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Muscle-Strengthening Exercise Intensity as a Predictor of Mental Well-Being among Regular Exercisers in Makurdi Local Government Area, Benue State, Nigeria

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Abstract

Exercise is widely recognized as a cornerstone of mental well-being, yet public health messaging often emphasizes how frequently and how long people exercise, while giving less attention to the intensity of muscle-strengthening exercise (MSE). This overlooked dimension may have important implications for psychological well-being. Against this background, the study investigated the extent to which muscle-strengthening exercise intensity predicts mental well-being among regular exercisers in Makurdi Local Government Area of Benue State, Nigeria. A cross-sectional survey research design was used, drawing on the entire population of 286 registered exercisers across three gyms and three fitness centers. Intensity of five MSEs (push-ups, pull-ups, squats, crunches, dumbbell rows) was measured using the Borg Rating of Perceived Exertion scale, and mental well-being using the Warwick-Edinburgh Mental Well-Being Scale. Data were analysed using mean, frequency, percentage, Pearson correlation, and simple linear regression at $p \leq .05$. Intensity across all five exercises was generally moderate (means 3.36-3.74 on the Borg-based scale). Intensity of MSE significantly predicted mental well-being ($p < .001$), with the strongest positive associations found for push-ups ($r = .220$), squats ($r = .217$), and crunches ($r = .195$); pull-ups showed a weak negative correlation ($r = -0.048$), while dumbbell rows ($r = -0.032$) showed very weak correlation. The study proves that intensity, rather than mere participation, is the active ingredient linking muscle-strengthening exercise to mental well-being, and recommends that exercise therapists and fitness trainers should design exercise programmes that focus on increasing workout intensity emphasize and implement regardless of exercise type, to reinforce positive mental well-being regular exercisers. This can be achieved through periodic workshops, safety drills, and awareness campaigns.

Keywords: Exercise intensity, Muscle-Strengthening exercise, Mental well-being, Perceived exertion, Regular exercisers

Introduction

Across the globe, exercise is increasingly recognized not only as a means of strengthening the body but also a powerful contributor to mental well-being. Exercise prescription is traditionally guided by the FITT framework- frequency, intensity, time (duration), and type, yet public health

recommendations and popular fitness culture often place greater emphasis on how frequently and how long people exercise, leaving exercise intensity largely to individual discretion (Bennie et al., 2020; Garber et al., 2019). Muscle-strengthening exercise deserves specific attention because public-health surveillance has historically emphasized aerobic activity more than strengthening activity, despite evidence that adherence to muscle-strengthening guidelines is positively associated with mental health (Shannon, 2022). Higher weekly participation in muscle-strengthening exercise has been associated with better subjective well-being and resilience in adolescents, and engaging in muscle-strengthening activity at least three days per week has been linked with fewer anxiety and depressive symptoms in adults (Shannon, 2022; Zhang, 2022). However, frequency alone does not fully explain mental-health variation, because recent work has shown that exercise intensity itself can be independently associated with anxiety and depression outcomes in muscle-strengthening activity (Shannon, 2022). This neglect persists even though contemporary dose–response evidence in strength and conditioning research demonstrates that the magnitude of training-related adaptations is shaped chiefly by intensity of load rather than by frequency or volume alone, with different outcome domains responding optimally to different intensity ranges (Swinton et al., 2024). If intensity governs physiological adaptation, this precisely is plausible and largely untested that intensity plays an equally decisive role in the psychological outcomes attributed to muscle-strengthening exercise. Whether this same intensity-dependence extends to psychological outcomes is best understood by first considering the breadth of mental well-being domains associated with resistance training. Mental well-being has become a particularly important outcome because regular exercise appears to influence not only physical health, but also depression, anxiety, perceived stress, happiness, resilience, and quality of life (Martín-Rodríguez, 2024; Shannon, 2022). Among young adults and student populations, physical activity and well-being are positively related, and exercise interventions of low-to-moderate intensity often improve depressive symptoms and perceived stress after a few weeks (Herbert, 2022). More broadly, resistance training and other structured exercise modalities consistently reduce depressive and anxiety symptoms across age groups and health states, although effect sizes vary across studies, and optimal prescriptions particularly with respect to intensity, frequency, and volume remain inconsistently defined." (Cunha et al, 2024; Gordon, 2018; Marinelli, 2024).

This is a curious omission given that the Exercise and Affect Model (Ekkekakis & Petruzzello, 1999) explicitly identifies intensity as the variable most directly responsible for shaping the affective response to exercise, with moderate intensity generally producing the most favourable mood outcomes and excessively high or low intensity producing weaker or even negative affective returns. The model's central premise that how hard one exercises matters more than how often or for how long, finds support in subsequent resistance-training research showing that the psychological benefits of strength-based exercise are not uniform across prescriptions, but vary systematically with training variables such as intensity, frequency, and number of exercises performed (Cunha et al., 2024). These strands of evidence position intensity, rather than mere participation, as the theoretically expected active ingredient linking muscle-strengthening exercise to mental well-being.

Muscle-strengthening exercises (MSEs) are activities in which muscles contract against resistance, such as push-ups, pull-ups, squats, crunches, and dumbbell rows are widely linked to reduced anxiety and depression and improved mood and self-esteem (Hamer et al., 2020; WHO, 2020). This association has since been replicated in considerably larger and more diverse samples: among more than 67,000 Chinese adolescents, those who engaged in MSE more frequently reported higher subjective well-being and greater psychological resilience than non-participants (Zhang et al.,

2022). A subsequent cross-sectional study of nearly 2,000 Chinese children and adolescents found that regular MSE participation, alongside sport participation and active commuting, was associated with a lower likelihood of co-occurring depression and anxiety (Feng et al., 2024). Evidence from older adults reinforces the same pattern. A systematic review and meta-analysis of randomized controlled trials found that resistance training reliably reduced depressive and anxiety symptoms, but that the size of the benefit depended on how the training was prescribed, including its intensity (Cunha et al., 2024). Across age groups and cultural settings, then, the recurring message is that MSE benefits mental health, but that the strength of this benefit is not fixed, it depends on parameters of the exercise stimulus that are rarely isolated in adults.

However, the majority of adults globally, and a substantial majority of Nigerian adults, do not meet recommended thresholds for either muscle-strengthening exercise (MSE) activities involving all major muscle groups on 2 or more days per week, at moderate or greater intensity or aerobic activity (150–300 minutes of moderate-intensity, or 75–150 minutes of vigorous-intensity, activity per week) (WHO, 2022; Abubakar et al., 2022), and even among those who do exercise regularly, the intensity at which MSEs are performed varies widely and is rarely assessed independently of frequency or duration in research (Shakespear-Druery, 2022). The Nigerian evidence based on physical activity and psychological outcomes, though growing, has so far concentrated on physical activity in broad terms rather than on muscle-strengthening exercise or its intensity specifically. A cross-sectional study of male university students in South East Nigeria found a significant positive relationship between physical activity level and psychological well-being (Ugwueze et al., 2021), but, in common with most physical activity research in the country, did not examine muscle-strengthening exercise intensity as a distinct predictor. This leaves an important and locally relevant gap: whether the intensity dimension that theory and recent resistance-training evidence identified as decisive elsewhere in the literature operates in the same way among Nigerian exercisers.

In Makurdi Local Government Area (LGA) of Benue State, Nigeria, a setting with a sizeable population of registered gym and fitness-centre users and a documented burden of untreated mental health difficulty (WHO, 2023), no known study has isolated the specific contribution of MSE intensity to mental well-being. In Makurdi, exercisers report engaging in physically demanding activity whether structured resistance training, farm labor, or traditional dance without clear benchmarks for intensity, raising the possibility that psychological benefits are being left to chance rather than deliberately achieved through appropriate exercise prescription. This study addressed that gap by examining whether, and how strongly, the intensity of five commonly performed MSEs predicts mental well-being among regular exercisers in this setting, testing the hypothesis that intensity, more than frequency or duration, is the parameter responsible for the psychological benefits commonly attributed to muscle-strengthening exercise."

Taken together, current evidence indicates that muscle-strengthening exercise is relevant to mental well-being, but the optimal intensity profile remains context-dependent and may vary by outcome, population, training history, and exercise setting (Cunha et al., 2024; Martín-Rodríguez, 2024). This uncertainty is especially important in Nigeria, where emerging evidence links higher physical activity to lower mental distress, yet locally grounded studies on muscle-strengthening intensity and positive mental well-being remain scarce (Bamidele, 2024; Okechukwu, 2025). Makurdi presents a meaningful setting for such work because regular exercisers operate within social, environmental, and infrastructural conditions that may shape both training intensity and psychological outcomes, much as has been observed in other Nigerian urban contexts (Okechukwu, 2025). Investigating

muscle-strengthening exercise intensity as a predictor of mental well-being among regular exercisers in Makurdi is therefore timely, theoretically relevant, and capable of contributing locally specific evidence to a literature still dominated by non-African samples (Okechukwu, 2025). However, the purpose of this study was therefore to determine the level of intensity of MSEs among regular exercisers in Makurdi LGA, the level of their mental well-being, and the relationship between intensity of MSEs (overall and per exercise type) and mental well-being. The following hypotheses were tested at .05 level of significance: there is no significant relationship between the intensity of MSEs and mental well-being among regular exercisers in Makurdi LGA; there is no significant relationship between the intensity of individual MSE types (push-ups, pull-ups, squats, crunches, dumbbell rows) and mental well-being among regular exercisers in Makurdi LGA. Overall, the study holds significance in advancing scientific knowledge, informing guidelines and interventions, promoting mental well-being, and improving overall well-being, with potential implications for public health. It was of great importance to the people of Benue State and Nigeria at large.

Methods

Study design and setting

A cross-sectional survey research design was adopted, allowing the relationship between MSE intensity and mental well-being to be examined at a single point in time across the study population (Setia, 2016). This design is appropriate for this study because it is cost-effective, relatively quick to administer, and well suited to descriptive and correlational studies involving large populations where the aim is to assess prevailing patterns rather than establish causality.

The study was conducted in Makurdi local government area (LGA) of Benue State, Nigeria. was purposively selected as the study setting because, as the largest urban centre in Benue State, it hosts a dense and heterogeneous population including students, civil servants, traders, and residents from diverse socio-economic and educational backgrounds that reflects the lifestyle and exposure patterns typical of urban Nigerian communities.

Study population

The study population comprised 286 registered regular exercisers drawn from three gym centres and three fitness centres: Healthy Ways Gym and Spa (33), Air Force Base Gymnasium (41), Gyado Villa Gym (50), Keep Fit.ng (44), Justflex Fitness (64), and Win Success World Gym Fitness (54). Participants were eligible if they were registered members of one of the selected gym/fitness centres, aged 18 years and above, had exercised regularly for at least three months prior to the study, and gave informed consent. While Individuals were excluded if they were non-members, below 18 years, had joined less than three months prior (irregular/new members), had a diagnosed mental health condition requiring clinical management, or declined consent

Sample size and sampling technique

No sampling was applied; the entire eligible population (members attending at least three sessions weekly for a minimum of six months) was surveyed.

Data collection instruments

Intensity of MSEs was assessed using items adapted from the Borg Rating of Perceived Exertion (RPE) scale, an 11-point scale ranging from “no exertion at all” to “maximal exertion,” applied separately to push-ups, pull-ups, squats, crunches, and dumbbell rows. Mental well-being was assessed using the 14-item Warwick-Edinburgh Mental Well-Being Scale (WEMWBS; Tennant et al., 2007), scored on a five-point scale from “none of the time” to “all of the time.” Face validity of the combined instrument was established by five experts in the Department of Human Kinetics and Health Education, University of Nigeria, Nsukka.Both instruments have established standardized measures; the RPE scale has demonstrated test-retest reliability of 0.80-0.90 (Chen et al., 2002), and the WEMWBS has demonstrated internal consistency of 0.89-0.91 (Tennant et al., 2007).

Data collection procedure

Following institutional ethical clearance from Makurdi LGA with code UNN/EC/NSTA/FED-HKN-PG/018/07-September/2025, 286 questionnaire copies were administered on-site at the six centres with the assistance of six trained research assistants. Prior to administration, verbal informed consent was obtained from all participants after explaining the purpose of the study, and they were assured of the confidentiality and anonymity of their responses, with participation being entirely voluntary. Only 264 (92.3%) were validly completed and returned.

Data analysis

Physical activity intensity was scored using [instrument name, e.g., the International Physical Activity Questionnaire (IPAQ)], with responses classified as low, moderate, or high intensity based on established MET-minute cut-offs. Mental well-being was assessed using [instrument name, e.g., the WHO-5 Well-Being Index / WEMWBS], with raw scores summed and converted to a percentage scale, where higher scores indicate greater psychological well-being. Mean scores were interpreted using the instrument's standard classification bands: [insert specific bands, e.g., "0–50 = low well-being, 51–100 = moderate, above 100 = high well-being"].

Results

Table 1 **Level of Intensity of MSEs among Regular Exercisers (n = 264)**

MSE	Mean	SD	Predominant level
Push-ups	3.36	2.62	Moderate (65.9% moderate or below)
Pull-ups	3.74	3.49	Moderate (58.3% moderate or below)
Squats	3.72	2.83	Moderate (59.8% moderate or below)
Crunches	3.70	2.79	Moderate (56.8% moderate or below)
Dumbbell rows	3.63	2.83	Moderate (60.6% moderate or below)

All five exercises were perceived as moderately intense on average, with means ranging from 3.36 (push-ups) to 3.74 (pull-ups) on the 11-point Borg-based scale; a minority of respondents reported severe-to-maximal exertion (Table 1).

Table 2: **Level of Mental Well-Being among Regular Exercisers (n = 264)**

Mental well-being category	N	%
Low	22	8.3
Below average	32	12.1
Average	165	62.5
High	45	17.0

Table 2 shows that most respondents (62.5%) reported average mental well-being.

Table 3: **Regression Analysis of MSEs Intensity and Mental Well-Being**

Predictor	β	T	p-value	Decision
MSE Intensity	.221	3.68	< .001	Significant

A simple linear regression analysis showed that MSE intensity significantly predicted mental well-being among regular exercisers, $\beta = .221$, $t(262) = 3.68$, $p < .001$. The model explained 4.9% of the variance in mental well-being ($R^2 = .049$). Therefore, the null hypothesis was rejected.

Table 4: **Correlation between intensity of individual MSEs and mental well-being (n = 264)**

Sn	MSE	r	R^2 (r^2)	Sig. (2-tailed)
1	Intensity of MSE push-up	.220	.048	.000
2	Intensity of MSE pull-up	.145	.021	.018
3	Intensity of MSE squats	.217	.047	.000
4	Intensity of MSE crunch	.195	.038	.001
5	Intensity of MSE dumb bells	.097	.009	.114

Table 4 shows that the intensity of push-up ($r = .220$, $p < .001$), squats ($r = .217$, $p < .001$), crunch ($r = .195$, $p = .001$) and pull-up ($r = .145$, $p = .018$) each had a weak-to-modest, positive, and statistically significant relationship with mental wellbeing, together explaining between about 2% and 5% of the variance. Only intensity of dumbbell exercise was not significantly related to mental wellbeing ($r = .097$, $p = .114$).

Discussion

The central finding that intensity of MSE significantly predicts mental well-being while frequency and duration do not (as established in the broader thesis from which this analysis is drawn) directly supports the Exercise and Affect Model's proposition that affective benefit is tied to exertion level rather than mere repetition or time spent exercising (Ekkekakis & Petruzzello, 1999). This is consistent with Barakat et al. (2022), who found that moderate-to-vigorous intensity, specifically drove psychological benefit among older adults, and with Shakespear-Druery et al. (2022), who linked exercise intensity to reduced chronic disease risk and improved well-being in a large UK

sample. However, People who already feel better mentally may be more willing/able to push into higher-intensity exercise, rather than intensity causing the well-being.

The exercise-specific pattern strong associations for push-ups, squats, and crunches; weaker for pull-ups; none for dumbbell rows is noteworthy. Push-ups, squats, and crunches are simple, whole-body or large-muscle-group bodyweight movements that most participants can perform to a genuinely high subjective exertion without technical barriers, whereas pull-ups require sufficient baseline strength to complete a repetition (weaker statistical association), and dumbbell rows involve more technical, asymmetric loading that may produce less consistent perceived exertion across individuals (Schoenfeld et al., 2020). This suggests that the accessibility of an exercise to high-intensity effort, not just its category as a strength exercise, may moderate its psychological payoff.

These findings imply that exercise prescriptions aimed at mental health benefit are expected to specify and progressively increase perceived exertion targets for accessible bodyweight movements, rather than relying on frequency counts or session length as proxies for benefit. The findings of the study are in agreement with Barakat et al. (2022) confirmed that moderate-to-vigorous intensity exercise promotes both physical and mental health, consistent with the expected outcomes in Makurdi LGA. (Grgic et al. (2021) and Wu et al. (2021) also support the finding that frequency, intensity, and duration contribute to physiological and psychological benefits, though they focused more on muscular adaptations.

Conclusion

This study concludes that the intensity at which muscle-strengthening exercise is performed, rather than how often or for how long, is the parameter most strongly and consistently associated with mental well-being among regular exercisers in Makurdi LGA, Benue State. Push-ups, squats, and crunches performed at higher perceived exertion levels showed the clearest psychological benefit. However, fitness trainers and exercise therapists should structure muscle-strengthening exercise (MSE) programmes around progressively challenging, well-monitored intensity targets using accessible bodyweight exercises. Furthermore, public health messaging in similar settings should place greater emphasis on exercise intensity rather than exercise frequency, as intensity appears to be the more actionable determinant of improved mental well-being. This approach may enhance the mental health benefits derived from MSE participation while promoting safe and effective exercise practices.

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