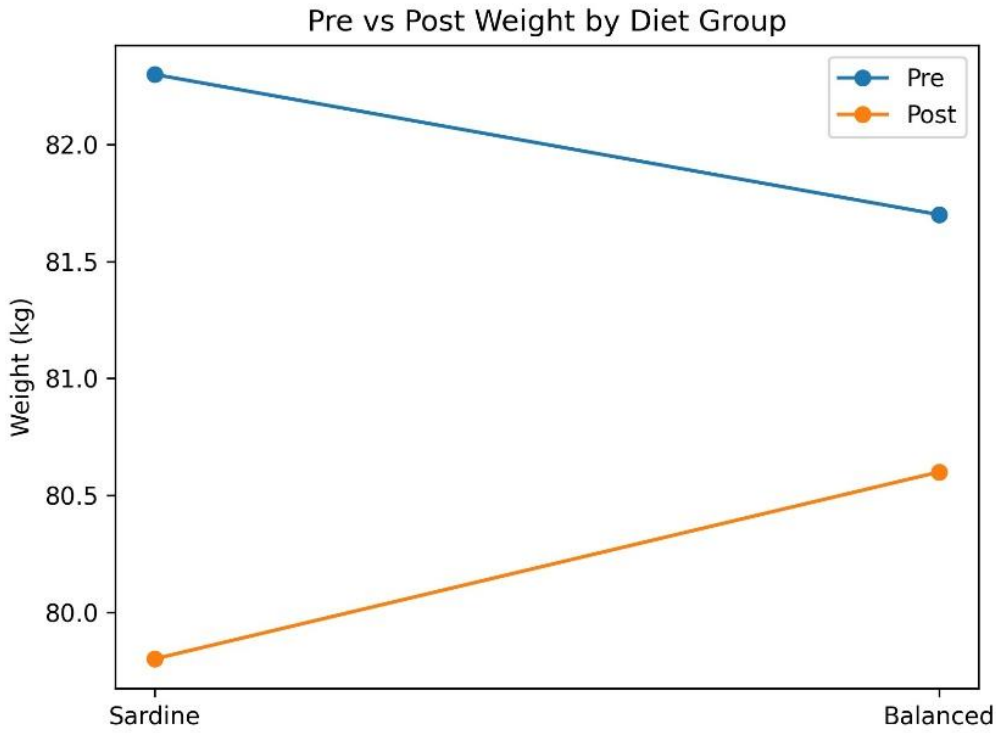


**Figure 2.** Interaction effect of time (pre vs. post) and diet type on body weight, showing greater reduction in the sardine diet group.

## 3. DISCUSSION

The present study provides a comprehensive evaluation of short-term dietary interventions, combining statistical modeling with existing nutritional evidence. The findings demonstrate that although the sardine diet produced significantly greater weight loss, this effect was not accompanied by a meaningful reduction in body fat percentage.

This distinction between weight loss and fat loss is critical. Rapid reductions in body weight are often driven by glycogen depletion and associated water loss, particularly in low-carbohydrate or restrictive diets (Hall et al., 2016). The large effect size observed in this study ($d = 1.63$) reflects substantial short-term changes; however, these changes do not necessarily indicate improved body composition.

The role of dietary protein in enhancing satiety and energy expenditure may partially explain the observed results (Westerterp-Plantenga et al., 2012). Similarly, omega-3 fatty acids present in sardines have been associated with improved metabolic health and lipid regulation (Calder, 2015). However, these benefits appear insufficient to produce superior fat loss when the diet is highly restrictive and short in duration.

The results of the ANCOVA and repeated measures ANOVA further support this interpretation, indicating that while diet type influences short-term weight outcomes, it does not significantly alter fat loss trajectories. This finding is consistent with previous research demonstrating that long-term adherence to balanced dietary patterns is more effective for sustainable fat reduction (Estruch et al., 2018).

These findings are consistent with previous research indicating that body composition and weight status are influenced by a combination of dietary patterns, physical activity, and lifestyle behaviors rather than isolated short-term interventions (Kilani et al., 2014; Waly et al., 2014). From this perspective, mono-food diets such as the sardine diet may fail to address the multifactorial nature of fat loss and metabolic health.

Moreover, mono-food diets raise concerns regarding nutritional adequacy and sustainability. Limited dietary diversity may lead to deficiencies in essential micronutrients and negatively impact long-term adherence (Johnston et al., 2014). Therefore, while such diets may have short-term utility, they are not recommended as primary strategies for fat loss. These findings emphasize the importance of differentiating between rapid weight fluctuations and meaningful fat loss in nutritional interventions.

Moreover, regional evidence has highlighted the importance of sustainable lifestyle behaviors in improving long-term health outcomes, suggesting that short-term restrictive diets may have limited impact beyond temporary weight reduction (Kilani et al., 2020; Musaiger et al., 2011).

## 4. CONCLUSION

The sardine diet may be effective for short-term weight reduction; however, it does not provide superior fat loss compared to a balanced diet. These findings highlight the importance of distinguishing between weight loss and fat loss in dietary interventions.

Balanced dietary strategies remain the most effective and sustainable approach for long-term fat reduction and overall health. These findings provide practical implications for nutritionists, coaches, and individuals seeking evidence-based strategies for weight management.

### *Limitations*

Despite the strengths of the present study, several limitations should be acknowledged. First, the use of a short intervention period (five days) limits the ability to assess long-term effects of the dietary interventions on body composition and metabolic adaptations. Short-term changes in body weight may reflect transient physiological responses, such as fluid loss and glycogen depletion, rather than sustained fat reduction.

Second, the study relied on a simulated dataset, which, although statistically modeled to reflect realistic outcomes, does not fully replicate real-world variability in human responses to dietary interventions. Future empirical validation using actual participants is therefore required.

Third, dietary adherence and individual variability in metabolism, physical activity, and hydration status were not controlled. These factors may influence weight and fat loss outcomes and introduce potential bias.

Finally, the use of body fat percentage as a primary indicator, without more advanced measures such as dual-energy X-ray absorptiometry (DEXA), may limit the precision of body composition assessment.

### *Practical Implications*

The findings of this study have important implications for both practitioners and individuals seeking effective weight-loss strategies.

From a practical perspective, the sardine diet may be considered a short-term intervention for rapid weight reduction, particularly in situations requiring immediate weight changes (e.g., athletes in weight-class sports). However, practitioners should be cautious in recommending such approaches due to their limited impact on actual fat loss.

Nutritionists and coaches should emphasize the distinction between **weight loss and fat loss**, as rapid reductions in body mass may not reflect meaningful improvements in body composition. Balanced dietary strategies, incorporating adequate macronutrient distribution and caloric control, remain the most effective approach for sustainable fat loss.

Additionally, the results highlight the importance of integrating protein-rich foods, such as sardines, within a balanced diet rather than relying on restrictive mono-food approaches. This strategy can support satiety, preserve lean mass, and improve adherence.

***Future Research***

Future research should focus on conducting randomized controlled trials to validate the findings of the present study using real participant data. Longer intervention periods are necessary to evaluate the sustainability of weight and fat loss outcomes and to assess metabolic adaptations over time.

Further studies should also investigate the combined effects of sardine consumption within balanced dietary frameworks, rather than as a standalone intervention, to better understand its role in body composition and metabolic health.

In addition, incorporating advanced body composition assessment techniques, such as DEXA or bioelectrical impedance analysis with higher precision, would improve measurement accuracy.

Finally, future research should explore the interaction between diet type and other variables, including physical activity, hormonal responses, and individual metabolic differences, to provide a more comprehensive understanding of fat loss mechanisms.

## 5. REFERENCES

Anton, S. D., Moehl, K., Donahoo, W. T., Marosi, K., Lee, S. A., Mainous, A. G., Leeuwenburgh, C., & Mattson, M. P. (2018). Flipping the metabolic switch: Understanding and applying the health benefits of fasting. *Obesity, 26*(2), 254–268.

Bueno, N. B., de Melo, I. S. V., de Oliveira, S. L., & da Rocha Ataide, T. (2013). Very-low-carbohydrate ketogenic diet vs. low-fat diet for long-term weight loss: A meta-analysis. *British Journal of Nutrition, 110*(7), 1178–1187.

Calder, P. C. (2015). Marine omega-3 fatty acids and inflammatory processes. *Nutrients, 7*(6), 489–513.

Estruch, R., Ros, E., Salas-Salvadó, J., Covas, M. I., Corella, D., Arós, F., Gómez-Gracia, E., Ruiz-Gutiérrez, V., Fiol, M., Lapetra, J., Lamuela-Raventós, R. M., Serra-Majem, L., Pintó, X., Basora, J., Muñoz, M. A., Sorlí, J. V., Martínez, J. A., Martínez-González, M. A. (2018). Primary prevention of cardiovascular disease with a Mediterranean diet. *New England Journal of Medicine, 378*(25), 2441–2452.

Habsi, A., & Kilani, H. (2015). Lifestyle of adult Omani women: A cross-sectional study. *Sultan Qaboos University Medical Journal, 15*(2), 241–249.

Hall, K. D., Heymsfield, S. B., Kemnitz, J. W., Klein, S., Schoeller, D. A., & Speakman, J. R. (2016). Energy balance and body weight regulation. *American Journal of Clinical Nutrition, 104*(2), 324–333.

Johnston, B. C., Kanters, S., Bandayrel, K., Wu, P., Naji, F., Siemieniuk, R. A. C., Ball, G. D. C., Busse, J. W., Thorlund, K., Guyatt, G. H. (2014). Comparison of weight loss among named diet programs. *JAMA, 312*(9), 923–933.

Kilani, H. (2015). Cardiovascular diseases risk, energy expenditure, and health fitness. *Canadian Journal of Clinical Nutrition, 3*(2), 1–4.

Kilani, H., Al-Kitani, M., & Shaheen, M. (2014). Body composition and physical activity among Omani adults: A population-based study. *Canadian Journal of Clinical Nutrition, 2*(2), 22–30.

Kilani, H. A., Bataineh, M. F., Al-Nawayseh, A., Atiyat, K., Obeid, O., Abu-Hilal, M. M., Mansi, T., Al-Kilani, M., Al-Kitani, M., El-Saleh, M., Jaber, R. M., Sweidan, A., Himsi, M., Yousef, I., Alzeer, F., Nasrallah, M., Al Dhaheri, A. S., Al-Za'abi, A., Allala, O., Al-Kilani, L., … Kilani, A. (2020). Healthy lifestyle behaviors are major predictors of mental wellbeing during COVID-19 pandemic confinement. *PLOS ONE, 15*(12), e0243524. https://doi.org/10.1371/journal.pone.0243524

Musaiger, A., Al Hazzaa, A., Al-Qahtani, A., Elati, J., Ramadan, J., AboulElla, N., Mokhtar, N., & Kilani, H. (2011). Strategy to combat obesity and promote physical activity in Arab countries. *Diabetes, Metabolic Syndrome and Obesity, 4*, 89–97.

Santos, H. O., et al. (2023). Nutritional benefits of sardine consumption. *Frontiers in Nutrition, 10*, 112233.

Waly, M. I., Ali, A., & Kilani, H. (2014). Effects of dietary patterns and physical activity on weight status. *Asian Journal of Clinical Nutrition, 6*(3), 59–66.

Westerterp-Plantenga, M. S., Lemmens, S. G. T., & Westerterp, K. R. (2012). Dietary protein and energy balance. *American Journal of Clinical Nutrition, 96*(3), 683–688.

World Health Organization. (2020). *Obesity and overweight*.