

Evaluating the effect of a 6-week progressive running interval training program on endurance and body mass index in overweight college students

Jet Longakit^{1ABCDE}, Romeo A. Fajardo^{2ABC}, Lloyd Coming^{3ABC}, Lyndie Toring-Aque^{1ADE}, Felix Jr. Aque^{1ADE}, Eliseo Jr. Villaganas^{4ABD}, Jay Carlo Bagayas^{5CDE}, Mara Cuya^{5CDE}, Allan Jay Cordova^{6ADE}

¹ Mindanao State University – Iligan Institute of Technology, Philippines

² Philippine Normal University-Mindanao, Philippines

³ Department of Teacher Education, Kolehiyo ng Pantukan, Philippines

⁴ Physical Education Department, Notre Dame of Marbel University, Philippines

⁵ Mindanao State University – General Santos, Philippines

⁶ Department of Education, Tupi National High School, Philippines

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Abstract

Background and Study Aim The increasing prevalence of overweight and obesity among university students has emerged as a notable public health concern. This trend is exacerbated by sedentary academic settings and a lack of time-efficient fitness programs. Thus, this study aimed to evaluate the effectiveness of a 6-week progressive running interval training (PRIT) program on endurance and body mass index (BMI) among overweight college students.

Material and Methods A total of 30 students (BMI \geq 25), aged 18–21 years, were randomly assigned to either an experimental group (n = 15), which engaged in thrice-weekly PRIT sessions supplemented with strength-endurance circuits, or a control group (n = 15), which did not participate in any organized physical training. Statistical analyses included paired and independent samples t-tests. The significance threshold was established at $p < .05$.

Results Post-test results demonstrated a significant increase in the training group across all assessed variables. Improvements in upper body, lower body, and core endurance were all statistically significant ($p < .001$). Moreover, a significant decrease in BMI was observed ($p < .001$). The control group showed minimal changes. These findings confirm the effectiveness of PRIT in improving endurance and reducing BMI within a brief intervention period.

Conclusions The results confirm the efficacy of the progressive running interval training (PRIT) program in enhancing endurance and reducing BMI over a short intervention period. This supports the integration of scalable, evidence-based interval training into campus wellness programs to improve student health, physical performance, and academic outcomes.

Keywords: endurance, body mass index, running interval training, overweight, college students

Introduction

The growing prevalence of overweight and obesity among university students has become a significant public health concern. This is especially true in academic environments where sedentary behaviors, poor dietary habits, and physical inactivity are increasingly normalized. Excess body weight compromises physical health and adversely influences academic achievement [1, 2], self-esteem [3, 4], and social engagement [5, 6, 7]. Despite widespread awareness of these consequences, many higher education institutions still lack structured, accessible, and time-efficient fitness programs specifically designed for overweight students [8, 9,

10]. Current health interventions often fail to meet the complex needs of this population. This may be due to inadequate intensity, limited progression, or poor integration with broader wellness initiatives [11, 12]. These issues highlight a critical gap in preventive strategies that are both feasible and sustainable within the academic environment.

One promising approach is progressive running interval training (PRIT), a scalable and structured training method that builds upon the core principles of high-intensity interval training (HIIT) [13, 14, 15]. Both PRIT and HIIT aim to improve aerobic and muscular endurance through intermittent bursts of effort followed by active recovery [16, 17, 18]. These modalities have consistently shown benefits across populations, including improvements in VO_2 max, cardiorespiratory fitness, and metabolic health [13, 14, 15, 16]. For overweight individuals, HIIT

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protocols have demonstrated reductions in body fat percentage and BMI over short durations, typically between six and eight weeks [19, 20, 21]. PRIT specifically has been recognized for its adaptability and progressive intensity. This makes it suitable for individuals with low baseline fitness. However, current literature predominantly examines these outcomes in general adult populations or athletes. Often, studies do not isolate the effects of such interventions in overweight university students, a group with unique psychological, academic, and behavioral demands [22, 23, 24].

Moreover, the potential advantages of progressive training programs, particularly those focused on running, in improving cardiovascular health, physical performance, and long-term fitness development are becoming more widely acknowledged [25, 26, 27]. Running activities, particularly those employing interval formats, have demonstrated significant enhancements in VO_2 max, lactate threshold, and overall movement economy. These elements are essential for both athletic and functional performance [28, 29]. Particularly, research by Michaelides et al. [30] indicated that college soccer players who participated in an eight-week interval running program greatly improved their aerobic capacity and ability to sprint repeatedly. This helped them sustain performance longer during games. Likewise, team sports players have shown improvements in explosive power and agility after engaging in progressive sprint interval training. This affirms its contribution to enhanced court performance [31, 32, 33]. In volleyball, structured running combined with plyometric training has demonstrated the ability to enhance jump height and reduce lower limb injury risks [34, 35]. In addition to competitive athletics, interval running has proven effective in improving BMI, muscular endurance, and metabolic indicators in sedentary or overweight college students [14, 36].

Furthermore, existing studies frequently overlook the integration of strength-endurance components with running-based interventions. These components may enhance training outcomes and adherence [37, 38]. While some evidence supports the use of school-based HIIT or interval programs to boost cardiovascular fitness and muscular endurance [38, 39, 40], limited research has focused on combining progressive running intervals with supplementary bodyweight strength circuits in an academic context. Moreover, few studies employ rigorous experimental designs to examine the short-term effects of such interventions, particularly over six weeks, on both endurance and BMI outcomes in overweight college students.

Thus, this study aimed to evaluate the effectiveness of a 6-week progressive running interval training (PRIT) program on endurance and body mass index (BMI) among overweight college students.

Materials and Methods

Participants

A priori power analysis was conducted using G*Power (version 3.1.9.7) for a two-tailed independent samples t-test. The analysis specified an alpha level of 0.05, power of 0.80, and a medium to large effect size ($d = 0.65$). It indicated that a minimum total sample size of 30 participants (15 per group) would be sufficient to detect statistically significant differences between groups. The study involved 30 overweight college students ($BMI \geq 25$), aged 18 to 21 years ($M = 19.33$, $SD = 0.72$), enrolled during the academic year 2024 to 2025. A purposive sampling approach was initially used to identify eligible participants based on predetermined inclusion criteria. These included: (1) classified as overweight according to World Health Organization (WHO) BMI standards, (2) enrolled as full-time college students, (3) medically cleared for moderate to vigorous physical activity, and (4) provided written informed consent. Following this, eligible participants were assigned to either the training group ($n = 15$) or the control group ($n = 15$) using a computer-generated randomization process to ensure unbiased group allocation.

Each participant completed a brief health and fitness assessment questionnaire before group assignment. The questionnaire included demographics, physical activity level, and history of illness or sports injuries. For safety and ethical compliance, the study excluded participants with chronic medical illnesses, metabolic or cardiovascular disease, or orthopedic injuries that could worsen with moderate to strenuous physical activity. Only cleared participants who provided written informed consent were admitted to the study. Individuals who met the inclusion criteria were randomly assigned to either the training group ($n = 15$), which engaged in the six-week running interval program, or the control group ($n = 15$), which did not undergo any structured exercise intervention. The following characteristics of the participants are shown in Table 1.

This study adhered strictly to ethical research standards prior to the start of the experiment. Participants were thoroughly informed of the research objective, and formal informed consent was obtained from every participant. The researchers outlined the prospective advantages of the study for the institution, the wider community, and the progression of scientific understanding. Participants were guaranteed that the data gathered would not be used in any subsequent study activities. They were also informed that their decision to withdraw from the study at any time would not affect their relationship with the researchers or the affiliated institutions. It would also not influence their access to current or future services. To maintain confidentiality and

anonymity, all identifying information was omitted during the processes of data collection, analysis, and distribution of findings. Participants were given the option to request a debriefing session or to withdraw at any time.

Study Design

This study employed a quasi-experimental pretest-posttest control group design over a six-week duration. After obtaining ethical approval and informed consent, participants were screened using a health and fitness questionnaire. The screening assessed eligibility based on BMI classification, age, and medical history. Participants who satisfied the inclusion criteria and received medical clearance for physical activity were randomly assigned to either the training group (experimental) or the control group.

The training group participated in a six-week progressive running interval program, held three times weekly. Each session lasted about 30 to 45 minutes and included a standardized warm-up and cool-down phase. The training structure and progression followed the protocol specified in Table 2. This table outlines the running intervals, set durations, intensity levels, and targeted endurance components for each two-week phase. The program aimed to incrementally challenge participants' cardiovascular and muscular endurance, prioritizing safety and gradual adaptation. In addition, the group performed complementary strength-endurance circuits twice a week. These circuits included dynamic bodyweight exercises, as shown in Table 3.

The control group did not undergo any structured fitness intervention. They were instructed to maintain their regular daily routines while avoiding the initiation of any new physical training programs during the six-week intervention period. To ensure compliance, participants were required to submit weekly physical activity logs. These logs recorded the duration and type of daily activities, including walking, commuting, screen time, and any form of recreational exercise. For three non-consecutive days per week, including one weekend day, participants used basic step-tracking devices such as pedometers, smartphone fitness apps like Google Fit and Apple Health, or digital wristbands with step-counting features. These tools objectively monitored their activity levels. Step count estimates were recorded and reported to the researchers weekly to ensure low to moderate activity during the intervention.

After six weeks, all participants completed post-test assessments that matched the pretests to evaluate changes in endurance and BMI. All testing procedures were standardized. Data collection was conducted under consistent environmental conditions to reduce external influences. Facilitators with training oversight monitored each session to ensure participant safety, adherence to the training protocol, and consistency in the execution of the intervention.

Statistical Analysis

All statistical analyses were performed using SPSS version 20. Descriptive statistics, including means, standard deviations, and frequencies, were

Table 1. Demographics of the participants

Demographic Variable	Training Group (n=15)	Control Group (n=15)
Male	5	6
Female	10	9
Age	19.33 ± .723	19.07 ± 1.03
Height (cm)	160.27 ± 4.46	162.33 ± 4.72
Weight (kg) before training	67.73 ± 2.86	68.80 ± 4.23
BMI (kg/m ²) before training	26.38 ± .941	26.11 ± 1.23

Table 2. Progressive Running Interval Training Program

Phase	Description	Interval Structure	Targeted Structure	Intensity and Rest
Weeks 1-2	Foundation Phase (build aerobic base)	3-4 sets of: 2 min light jog + 1 min walk	Core endurance (posture, rhythm, breathing)	60-65% HRmax Rest: 2 min between sets
Weeks 3-4	Development Phase (increase volume and tempo)	4-5 sets of: 3 min moderate run + 30 sec walk	Lower and upper body endurance (stride control, arm drive)	70-75% HRmax Rest: 90 sec between sets
Weeks 4-6	Performance Phase (add speed bursts and recovery)	5-6 sets of: 1.5 min fast run + 30 sec jog + 1 min walk	Full-body endurance (speed, posture, recovery capacity)	80-85% HRmax Rest: 1-2 min between sets

Table 3. Complementary Strength endurance circuits

Test Variables	Specific Exercise	How to Execute	Sets x Reps / Time	Target Benefit
Upper Body Endurance	Shadow Boxing with Footwork	Stand in a guard position and throw punches (jab, cross) while moving from side to side. Stay light on your feet and move quickly.	3 x 30 seconds	Cardio, arms, shoulders, and coordination
	Bear Crawls (Forward and Back)	Get on all fours, with your knees hovering. Then, crawl forward with your right hand and left foot, and then backward.	3 x 20 seconds	Endurance in the shoulders and arms, stability in the trunk
Lower Body Endurance	Squat Jumps / Bodyweight Squats	Stand up, kneel down, and then jump up. Land carefully back into the squat. Take out the jump for less effect.	3 x 10–12 reps	Leg strength, explosive endurance
	High Knees (Jog or March in Place)	Quickly pull your knees to your chest while pumping your arms on each side. For a low-impact version, march in place.	3 x 30 seconds	Endurance in the heart and lungs, flexibility in the hips
Core Endurance	Mountain Climbers	While in plank position, switch driving knees toward the chest. Keep the beat constant. If you need to, slow down.	3 x 20–30 seconds	Core engagement, shoulder support, and cardio
	Standing Oblique Knee Drives	Put your hands behind your head and twist your torso to bring one knee up to the same-side elbow. Switch sides.	3 x 20 reps (10/side)	Obliques, balance, and trunk control

calculated to summarize participant demographics and test outcomes. To evaluate within-group changes from pretest to posttest, paired samples t-tests were used. Between-group differences were analyzed using independent samples t-tests. For each t-test, effect sizes were computed using Cohen’s d, and 95% confidence intervals (CIs) were reported to provide estimates of the precision and magnitude of observed effects. Before conducting parametric tests, the assumptions of normality and homogeneity of variance were assessed. Normality of the data was examined using the Shapiro–Wilk test, and homogeneity of variance was tested using Levene’s test. All variables met the assumptions for t-test procedures, justifying the use of parametric analyses. A significance level of $p < .05$ was used for all inferential tests. Wherever applicable, exact p-values are reported. Values below .001 are denoted as $p < .001$ only when software output does not provide greater precision.

Results

Independent samples t-tests confirmed that there were no significant baseline differences between the training and control groups across all variables, indicating group equivalence prior to the intervention (Table 4). For example, upper body endurance scores were comparable ($t = 0.425, p = .674$), as were values for lower body endurance, core endurance, and BMI. All showed non-significant differences with small effect sizes. These findings support the initial homogeneity of the groups and justify the validity of subsequent comparisons.

Post-test independent samples t-tests revealed significant differences between the training and control groups across all measured outcomes, with the training group demonstrating substantially greater improvements (Table 5). Specifically, participants in the intervention group outperformed their counterparts in upper body, lower body, and core endurance, as well as in BMI reduction. All comparisons yielded $p < .001$. For example, the largest mean difference was observed in lower body endurance ($t = 16.362$), followed by core endurance ($t = 14.871$), upper body endurance ($t = 12.096$), and BMI ($t = 5.337$). These results provide strong evidence of the effectiveness of the progressive running interval training program in enhancing muscular endurance and improving body composition among overweight college students.

Table 6 summarizes the within-group comparisons using paired samples t-tests. The training group exhibited significant improvements across all measured variables after the six-week PRIT program. These improvements were accompanied by large effect sizes and narrow confidence intervals, supporting the robustness of the findings. Notable gains were observed in upper, lower, and core endurance (all $p < .001$), alongside a significant reduction in BMI ($t = -10.554, p < .001, 95\% \text{ CI } [-3.004, -1.989]$). In contrast, the control group showed only marginal pre-to-post improvements, with small effect sizes and relatively minor changes in endurance and BMI. Although some changes reached statistical significance (e.g., $p = .028$ to $.006$), their magnitude was considerably lower than

Table 4. Pre-test scores for both training and control groups

Test Variables	TRg M ± SD	CTg M ± SD	t-value	p-value	Mean Difference	95% CI
Upper Body Endurance	5.73 ± .88	5.867 ± .83	.425	.674	.133	-.509 - .776
Lower Body Endurance	4.80 ± .68	5.13 ± .64	1.387	.176	.333	-.159 - .826
Core Endurance	4.87 ± .74	4.60 ± .632	-1.058	.299	-.267	-.783 - .249
Body Mass Index	26.38 ± .94	26.11 ± 1.23	-.685	.499	-.274	-1.095 - .546

Note: TRg- training group; CTg- control group; M- mean; SD- standard deviation

Table 5. Post-test Scores for both training and control groups

Test Variables	TRg M ± SD	CTg M ± SD	t-value	p-value	Mean Difference	95% CI
Upper Body Endurance	8.67 ± .49	6.27 ± .59	12.096	<.001	2.400	2.806 – 1.994
Lower Body Endurance	9.40 ± .63	5.67 ± .62	16.362	<.001	3.267	4.201 – 3.266
Core Endurance	8.47 ± .52	5.20 ± .68	14.871	<.001	3.733	3.717 – 2.817
Body Mass Index	23.89 ± 1.77	25.98 ± 1.28	5.337	<.001	1.645	1.013 – 2.276

Note: TRg- training group; CTg- control group; M- mean; SD- standard deviation

Table 6. Paired Sample T-test for both training and control groups of college students

Parameters	Pretest M ± SD	Posttest M ± SD	t-value	p-value	95% CI
Upper-Body Endurance					
Control Group	5.867 ± .83	6.27 ± .59	2.449	.028	.050 - .75
Training Group	5.73 ± .88	8.67 ± .49	10.330	<.001	2.324 - 3.542
Lower-Body Endurance					
Control Group	5.13 ± .64	5.67 ± .62	3.228	.006	.179 - .87
Training Group	4.80 ± .68	9.40 ± .63	19.572	<.001	4.096 - 5.104
Core Endurance					
Control Group	4.60 ± .632	5.20 ± .676	3.154	.007	.192 - 1.008
Training Group	4.87 ± .74	8.47 ± .52	16.837	<.001	3.141 - 4.059
Body Mass Index					
Control Group	26.11 ± 1.23	25.98 ± 1.28	-2.642	.019	-.231 - -.024
Training Group	26.38 ± .942	23.89 ± .765	-10.554	<.001	-1.989 – -3.004

that of the training group. These results reinforce the conclusion that the observed improvements were primarily driven by the structured intervention rather than natural variability or incidental activity.

Discussion

This study examined the effects of a six-week progressive running interval training (PRIT) program on endurance and BMI among overweight college students. The findings demonstrated that participants in the training group experienced significant improvements in upper body, lower body, and core endurance, along with a notable reduction in BMI. These results provide empirical support for the utility of structured, time-efficient interventions in improving fitness and body composition among students who are typically underserved by traditional university wellness programs.

The observed improvements in endurance align

with previous studies highlighting the efficacy of interval training in enhancing aerobic and muscular performance [14, 41]. However, unlike many existing interventions that focus on either continuous training or athletic populations, this study applied a structured PRIT protocol tailored specifically to overweight college students. Notably, while most literature reports HIIT's effectiveness in general or athletic populations [42], fewer studies have explored such interventions in overweight student cohorts using strength-endurance complements. This targeted approach contributes to a growing yet still limited body of research focused on scalable fitness solutions within academic environments. One point of contrast arises from studies suggesting that short-term interventions may produce inconsistent or unsustainable results, particularly when factors such as participant adherence, training intensity, or motivational support are not adequately addressed.

For example, Bellicha et al. [20] concluded in their meta-analysis that while exercise training can result in weight loss and improved fitness in individuals with obesity, the outcomes tend to vary widely across short-term programs, especially when supervision is limited or sessions are not progressively structured. Similarly, Baillot et al. [10] found that individuals with overweight or obesity often experience low adherence to physical activity programs due to early fatigue, perceived difficulty, or lack of motivational reinforcement. This was echoed by Oppert et al. [21], who emphasized the importance of behavioral support mechanisms in sustaining physical activity engagement in weight management contexts.

In contrast, other studies have found outcomes similar to the present research. For instance, Sonchan et al. [14] and Hu et al. [9] reported significant improvements in cardiovascular fitness and BMI following short-duration interval training among university students. These findings highlight the potential of time-efficient interventions when combined with adequate progression and participant supervision. Ramos-Campo et al. [43] also reported that structured resistance circuit-based interventions can significantly improve both aerobic capacity and body composition over brief periods, particularly when integrated into participants' daily routines.

The current study's high compliance rate and notable improvements may be attributed to its gradual progression in intensity, incorporation of bodyweight strength circuits, and alignment with student schedules. These features may have enhanced both feasibility and engagement. This contrasts with interventions that apply fixed high-intensity protocols without accounting for participant fitness levels or preferences, which often lead to early dropout or minimal gains [5, 44]. Moreover, the blend of aerobic and functional exercises in this study likely improved exercise variety and reduced monotony, which is known to support adherence [45]. These findings underscore the importance of tailoring interventions not only to physiological capacity but also to the psychosocial context of the target population.

The results of this study have substantial implications for educational practice and health promotion, particularly in the context of increasing obesity rates and physical inactivity among college students. The six-week progressive running interval training (PRIT) program was effective in improving endurance and lowering body mass index (BMI). These findings suggest that structured, time-efficient, and accessible fitness programs can help overweight individuals improve their overall health and physical performance. For educational institutions, this implies that PRIT can be integrated into physical education classes or campus wellness programs to help students maintain lifelong fitness,

counteract sedentary behavior, and enhance both physical and mental well-being, which may positively affect academic performance. Additionally, the program offers student-athletes a beneficial off-season or supplementary training method that improves cardiovascular endurance, core strength, and body composition – key elements in injury prevention and athletic readiness. Furthermore, the implementation of evidence-based interventions aligns with global health priorities, particularly those outlined by the World Health Organization (WHO), which emphasize physical activity as a strategy to prevent non-communicable diseases.

In light of these findings, it is recommended that colleges and universities institutionalize structured exercise programs, such as PRIT, within general health curricula or extracurricular offerings. Health educators and fitness professionals may also consider adapting similar progressive training methods for diverse populations, including students with varying fitness levels or health-related risks. Future studies could examine long-term compliance, psychological outcomes (e.g., motivation, self-efficacy), and the effects of integrating PRIT with nutritional interventions to optimize health outcomes. Expanding this research to include various demographic groups and testing its applicability in mixed or remote learning environments may yield valuable insights for broader implementation.

Study Limitations and Directions for Future Research

The current study provides significant insights into the advantages of a six-week progressive running interval training (PRIT) program; however, it has certain limitations. First, the study involved a relatively small sample size of 30 participants, potentially limiting the generalizability of the findings to larger populations. The participants were overweight college students from a single institution, further restricting the applicability of the results to broader age groups, activity levels, or individuals with varied health conditions. The study utilized BMI as the primary measure of body composition, which, although commonly employed, does not differentiate between fat mass and lean mass. More precise metrics, such as body fat percentage or waist-to-hip ratio, could offer a more comprehensive understanding of the physical changes resulting from the intervention. Second, the intervention lasted only six weeks. While this duration was sufficient to observe notable improvements in endurance and BMI, it remains uncertain whether these benefits are sustainable over the long term without continued training. Moreover, the study did not assess psychological characteristics such as motivation, enjoyment, or adherence, which may influence the long-term efficacy and feasibility of the intervention in real-world settings. Future

research should include longitudinal designs with larger and more diverse populations to improve the generalizability of findings. Incorporating detailed body composition assessments and physiological indicators (e.g., VO_2 max, lactate threshold) would enhance understanding of the mechanisms driving observed changes. Subsequent studies may also explore the integration of nutritional monitoring, behavioral coaching, or digital tools (e.g., fitness applications, wearable trackers) to promote adherence and optimize outcomes. Ultimately, examining the psychological and academic impacts of structured exercise programs may provide a more holistic understanding of the role of physical fitness in student success and well-being.

Conclusions

This study provides concrete evidence that a six-week progressive running interval training (PRIT) program, combined with functional strength-endurance exercises, can significantly improve upper, lower, and core muscular endurance while reducing BMI in overweight college students. Unlike many existing interventions, this program was specifically designed to align with the physical capabilities and time constraints of university students with excess body weight, demonstrating

both effectiveness and feasibility in a campus setting. The study's key contribution lies in its integration of progressive aerobic and bodyweight circuits into a time-efficient format that produced measurable physiological benefits within a short duration. These findings highlight the value of customized, low-cost training strategies for addressing sedentary lifestyles in higher education institutions, particularly where access to formal fitness resources may be limited. In addition to confirming health improvements, the study emphasizes the importance of structured, scalable programs that account for the motivational and logistical barriers commonly faced by overweight students. Institutions may consider adopting similar interventions as part of campus wellness programs, physical education curricula, or extracurricular health initiatives to promote long-term student well-being and academic performance. Future research should examine the sustainability of these gains, their psychological impacts, and potential adaptations for diverse student populations.

Conflict of interests

The authors declare that there is no conflict of interests.

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Information about the authors:

Jet Longakit; (Corresponding author); <https://orcid.org/0000-0002-6193-7492>; jet.longakit@g.msuiit.edu.ph; Mindanao State University – Iligan Institute of Technology; Iligan City, Philippines.

Romeo A. Fajardo; <https://orcid.org/0009-0008-7746-4352>; fajardo.roa@pnu.edu.ph; Philippine Normal University-Mindanao; Agusan Del Sur, Philippines.

Lloyd Coming; <https://orcid.org/0009-0006-2237-1816>; lloydiecoming@gmail.com; Department of Teacher Education, Kolehiyo ng Pantukan; Davao de Oro, Philippines.

Lyndie Toring-Aque; <https://orcid.org/0009-0009-6013-1305>; lyndie.toring@g.msuiit.edu.ph; Mindanao State University – Iligan Institute of Technology; Iligan City, Philippines.

Felix Jr. Aque; <https://orcid.org/0009-0005-0366-7016>; felixjr.aque@g.msuiit.edu.ph; Mindanao State University – Iligan Institute of Technology; Iligan City, Philippines.

Eliseo Jr. Villaganas; <https://orcid.org/0009-0000-2137-2661>; evvillaganas@ndmu.edu.ph; Physical Education Department, Notre Dame of Marbel University; Koronadal City, Philippines.

Jay Carlo Bagayas; <https://orcid.org/0009-0005-4139-4418>; jaycarlo.bagayas@msugensan.edu.ph; Mindanao State University – General Santos; General Santos, Philippines.

Mara Cuya; <https://orcid.org/0009-0003-5574-0321>; mara.cuya@msugensan.edu.ph; Mindanao State University – General Santos; General Santos, Philippines.

Allan Jay Cordova; <https://orcid.org/0009-0000-8082-6192>; allanjaycordova@gmail.com; Department of Education, Tupi National High School; Tupi, South Cotabato, Philippines.

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