

The effect of strength training on women's happiness and well-being: a systematic review

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Abstract

Background: Despite the widespread health benefits of strength training, women are often discouraged to seek this practice due to limiting gender-constructed roles influenced by cultural ideations that resist exaggerated hypertrophy among women. The objectives of this systematic review are two-fold. Primarily, to access and summarize information from existing studies underscoring the effects of regular strength training practice on women's well-being, published in the last 10 years. Second, to relate the findings of this study with the PERMA model of well-being from positive psychology.

Methods: Two electronic databases were used in this review, namely, Google Scholar and PubMed. The inclusion criteria comprised papers published in English and dated between January 1, 2012, and May 15, 2022, yielding a total of 439 publications. Furthermore, studies were excluded if: no interventions were applied, the results did not focus on female participants, the study lacked variables related to well-being, and the study was not based on strength training. Upon screening for relevance and applicability of the studies based on the abovementioned criteria, 11 publications were selected, and the Cochrane Risk of Bias Tool (RoB 2.0) was applied to assess the risk of bias.

Results: In total, 457 female participants from the 11 studies were included in this review. And seven studies presented positive effects of strength training on variables related to well-being, while three studies presented no significant changes. The remaining article did not present any significant changes in sense of coherence (SoC) and health-related quality of life (HRQoL); however, it found positive effects for hope, while no negative effects were observed.

Discussion: Literature underscoring the benefits of strength training on women's happiness is limited. Furthermore, studies that comprised only female participants are also limited, and largely characterized by variations in age, physical health, cultural context, and previous relationship with sports. Moreover, the effects of mental health and well-being are often not prioritized in research, resulting in study designs that have limited use among psychologists and other mental health professionals. Nevertheless, the current review showed that strength training exerts predominantly positive effects on women's happiness. While some effects were neutral, no negative effects were found. Possible implications of the current paper refer to the stimuli of the prescription of a program of strength training for women aiming to improve overall well-being and to call attention to the need for more scientific research on the topic.

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Introduction

In June 2018, the World Health Organization (WHO) published the Global Action Plan On Physical Activity 2018–2030 to highlight and promote the importance of practicing sports to treat and prevent non-communicable diseases (NCDs, which accounted for 74% of global deaths in 2019), as well as to enhance mental health, quality of life (QoL), and well-being.

The action plan identifies the different forms of physical activities that can be practiced by individuals, such as walking, the practice of yoga, and cycling, while emphasizing sufficient duration, intensity, and frequency. Furthermore, the WHO underscores the various benefits and overall opportunities for communities induced by these activities. The WHO recommends at least 150 min of moderate-intensity aerobic physical activity with two or more days a week of muscle-strengthening activities involving major muscle groups. Thus, this systematic review focuses on muscle-strengthening activities and aims to understand the effects of regular practice of strength training on women in particular. Several authors have indicated that women suffer from not recognizing the damaging effects produced by mental health disorders, such as depression and anxiety, in contrast to men (Boyd et al., 2015; Rosenfield & Mouzon, 2013; Van Droogenbroeck et al., 2018). Furthermore, research has shown that women practice sports moderately with less vigorous physical activity than men (Arriaza Jones, 1998; Edwards & Sackett, 2016; Troiano et al., 2008). In the specific analysis of strength training, several authors have underscored that cultural resistance discourages females from seeking resistance training as they fear having “exaggerated” hypertrophy, exacerbated by constructed gender roles that regard women as “weaker” than men (Cholewa, 2018; Ebben & Jensen, 1998).

In addition to weightlifting in a gym, strength training is described as the repeated muscular movement against a resistance that is typically higher than actions performed in daily motions. Furthermore, exercises that make use of body weight and elastic bands are referred to as functional training. Studies have reported that regular practice of these exercises offers several health benefits, namely, facilitating the maintenance of healthy body weight and body composition, increasing lean mass, lowering blood pressure, and thus reducing the risk of heart diseases (Pescatello, 2014). Moreover, additional benefits for bone density, muscular health (Maestroni et al., 2020), functional capacity, and isometric strength have been reported (Valiente-Poveda, 2021). In the context of mental health, a review published by O’Connor and Herring (2010) highlighted the positive effects that strength training has on the symptoms of anxiety, depression, and fatigue, showing improvements in cognition, self-esteem, and sleep quality. However, studies in this regard were limited and most of the reviewed papers did not prioritize the analysis of mental health benefits.

The use of positive psychology as the theoretical basis of reference is scientifically convenient to highlight various aspects of well-being from the perspective of mental health promotion. Goodman et al. (2018) found a correlation of 0.98 between Diener’s model of subjective well-being and Seligman’s PERMA model. As underscored by Seligman, this result indicated that the PERMA components formed the “building blocks” of well-being.

The PERMA framework emerges from positive psychology with the goal of understanding, knowing, and measuring the elements that enhance individual happiness and contribute to a

thriving and flourishing society. Furthermore, the PERMA framework is composed of: **P**ositive emotions; **E**ngagement; **R**elationships; **M**eaning, and **A**ccomplishment.

In this article, we systematically review existing literature to elucidate the relationship between strength training and happiness among women, under the holistic perception of the PERMA model established by Seligman.

Methodology

This systematic review was conducted according to the PRIMA protocol. Two electronic databases were used for this research, namely, Google Scholar and PubMed, in which the references of previous related citations (Additional Papers n = 4 in Figure 1) were reviewed for relevant publications.

For the synthesis of this study, papers published in English and dated between January 1, 2012, and May 15, 2022, were included. The keywords used in the database search were “women,” “well-being,” “strength training,” and “psychology,” which yielded a total of 439 publications including duplicates, non-reviewed papers, and publications that did not offer free access.

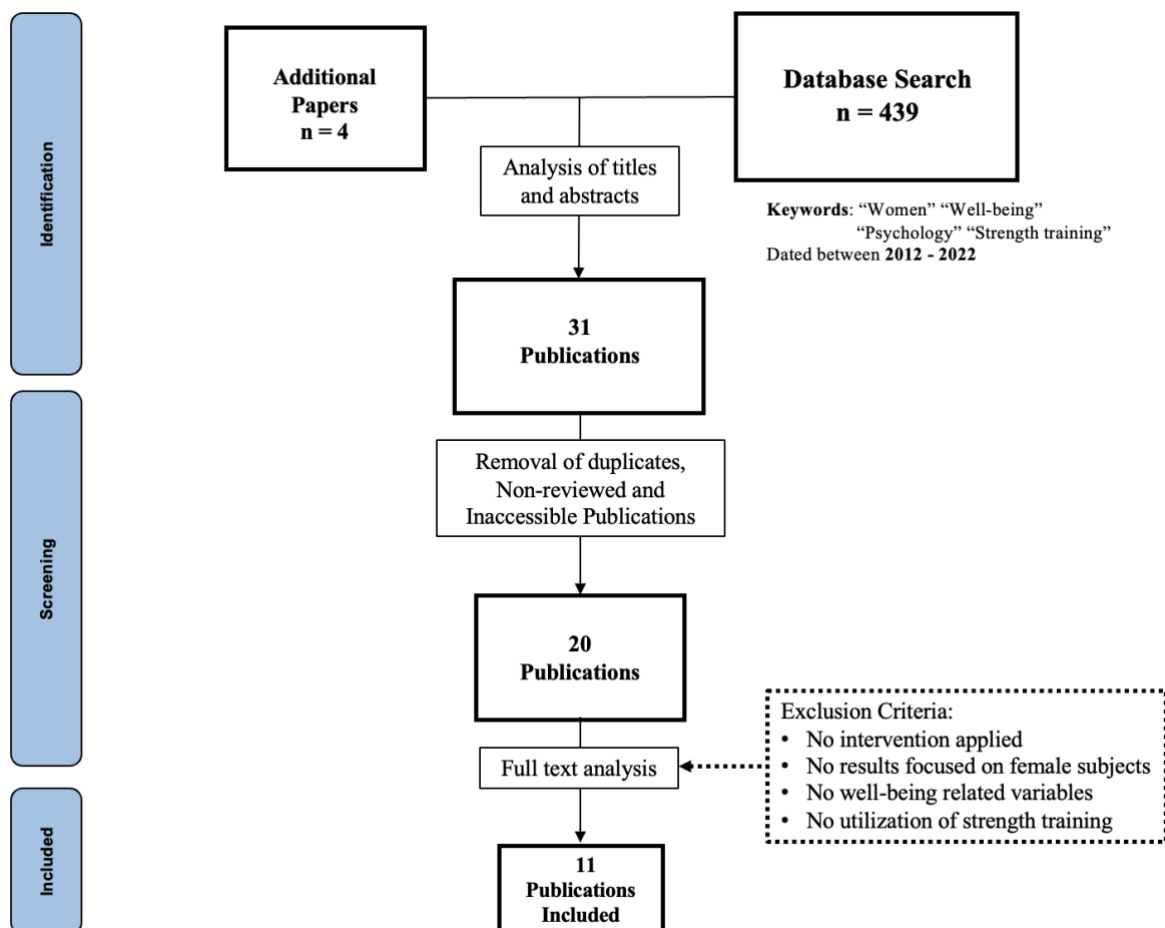
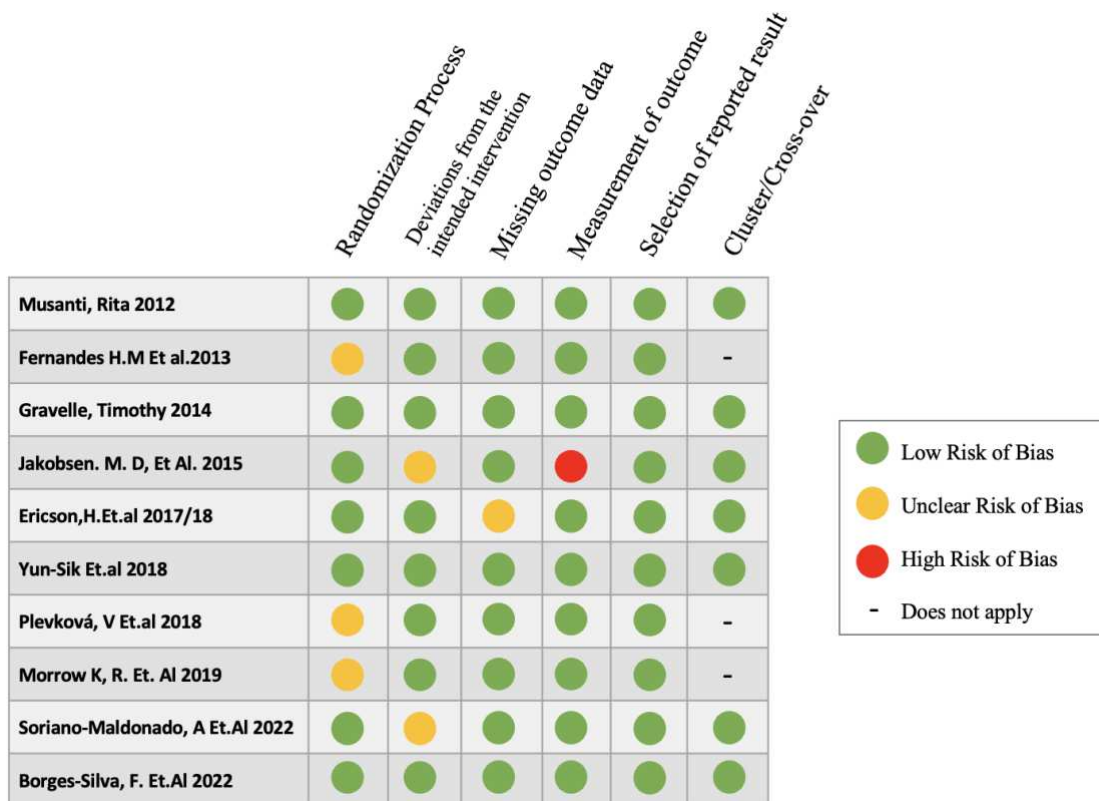


Figure 1. Systematic Flow of Research

For each article, the author applied the Cochrane Risk of Bias Tool (RoB 2.0) to assess the risk of bias. The process consisted of specifying the results analyzed by the researchers and the effect of interest for the current analysis. Thereafter, the sources of information used were listed to inform the assessment, followed by answering the signaling questions of the RoB 2.0. Finally, the risk of bias in each domain and the overall risk of bias for the results were judged. The randomized trials were considered across five domains in which the bias could occur during research: during the process of randomization, as a result of deviations from the intended intervention, due to missing outcome data (e.g., dropouts), in the measurement of the outcome, and in the selection of the reported results. Furthermore, an additional domain was included, as per the recommendation for cluster-randomized and cross-over trials. To mitigate inconsistencies in results, the scores were presented to a colleague for discussion. Consequently, no article presented a relevant risk of bias as synthesized in the Risk of Bias figure (Figure 1).

Figure 1. Assessment of Risk of Bias



Results

The titles and abstracts were screened for relevance, resulting in the selection of 31 publications. Thereafter, duplicates (n =2), non-reviewed papers, (n =4), and papers that were not entirely free to access (n = 5) were removed as it was not possible to analyze the methodology, findings, and variables studied in detail.

The entire manuscripts of the remaining 20 publications were read papers that met the exclusion criteria were removed, that is, studies where no interventions were applied, the results did not focus on female participants, the study lacked variables related to well-being, and the study was not based on strength training. Thus, a total of 11 publications were used in the current research. The review was performed by an independent researcher and the only automation tool applied was an “Alert” created on Google Scholar using the previously mentioned keywords and data intervals.

Samples

The 11 studies included in this review comprised a final total of 457 female participants. From the initial total of 471 participants, 14 were excluded to avoid duplicates. The ages of the participants ranged from 14 to 75 years; among them, 85 women were cancer survivors while the remaining had no reported health issues. Upon exclusion, 372 participants remained, including 32 physically active women and 52 women with no previous formal strength training. The remaining individuals had not reported whether they were physically active before the intervention. Furthermore, wide variations were observed among the samples, ranging considerably in age, health status, country, and previous association with sports.

Interventions

Table 1 provides a summary of the main findings, detailed samples, interventions, and countries. The intervention duration ranged from 8 to 24 weeks, with one outlier of 5 years. Furthermore, the intensity and volume of the load varied among researchers. For example, Ericson et al. (2017) used an initial load of 50% 1RM (Repetition Maximum) with 12–15 repetitions per set during the first two weeks of intervention, while in the rest of the interventions, a load of 75–85% 1RM with 8–12 repetitions per set was used. Gravelle (2014) had two sets with loads of approximately 65–75% 1RM (10–14RM) using progressive loads and repetitions during the first six weeks. Soriano-Maldonado et al. (2022) used one repetition maximum which was an equivalent of 40–70% (1RM, individually estimated). This progressively increased the load from 24RM (approximately 40% 1RM) to a 12RM load (approximately 70% 1RM). Furthermore, Fernandes et al. (2013) also used the 70% 1RM load for the first week with 10 repetitions. However, the weight load was increased by 5% every three weeks with repetitions varying between 8 and 20.

Borges-Silva et al. (2022) aimed to focus on the effects of a heavy load intervention. Thus, they designed the beginning of the training based on 2 sets of two of the following: lying leg curls, pec deck fly, or seated calf raises. The loads comprised 12 repetitions with 50% 6RM, a rest of 1 min, 10 repetitions with 75% 6RM, and a 2-min rest followed by the first main training set. The 6 RM load was adjusted regularly, and the women used weights that allowed only 6 repetitions (approximately 85–90% 1RM).

Musanti (2012) used the Rated Perceived Exertion (RPE) for measuring the perceived intensity of the exercise and maintained the participants between 3 and 5 RPE (moderate to heavy). RPE (light to heavy) was also used by Yun-Sik et al. (2018), who only increased the loads when the participant performed 12 repetitions for three sets with the correct form.

Jakobsen et al. (2015) used circuit training and indicated that the loads were increased progressively. However, no further details were provided regarding volume and intensity by both Jakobsen et al. (2015) and Plevková et al. (2018).

Measurements of Well-being

Notably, only 2 of the 11 publications used the exact document to assess the desired data. The large variability observed in the usage of documents may have been due to the wide variations in the life and context of the study samples, influenced by the availability of reliable versions translated from native languages.

To measure the subdomains of physical self-esteem, Musanti (2012) used self-report measures, namely, the Physical Self-Perception Profile (PSPP) comprising the following subdomains: physical condition (PC), physical strength (PS), attractive body (AB), and global domain. The Piper Fatigue Scale (PFS) and the Hospital Anxiety and Depression Scale (HADS) were used to assess other variables. The results displayed a significant increase in PS, AB, and PSE (physical self-esteem). In addition, the fatigue, anxiety, and depression scores decreased significantly for a specific subgroup.

Morrow et al. (2019) aimed to assess the effects of strength training on self-esteem. However, they used a different approach, namely, the Rosenberg Self-Esteem Scale (RSES). Furthermore, to assess the variations in subjective stress, the Perceived Stress Scale (PSS) was used; a significant increase was observed in RSES scores, while the PSS scores did not change significantly.

To visualize the impact of the intervention on stress, Ericson et al. (2017) used the Positive and Negative Affect Schedule (PANAS), which measures both mood and affect. The Sense of Coherence Questionnaire (SOC-13, a shorter version of SOC-29), the Short-Form Health Survey (SF-12) that measures the health-related quality of life (HRQoL), and the Trait Hope Scale were also used to measure Hope levels. The study found that resistance training was linked to a higher motivational state and a lower negative affect among the participants. Furthermore, increased levels of hope and positive variations for negative affect were observed post-intervention, indicating a significant reduction in negative affect after intervention in contrast to the control group.

Ericson et al. (2017) used the SF-12 to measure the HRQoL, while Borges-Silva et al. (2022) used the SF-36-Item Health Survey, which analyzes the HRQoL in eight separate dimensions related to physical, emotional, and social well-being. Significant changes were found in the dimensions of physical functioning, general health, vitality, role emotional, and the physical component summary. However, no significant changes were observed in social functioning, mental health, or the mental component summary. Gravelle (2014) assessed variations in the QoL using the long version of the MOS-SF36 (Medical Outcomes Study short form) and found no significant changes in any of the QOL subscales.

Yun-Sik et al. (2018) also applied a different approach by simultaneously testing the participants' blood for serotonin, dopamine, epinephrine, and norepinephrine levels, as well as

applying the Korean version of the short form of the Geriatric Depression Scale (SGDS-K) to determine participants' depression levels. They found no significant difference in the depression score and a decrease in the serotonin, dopamine, epinephrine, and norepinephrine levels.

Depression levels among the participants were tracked before and after the intervention by Soriano-Maldonado et al. (2022), who focused on symptomology using the Center for Epidemiologic Studies-Depression Scale (CES-D). The HRQoL was assessed with the Functional Assessment of Cancer Therapy-Breast (FACT-B) while life satisfaction was assessed using the Spanish version of the Satisfaction with Life Scale (SWLS). The results were consistent with the findings of Yun-Sik et al. (2018) and the intervention showed no effect on depressive symptoms. Additionally, no effect was observed on cancer-related fatigue, HRQoL, and life satisfaction.

Fernandes et al. (2013) used research on the self-report measure developed by Diener et al. (1995) to assess life satisfaction. For the self-reported health status, a single-item question that asked women to rate their health status using a 10-point scale was used (ranging from 1 = very poor to 10 = excellent). To assess the depression symptoms' scores, Fernandes et al. (2013) applied the Beck Depression Inventory (BDI). Moreover, to measure body satisfaction, a "one question" report was used, with a 10-point response scale: "How satisfied are you with your body/appearance?" (1:very dissatisfied to 10:very satisfied). The results showed a large significant effect of time on the perception of health status and depression scores, but not on body satisfaction and satisfaction with life.

Plevková et al. (2018) also focused on change in body satisfaction, working with girls aged between 14 and 15 years. The researchers used the Contour Drawing Rating Scale (CDRS) silhouettes technique, in which the participants selected the figure most representative of their current body size. Thereafter, the participants chose the figure that represented the body that they would like to have (ideally). After the pre- and post-intervention calculations, strength and endurance circuit training was found to be associated with a significant decrease in body dissatisfaction in both experimental groups.

Jakobsen et al. (2015) aimed to assess the perceived changes after intervention using a questionnaire. The participants used a 3-point scale consisting of "worsened," "unchanged," or "improved" to evaluate post-intervention changes in well-being, job satisfaction, a desire to exercise, energy for family and friends, and motivation for healthier eating and socializing with colleagues. Jakobsen et al. (2015) observed a significant improvement in well-being, job satisfaction, a higher desire to exercise, increased energy for family and friends, and increased motivation to eat better and socialize more.

Table 2. Aggregated Overview of Relevant Study Findings

References	Country	Sample	Intervention	Main Findings
Musanti (2012)	USA	42 female breast cancer survivors.	12 weeks of one of the four based exercise programs: aerobic (A), resistance (R), aerobic plus resistance (AR), or flexibility (F).	The R group showed a significant increase in physical self-esteem and increase in the subdomains of physical strength and attractive body. Reduction of fatigue anxiety and depression scores.
Fernandes et al. (2013)	Portugal	14 female participants, older than 55 years.	Resistance training 3× week for 24 weeks.	Significant improvement in perceived health status and reduction in depressive symptoms.
Gravelle (2014)	Nova scotia	11 female cancer survivors.	Strength training (n=5) 1 day/week (n=6) 2 days/week for 13 weeks (The first two first weeks comprised introductory exercises).	No significant changes in the QoL subscales or measures of fatigue.
Jakobsen et al. (2015)	Denmark	200 female healthcare workers aged between 18 and 67 years.	Strength training exercises performed either at home or work comprising 5×10 minutes for 10 weeks.	Positive effect on subjective well-being, increased job satisfaction, desire to exercise, as well as energy for family and friends.
Ericson et al. (2017)	Sweden	32 healthy physically active female participants aged between 65 and 70 years.	Resistance training 2× week for 24 weeks.	No significant changes concerning levels of SoC and HRQoL. Positive variation in hope and negative affect.
Ericson et al. (2018)	Sweden	14 physically active Swedish women aged between 69 and 75 years.	Continuation of Resistance training 2× week for almost five years.	Positive salutogenic effect on mental health.
Yun-Sik et al. (2018)	Korea	21 female participants	Strength training, 3× week for 24 weeks.	Reduced serotonin, dopamine, epinephrine, and norepinephrine. No

		older than 65 years.		significant differences in depression scores.
Plevková et al. (2018)	Slovakia	53 female students aged from 14 to 15 years.	Strength and endurance circuit training 2× week for six weeks.	Positive effects on body image and a significant decrease in body dissatisfaction.
Morrow et al. (2019)	USA	22 healthy, untrained female college students.	Resistance weight training 2× week for eight weeks.	Positive effect on physical strength and self-esteem (stress was not measured concisely due to the influence of the exam periods).
Soriano-Maldonado et al. (2022)	Spain	32 female breast cancer survivors, mean age of 52.6 years.	Resistance training combined with home-based physical activity for 12 weeks.	No effect on cancer-related fatigue, depressive symptoms, HRQoL, or life satisfaction.
Borges-Silva et al. (2022)	Spain	30 untrained female participants aged between 60 to 75 years.	Heavy-load CRT ($n = 15$) or heavy-load TRT ($n = 15$) 2× week for a 12-week period.	For the CRT group, positive changes in physical functioning, general health, vitality, role emotional, and physical component summary. For TRT, a positive effect only occurred for physical functioning.

Note: Abbreviations: USA: United States of America; QoL: Quality of Life, SoC: Sense of Coherence; HRQoL: Health-related Quality of Life; CRT: circuit resistance training; TRT: traditional resistance training.

Discussion

The current study aimed to review and interpret existing literature using the holistic perception of the PERMA model as established by Seligman. From the perspective of Positive Psychology, this review focused on the positive elements of the previous research participants and determined possible ways in which to maximize these factors to help them thrive. Despite the emphasis on positive aspects, behaviors, and affect, this study did not aim to overlook the negative aspects.

The PERMA model is composed of Positive emotions, Engagement, Relationships, Meaning, and Accomplishment. Positive emotions are defined as hedonic feelings usually related to short effect rewards such as pleasure and comfort. In the context of sports practice, individuals actively tend to feel an increase in positive emotions induced by the excitement of performing the activities, or the joy experienced from winning and achieving goals. (Uusiautti et al., 2017). The current systematic review observed a significant effect on positive emotions

in the study by Ericson et al. (2018), which demonstrated a positive salutogenic effect as a result of strength training. Furthermore, Borges-Silva et al. (2022) found positive changes associated in the “role emotional” of the SF-36 in their study. In the context of the questionnaires, the PANAS used by Ericson et al. (2017) indicated a strong association with positive emotions resulting from a high self-reported positive affect (PA) characterized by a state of high energy filled with pleasurable engagement. Consequently, these results were also connected with the Engagement aspect of the PERMA, resulting in a high PA characterized by deep concentration.

Engagement refers to a level of “absorption” and immersion in a task, characterized by an intense interest, flow, and continuity. Furthermore, the flow is to an extent that an individual loses track of time while performing a specific activity for an organization or a cause. However, engagement does not depend on the production of positive emotions as Seligman reported that individuals felt “nothing” during the flow. In the context of sports practice, “engagement” refers to concentration and flow, distinguished by the opportunity to use and develop individual strength (Seligman, 2011; Wu, 2014).

Relationships include the aspects related to an individual’s social network and comprise the feelings of receiving care from loved ones as well as a sense of identity in a group. Relationships include family, friends, and colleagues. From a sports perspective, these relationships extend to the bonds formed among team members, a club, coaches, and athletes, as well as frequent members of the same gym. Jakobsen et al. (2015) found a significant increase in available energy for family and friends after the strength training intervention. Furthermore, social functioning comprised one of the eight dimensions scored by the SF-36, which can be linked to the Relationships aspect of PERMA.

Meaning refers to purpose, a sense of belonging to something greater than self, and having direction in life. In the context of sports research, Mirehie and Gibson (2019) interviewed 13 active women skiers and observed meaning primarily from the narratives of the advanced-level participants. The participants reported that they were establishing something meaningful for themselves and the broader society by participating in activities such as charity-based snow-sports events and joining a club. With a particular focus on strength training, Ericson et al. (2017) used the Trait Hope Scale and obtained a positive effect after the intervention. Furthermore, SoC was identified as an additional variable related to the “Meaning” aspect in the same study. However, if at least three components were found to be meaningless, no significant effects related to the SoC levels were observed after the strength training.

Accomplishment describes long-term achievable goals, underscoring the progress made towards these goals, and advanced results that supersede instant gratification. In 2019, a Brazilian study found a significant positive relationship between self-esteem, positive emotions, and accomplishment based on the self-esteem questionnaire results. This is comparable to the markers of the PERMA model and supports the hypothesis that by exhibiting favorable attitudes toward themselves, individuals tend to experience achievement events more positively because they feel that they deserve it. Thus, three articles from the current systematic review presented significant positive effects on self-esteem and body image.

Among the 11 studies included in this systematic review, seven exhibited positive effects of strength training on variables associated with well-being, while three studies did not

find any significant changes. The remaining article presented no significant changes in SoC and HRQoL but found positive effects on hope while no negative effects were observed.

As stated in the introductory sections of this review, studies comprising only female participants were limited due to wide variations in age, physical health, cultural context, and previous relationship with sports. Furthermore, as noted by O'Connor and Herring (2010), research often does not prioritize well-being and mental health effects, focusing primarily on the common effects on physical health and body composition. Therefore, future research should design more focused studies, the results of which can be used by psychologists and other mental health professionals.

As previously noted, literature that focuses on the benefits of strength training on the happiness of women is limited. However, extensive literature is available that either underscores aerobic training or does not provide results that are specific to women. Thus, there is a clear need for further research that explores this particular relationship. Nonetheless, the current systematic review shows predominantly positive or neutral effects of strength training on women's happiness; notably, no negative effects were found.

Additional information

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Competing interests

The authors declare that they have no competing interests”

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