Innovations

Association of Gluteal Muscle Weakness and Sedentary Life Style among Postmenopausal Females: A Systematic Review

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Abstract

Introduction*: In postmenopausal women, gluteal muscular weakness and a sedentary lifestyle are growing concerns that could exacerbate musculoskeletal diseases and metabolic syndrome. Comprehending these two variables' correlations is vital in formulating efficacious intervention tactics for this particular demographic.*

***Objective**: The purpose of this systematic review is to assess the relationship between postmenopausal women's gluteal muscle weakness and sedentary behavior, with an emphasis on identifying important variables, plausible explanations, and implications for intervention and health. **Methods**: A thorough search for published research up to April 2024 was done using a variety of databases, including PubMed, Scopus, and Google Scholar. Studies looking at the connection between postmenopausal women's sedentary lifestyles and gluteal muscular strength were eligible, as were observational studies and clinical trials. Information about the study's design, sample composition, methods of assessment, and conclusions regarding sedentary behavior and gluteal muscle weakness were retrieved. **Result**: A total of 11 studies met the inclusion criteria. The review found a strong correlation between postmenopausal women increased gluteal muscle weakening and their sedentary lifestyles. Extended durations of inactivity, or sedentary behavior, have been repeatedly associated with decreased gluteal muscular strength. According to the research, a decrease in physical activity may cause or worsen gluteal muscle weakness, which may have a negative impact on one's health by raising the risk of falls, causing lower back pain, and reducing one's*

functional mobility. ***Conclusion****: The data show that sedentary lifestyles and gluteal muscle weakness are significantly correlated in postmenopausal women. These results demonstrate the necessity of focused interventions to enhance gluteal muscle strength and encourage physical activity in order to improve health outcomes in this population. Future studies ought to examine the efficiency of particular exercise regimens and lifestyle adjustments in reducing these problems.*

Keywords: *Gluteal Muscle Weakness, Sedentary Lifestyle, Postmenopausal, Female, Systematic Review, Physical Activity, Musculoskeletal Health.*

1. Introduction

Menopause is a term that directly describes the natural process in women where menstruation stops. It marks a transitional phase in every woman's life.[1]The main reproductive hormone, estrogen (17β-estradiol), drastically decreases throughout this period, going from normal cyclic levels (100–250 pg/mL) to fewer than 10 pg/mL. Consequently, there is a reduction in estrogenic activity as a result of estrogen's diminished capacity to completely attach to receptors and activate

target cells.[2]Menopause is characterized by a dramatic decrease in the synthesis of female hormones including progesterone and estrogen as well as the ovaries' cessation of egg production.[3,4]

Women often encounter symptoms like weight gain, night sweats, hot flashes, sleep disorders, osteoporosis, mental difficulties, and cardiovascular problems at this stage. It is predicted that women would experience the postmenopausal stage for around 40% of their lifetimes due to an increase in life expectancy.[5]Particularly, endothelial dysfunction, alterations in body composition and lipid profile, elevated arterial pressure, and insulin resistance[6] all contribute to an increased risk of cardiovascular disease at the onset of menopause[7]. Furthermore, postmenopausal women may see a decrease in their bone mass, strength [8], and muscle mass [9] due to their shift to a more sedentary lifestyle.

Because of the quick development of technology over the last few decades, there has been a consistent decrease in physical activity and an increase in sedentary lives. [10,11] As a result, several once-strong muscles that were essential for proper posture and injury prevention are now working less. This is particularly true for

the muscles in the trunk and hips that supported the erect posture against gravity [12].

External rotation and hip abduction are mostly positively influenced by the gluteus maximus (GMa) and gluteus medius (GMe) muscles. [13-14,16] The primary muscles involved in pelvic stability and lower extremity function are generally the GMe and GMa muscles. Their involvement is often linked to conditions affecting the hip, pelvis, and knee. [15,16] The superior gluteus maximus becomes active when performing various movements other than walking, lifting, throwing, crouching, and climbing stairs namely during sprinting, running, and climbing.[17] Muscular imbalance is the primary cause of low back pain in sedentary people, and if untreated, this imbalance can lead to a persistent lower back pain syndrome.The entire body is stabilized and has full range of motion (ROM) owing to the gluteal and core muscles.[18] The "core" muscle network's weakening is the primary cause of many illnesses. As a result, it may cause back pain, an excessive amount of strain on the lumbar spine, low muscular endurance, hip extensor imbalance, lower extremity instability, and eventually paraspinal muscle atrophy.[19]

Therefore, this study focuses on finding the relationship between two key factors in post-menopausal women, namely, gluteal muscle weakness and sedentary lifestyle through the help of literature that has already been published.

1.1 Aim of the Study

- The main goal is to ascertain whether a sedentary lifestyle and weaker gluteal muscles are significantly correlated in postmenopausal women. The aim of this study is to establish whether sedentary postmenopausal women tend to have weaker gluteal muscles, which may have an impact on their general health and range of motion.
- To assess how sedentary behaviour affects gluteal muscle strength and investigate any potential health effects of gluteal muscle weakness.
- To Examine the Function of Exercise in Preventing Gluteal Muscle Weakness.

1.2 Need of the Study

It is essential to comprehend the connection between postmenopausal women's gluteal muscle weakening and sedentary lifestyles in order to design

focused interventions that enhance physical health and quality of life. It might result in suggestions for dietary adjustments, particular workout regimens, or public health initiatives meant to encourage postmenopausal women to become more physically active in order to mitigate the harmful impacts of a sedentary lifestyle.

1.3Research Question

- Does a sedentary lifestyle make postmenopausal women more susceptible to developing weakening in their gluteal muscles?
- What effects can gluteal muscle weakening have on a postmenopausal woman's health?

2. Methodology

Research problem is analysed using secondary data analysis.Articles were explored on PUBMED, Scopus, google scholar, web science, journals and books to find articles related to association of gluteal muscle weakness and sedentary lifestyle in post-menopausal women. For this study, articles

published in various journals in the time period 2007-2024 in english language.

Population: Post-menopausal women, those who have attained menopause.[1]

Keywords: Gluteal muscle weakness, sedentary lifestyle in women, post-menopausal women, relationship between sedentary lifestyle and gluteal muscle weakness.

Study identification: Data was collected from co-relational studies, systematic reviews, interview based, cross sectional studies and self-reporting study.

2.1 Inclusion Criteria

- Studies published between 2007-2024.
- Studies involving postmenopausal women.
- Studies related to gluteal muscle weakness and sedentary lifestyle.

2.2 Exclusion Criteria

- Articlesother than English language.
- Incomplete studies

- Interventional studies.

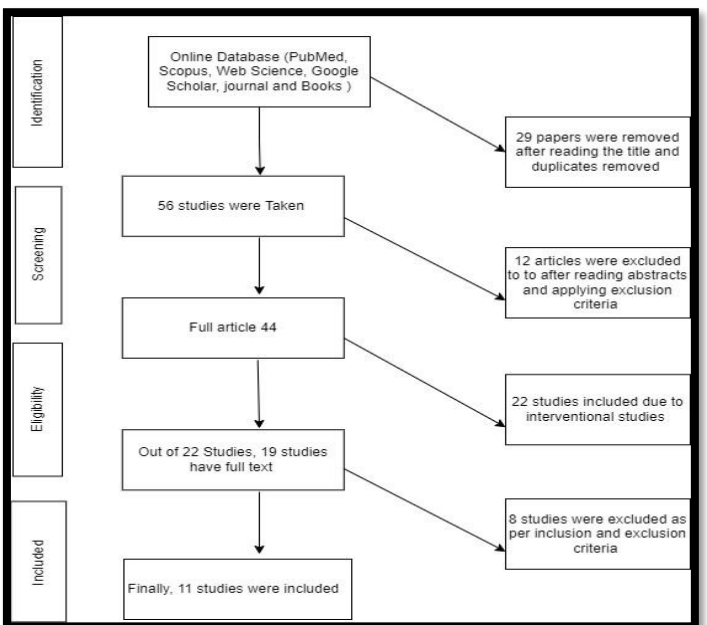

Figure.1 Study Design

3. Review Of Literature

For this study, literature on gluteal muscle weakness and sedentary lifestyle among post-menopausal women was selected.

Table.1 Study Characteristics

S. No.	Title of the study	Author's name, year	Methodology	Result
1	Features, measurements, determinants, treatments, and outcomes of musculoskeletal symptoms in postmenopausal women: A scoping	Tram Thi Bich Nguyen et al, Jul 2024	A scoping investigation was completed by December 2022 using six databases: Web of Science,	Musculoskeletal complaints in postmenopausal women include pains in the upper and lower limbs, soreness in the spine, and a decline in physical

	review		Scopus, Medline, Cochrane, CINAHL, and Embase. Sixty-three objects were discovered.	ability.Four types of assessments were made: common muscular problems and the standard of lives particular to menopause questionnaires, common musculoskeletal symptoms, and menopause-specific musculoskeletal symptoms.The variables revealed four

				concepts:characteristics and physiological variables , psychologicalvariables, and way of living.For postmenopausal women with musculoskeletal problems, there are pharmacological therapy, diet plans, and exercise regimens available.[26]

2	Evaluation of Muscle Strength and Endurance in Postmenopausal Women: A Cross-sectional Study	Arati V Mahishale et al (2021)	Cross-sectional research with 65 postmenopausal women was conducted. The study included measurements of height, weight, BMI, and waist-hip ratio.The	Postmenopausal women have strong cardiovascular endurance but diminished strength in their upper and lower limbs. Strength in the handgrip, gluteal, and hamstring muscles significantly linked with BMI, and the majority of the women had central

			strength of the quadriceps, hamstrings, gluteal, calf, back, and abdominal muscles was evaluated using a pressure biofeedback unit.A portable dynamometer was used to evaluate the handgrip	obesity.[2]

			strength. A 6-minute test and step test were used to assess cardiovascular endurance. The outcome measure were used in this study 1. Pressure Biofeedback 2. Handheld dynamometer 3. 6-minute walk test	

			(6MWT) 4. The YMCA offers a three-minute bench step training program.	
3	Musculoskeletal Health in Menopause	Kathleen A. Geier et al, Dec 2021	The physiology of the musculoskeletal changes associated with menopause is covered in the chapter, along	musculoskeletal alterations after menopause can be attributed to estrogen deficiency which can lead to significant metabolic bone and muscle changes. Most

			with information on diagnosing, treating, and preventing the more often reported disorders.	women complain of arthralgia and myalgia in post-menopausal stage.[28]
4	Correlation analysis between biochemical markers, pain perception, low back functional	Juliana Brandão Pinto De Castro et al, Jan 2020	The study comprised eleven postmenopausal women (body mass	Women who have gone through menopause and are older typically have lower levels of lumbar strength

	disability, and muscle strength in postmenopausal women with low back pain		63.07 ± 9.78 kg, height 1.55 ± 0.07 m, BMI 26.01 ± 2.67 kg/m2) who had spine functioning impairment and discomfort.They were between the ages of 44 and 66.For the purpose of examining the	and greater blood cortisol levels. Furthermore, there is a correlation between lower lumbar strength and higher cortisol levels. Higher pain perception in patients with lower estrogen levels often ladies experiencing low back ache after menopause.[5]

			baseline blood was extracted using the luminescence technique, the blood levels of cortisone and estradiol were measured, and CK was determined using the enzymatic method.The Roland-Morris	

			Questionnaire (RMQ) and the Visual Analogue Scale (VAS) were used to measure the opinion about spinal functional limitations and tenderness. , respectively. An isometric test was used to measurethe	

			endurance of the musculature that stretch the backbone and the power of the gastrointestinal wall.	
5	Muscle mass in Indian post - menopausal women: An observational study	Arati Mahishale et al, Aug 2019	For this study, one hundred post-menopausal women in the 50–55 age range who	Women's BMI was 28.8 ± 3.4 kg/m^2. In postmenopausal women,girth measurements showed average frequency of

			were in generally good health were included. This study used the skinfold measurement, body mass index (BMI), girth measurement, and waist-hip ratio as outcome measures.	change to be 38%, whereas changes in skinfold measurements had a frequency average of 43.8%. The current study found that the majority of postmenopausal women had muscle mass scores that were below average. [25]

6	Association Between Pelvic Floor Muscle Strength and Sexual Function in Postmenopausal Women	Michelle Sako Omodei et al, Dec 2019	226 heterosexual, Women who are engaged in sexual activities aged 45–65 who had not had amenorrhea in over a year and had no pelvic floor problems participated in a cross-sectional	Compared to women with functional PFM, postmenopausal women with dysfunctional PFM were doing bad inintimacy activity.[20]

			study using analytical techniques. The Female Sexual Function Index (FSFI), whose score of ≤26.5 signifies sexual dysfunction, used to assess sexual functions. PFM strength was measured	

			with a modified Oxford scale (with rating of 0–5) through bidigital vaginal palpation, and the results were divided into two categories: nonfunctional (scoring of 0–1, lacking an abbreviation) andeffective	

			(scoring of 2–5, with an abbreviation).	
7	Gluteus Minimus and Gluteus MediusMuscle Activity During CommonRehabilitation Exercises in HealthyPostmenopausal Women	Charlotte Gandertonet al, Dec 2017	Intramuscular transducers were placed into the Gluteus Medius and Gluteus Minimus sections of ten postmenopausal, healthy women.	The exercise that ranked highest forentire muscular segments—aside from the front Gluteus Minimus, which ranked second—was the static standing hip hitch with opposite hip swing. Entire muscle parts chose

			Following completion of seven gluteal rehabilitation exercises, the workouts were ranked from highest to lowest using average normalized muscle activity.	the dip test as the most highly-rated dynamic exercise.[21]
8	Relationship between pelvic floor muscle	Maíra de Menezes Franco et al, June 2017	In this cross-sectional study, on 113	PFM efficacy was poorer in postmenopausal

	strength and sexual dysfunction in postmenopausal women: a cross-sectional study		patients with menopause, vaginal manometry was used to assess PFM strength, the Female Sexual Function Index (FSFI) is considered to check sexual activity(score of ≤26.5 indicatedintimate dysfunction),	women with reproductive dysfunction than in those lacking such problems. A slight association was observed involving the extent of urine incontinence and reproductive ability.[24]

			and the International Consultation on Incontinence Questionnaire -Urinary Incontinence (ICIQ-UI) Short Form was used to assess reports of urinary incontinence. Spearman's rank correlation	

			coefficient (ρ), the Mann-Whitney test, and 95% confidence intervals were used for statistical analysis.	
9	Low back pain in healthy postmenopausal women and the effect of physical activity: A secondary analysis	Mirca Marini et al,may 2017	A survey focusing on non-specific muscular discomfort was completed by	At baseline, 32.9% of the patients had LBP. females randomly assigned to PA administration had a decreased

	in a randomized trial		210 of the 234 women who participated in the DAMA investigation overall, simultaneously at base and 24 months after the course of treatment. The DAMA experiment is the subject of this study's second-party	predominance of LBP at following up (21.6%) compared to beginning (33.3%) (p = 0.02). Conversely, across women who were not given the PA treatment, the prevalence of LBP was lower at follow-up (25.6%) and higher at baseline and follow-up (32.4%) (p = 0.30). Overall, there was

			evaluation. In order to reduce mammographic breast thickness in after menopause women, it is based on nutrition and moderate-intensity exercise.	no noticeable difference in LBP across groups as a result of the PA intervention.[22]
10	A comparison of	Charlotte Gande	The TFL had a	After menopause

	gluteus medius, gluteus minimus and tensor facia latae muscle activation during gait in post-menopausal women with and without greater trochanteric pain syndrome	rton et al, April 2017	surface electrode, while the GMin (x2) and GMed (x3) segments had intramuscular electrodes inserted. Ten members of the control group and eight GTPS patients completed six walking tests. Max	patient having GTPS were found to have increased segmental gluteal muscular induction, decreased diversity in contraction of muscles, and diminished hip abduction capacity in a contrast with norms. These results could lead to increased pain and strain in the gluteal tendon. An opposite

			magnitude, mean magnitude, along with time to peak at all stages of the gait cycle (0–30%, 30%–toe off (TO), whole stance, and swing) were evaluated across categories using separate t-	sequence of the mean frontal GMinstimulation in the GTPS sample may be intrinsically connected to changes instride traits . .[23]

			tests and effect-size (ES) estimates. The variability of muscle activation was calculated using the mean coefficient of variation (CV).	
11	Newly Developed Chronic Conditions and Changes in	Juhua Luo et al, Nov 2015	Prospective Cohort Study design was	Every one of the seven persistent illnesses and

	Health-Related Quality of Life in Postmenopausal Women		used. 40 clinical facilities around the US comprise the setting.The Women's Health Initiative: 1993–1998 Cohort Study included 75,198 women between the ages of 50 and 79. Tools for	HRQoL for physical as well as psychological wellness were significantly correlated. .The greatest reduction in HRQoL for both physical and psychological wellness was seen by females who had an episode stroke (PCS: 10.2, 95% CI = 8.3–12.1; MCS: 10.4, 95% CI = 8.8–12.1),

			measuring HRQoL based on the 36-question Shorter Format survey (SF-36), changes in HRQoL from beginning to the third year in scores on the Physical (PCS) and Mental (MCS) Factor Overview of	surpassing minimum significant differences (MCID).A larger decline in HRQoL was associated with a higher number of new persistent illnesses. Women with a minimum of two chronic illnesses experienced reductions in HRQoL that were greater than MCID.

			the SF-36, and the emergence of seven chronic illnesses (coronary disease, cancer, cerebrovascular accident, bone loss, insulin resistance, and arthritic conditions).	.People with coronary artery disease and cardiovascular accident had the most reduction in their physical condition, and people with arthritis and stroke had a significant decrease in their psychological state.The more recently an illness was diagnosed, the lower PCS was for

				all conditions except diabetes mellitus and stroke. A similar tendency for MCS was noted for stroke and cancer.[27]

4. Discussion

The study aimed at exploring the association between gluteal muscle weakness and sedentary lifestyles among postmenopausal women. The analysis of literature highlights how these factors interact and provide recommendation for further studies and intervention strategies.A clear association can be seen between sedentary behavior and increased gluteal weakness in post-menopausal stage.

Tram Thi Bich Nguyen et al [26] did a scoping review to associate musculoskeletal symptoms in postmenopausal women. They found that women experienced somatic experience of non-specific origin with physical inactivity. They

categorised their findings into 4 subtypes: musculoskeletal symptoms in menopause, musculoskeletal symptoms in general, QOL in menopause and general QOL question sheets. This study focused on the need for comprehensive policy to cater to musculoskeletal symptoms thereby promoting their QOL.

Arati V Mahishale et al [2] performed a cross-sectional study on 65 postmenopausal women to assess muscular strength and cardiovascular endurance.We measured waist-hip ratio, height, weight, and BMI. Measurements were made withdynamometer for strength of handgrip, a walk-and-step test for endurance of the heart, and a neurofeedback unit for muscle strength (quadriceps, hamstrings, gluteal, calf, back, and abdominal muscles). They found that when relative to normal levels, there was a substantial decrease in both extremities muscle strength and a strong positive correlation between BMI and glute strength.

Kathleen A. Geier et al[28]reported on relation between menopause and musculoskeletal health. While estrogen deficiency post menopause can be sought as a reason for low bone density, strength and mucle mass. The lifestyle of a

person and her nutritional factors also play a major role in determining the bone, joint and muscle health. The management can be a combination of integrative, behavioral and pharmaceutical therapies.

Juliana Brandão Pinto De Castro et al[5]examined the relationship between pain perception, low back functional impairment, cortisol, creatine kinase (CK), estradiol, and the strength of the lumbar and abdominal muscles in women going through low back pain after menopause. They took blood to study for basal serum levels of cortisol, chemiluminescence method for estradiol, enzymatic method for CK, pain perception using VAS, lumber functional incapacity using RMQ and abdominal and spinal extensors strength using isometric tests on 11 postmenopausal women. They reported a negative correlation between cortisol level and lumbar strength(abdominal, gluteal and erector spinae).

Arati Mahishale et al[25] studied BMI, girth, skinfold measurement and waist-hip ratio in 100 healthy post menopausal women. They found the muscle mass post menopause below average to normative value and emphasised on prevention of muscle loss.

Michelle Sako Omodei et al[20] studied the interrelation between lower abdominal muscle weakness and intimateactivity in 226 sexually active female after menopause. They assessed intimate function using Female Sexual Function Index(FSFI) and lower abdominal muscle strength by bidigital vaginal palpitation using Oxford scale. They found a poor favorableassociation oflower abdomen muscle strength with FSFI score and concluded supporting PFM strength to be an important aspect for sexual function in postmenopausal women.

Charlotte Ganderton et al[21]did a cross-sectional study to determine gluteal muscle activity during exercises in postmenopausal women. 4 isometric and 3 dynamic exercises were used in 10 healthy postmenopausal women to identify muscle activity of GMin and Gmed using intramuscular electrodes. They concluded that hip hitch and its modifications optimally activatesGMin and GMed muscle segments and can be used in rehabilitation of hip muscles in post-menopausal women.

Maíra de Menezes Franco et al[24] performed a cross sectional study on 113 female after menopause to identify association between lower abdomen muscle strength, sexual dysfunction and problem with urine control. Instruments used

were vaginal manometry for PFM strength, Female Sexual Function Index (FSFI) for sexual function and Internationa; consultation on Incontinence Questionnaire Urinary Incontinence (ICIQ-UI) Short Form for problem with urine control. They found that postmenopausal females with sexual dysfunction showed a decreased lower abdomen muscle strength. The degree of urine incontinence and sexual function showed a slight connection.

Mirca Marini et al[22] performed randomized trial using secondary analysis. Investigating the prevalence of low back ache in Italian postmenopausal women and the result of a 2 year physical activity (PA) exercises on LBP prevalence were the main goals of the study. The study, which was part of the DAMA trial, looked at dietary changes and PA as ways to lower mammographic breast density. Initially 32.9% participants reported LBP; those in the PA intervention group saw a significant decrease in LBP (from 33.3% to 21.6%). The total LBP prevalence showed no major difference between control and therapeutic group according to statistical analysis.

Charlotte Ganderton et al[23] studied activation of gluteus medius, gluteus minimus and tensor facia latae muscle during walking in postmenopausal females

with and without trochanteric bursitis. Segments of GMin (x2) and GMed (x3) were inserted with intramuscular electrodes, and TFL was surface-tested. The study compared the peak magnitude, average magnitude, and time to peak of the different groups from every step of the gait cycle (0%–30%, 30%–toe off (TO), total stance, and swing) using independent t-tests and effect-size (ES) estimations, and calculated the variability of muscle activation (CV) using the mean coefficient of variance. Post-menopausal women with GTPS showed lower hip abduction strength, less variability in muscle activation, and higher segmental gluteal muscle activation than controls.

Juhua Luo et al[27] did a prospective cohort study to examine result of chronic conditions developed after menopause on health relatedquality of life(HRQoL).Using the Medical Outcomes Study 36-item Short Form Survey (SF-36), the impact of seven ongoing conditions—hypertension, coronary artery disease, cancer, cereberovascular accident, bone loss, insulin resistance, and arthritis—on HRQoL mostly mental and physical elements. It was found that every condition significantly decreased physical and mental health in HRQoL, with multiple conditions HRQoL declined more.

5. Conclusion

This systematic review investigated the relationship between postmenopausal women's gluteal muscle weakness and sedentary lifestyles, emphasizing the substantial influence of these variables on general health and well-being. Results show that gluteal muscle weakness is common in postmenopausal women and that a sedentary lifestyle aggravates the condition.

The decline in gluteal muscular strength in this population was found to be largely caused by a sedentary lifestyle, which is defined by extended periods of inactivity. The significance of treating physical inactivity as a controllable risk factor for muscle weakening and associated health consequences is highlighted by this association. The research also highlights how treatments that target strengthening the gluteal muscles and boosting physical activity may be able to lessen the negative consequences of leading a sedentary lifestyle.

In addition, our analysis points up a number of gaps in the literature, including the necessity of additional longitudinal study to improve comprehension of the chronic consequences of sedentary behavior and gluteal muscle weakness and the creation of exercise regimens specifically designed for postmenopausal

women. In order to improve health outcomes for this population, future research should concentrate on investigating practical methods for increasing physical activity levels and strengthening the gluteal muscles.

In conclusion, enhancing the health and quality of life of postmenopausal women requires addressing gluteal muscle weakness and encouraging an active lifestyle. To counteract the negative consequences of a sedentary lifestyle, resistance training and physical activity promotion should be incorporated into clinical practices and public health programs.

6. Limitations

- Differences in study designs can make it difficult to compare results and draw firm conclusions.
- Generalisation cannot be made.
- Other factors like diet, medication, or comorbidities might not have been fully controlled for or reported in the studies reviewed.

- The quality of the examined research may differ, with some containing methodological errors such as limited sample sizes, insufficient control groups, or subpar measuring methods.

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