

Enhancing health-related physical fitness through Arnis: effects of a martial arts training program on collegiate students

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Background and Study Aim Arnis, a Filipino martial art, is recognized for its potential to enhance physical fitness, yet its comprehensive impact on health-related fitness remains underexplored. Therefore, this study investigated the effect of the Arnis Training program (ATG) on Health-related Physical fitness of untrained Collegiate Students.

Material and Methods The study randomly selected 192 college students, divided into two groups: Arnis Training (n=96) and Random Physical Activity (n=96). The ATG participated in a 10-week program with sparring and Anyo sessions, three times a week for 60–90 minutes, led by a certified instructor. The Random Physical Activity Group (RPAG) engaged in self-selected physical activities, following the same schedule. Pretesting and post-testing measured endurance, strength, and body composition using five tests: one-minute push-up, planking, three-minute step, 1 Repetition Max Bench Press (1RMBP), Back Squat (1RMBS), and a Skin Caliper test for lean body mass (LBM) and fat mass (FM). Post-testing occurred three days after the training to minimize fatigue. Paired t-tests were used for within-group comparisons, and independent t-tests for between-group comparisons.

Results Results indicated that Arnis training improved overall health-related fitness for all, especially females. Males did not gain in cardiovascular endurance or fat mass. The RPAG achieved better squatting strength and LBM for all, with males showing gains in cardiovascular fitness and fat mass. Moreover, the ATG outperformed in most areas except squatting strength, with females displaying notably higher fitness components than those in RPAG. The findings suggest Arnis effectively enhances fitness, particularly for females, though sex-specific requirements necessitate tailored programs emphasizing cardio or fat-reduction.

Conclusions The findings emphasize that ATG and RPAG training programs led to notable fitness improvements, but the ATG program showed more consistent gains across various fitness components. This suggests incorporating Arnis training into fitness programs could be highly beneficial, particularly for enhancing cardiovascular endurance, strength, and body composition. With its emphasis on agility, coordination, and strength, Arnis may offer a holistic approach to improving overall fitness. Its potential as a comprehensive training tool highlights the value of integrating martial arts-based programs into physical education and sports regimens to promote better health outcomes. This study underscores the importance of exploring diverse training methods like Arnis to optimize fitness and physical performance.

Keywords: Arnis, martial art, physical fitness, untrained collegiate students

Introduction

With the virtue of Republic Act no. 9850, Arnis is the National Martial art and Sport of the Philippines. This is commonly referred to as Eskrima or Kali. It focuses on combat with weapons such as sticks, knives, and other bladed instruments, as well as techniques using only the hands. The art of Filipino culture has a rich historical background, dating back to the pre-colonial era. It initially developed as a practical means of self-defense and then evolved into a form of artistic expression in resistance to colonial forces [1]. Arnis embodies the core principles of bravery and resourcefulness that define the Philippine society. Despite the efforts of colonizers to stifle its existence, this martial art

has been discreetly safeguarded and transmitted over centuries. Today, Arnis is not only cherished as a sport but also as a fundamental aspect of Filipino cultural identity. It has been officially acknowledged as the national martial art and sport of the Philippines under the Republic Act 9850 [1]. Research emphasizes the societal and academic advantages of engaging in Arnis, demonstrating its contribution to enhancing physical well-being, self-control, and a sense of cultural identity among participants [2]. From a way of fighting for survival, martial arts, and sports, Arnis was widely practiced in the country of Philippines.

Physical fitness can be categorized into two aspects: health-related fitness components and skill-related fitness components. The first part pertains to the constituents of fitness that are

crucial for maintaining a good physical appearance. Cardiovascular endurance, strength, and maintaining a good body composition, characterized by increased lean body mass and decreased fat mass, are crucial elements of physical fitness that provide multiple health advantages. Cardiovascular endurance improves cardiac health and promotes the effectiveness of the respiratory and circulatory systems, resulting in greater delivery of oxygen to tissues and enhanced elimination of metabolic waste products [3]. Strength and muscular endurance have a crucial role in total physical performance, metabolic rate, and injury prevention, especially as persons get older [4]. Increased lean body mass is correlated with enhanced muscle function, higher metabolic rate, and decreased vulnerability to frailty. Conversely, decreased fat mass is associated with reduced risks of cardiovascular diseases and comorbidities such as type 2 diabetes [5, 6]. Consistent participation in both aerobic and resistance training has been proven to promote these aspects of physical fitness. This, in turn, improves the quality of life and increases lifespan by reducing the risk factors for diseases and preserving functional independence [7]. For untrained individuals, their physical fitness components are essential as they are requirements for a healthy body, and also a prerequisite for sports participation

Moreover, previous studies have explored the usage of martial arts as a way to improve physical fitness among various populations. Martial arts instruction greatly improves physical and technical skills among different groups of people. Research suggests that tailored martial arts training boosts stability, strength, and endurance in college students, leading to notable improvements in fitness and technical proficiency [8]. Furthermore, research has demonstrated that implementing organized physical training programs can enhance both general physical fitness and the level of sports performance among martial arts athletes [9]. Studies examining the practice of intense martial arts among adults have found that it leads to enhancements in balance, cognitive abilities, and psychological well-being. These findings suggest that there are possible health advantages that can extend into old age [10]. In addition, balancing training specifically improves the functional performance of martial arts athletes by enhancing the execution of complicated movements [11]. Engaging in rigorous martial arts training has been found to have positive effects on physical fitness among senior individuals, indicating its potential as a healthy exercise for aging populations [12]. In addition, research has demonstrated notable enhancements in various aspects of physical fitness, including cardiorespiratory fitness, speed, agility, strength, flexibility, coordination, and balance, as a result of children participating in martial arts programs. This highlights the practical value of

incorporating martial arts into physical education [13]. These studies highlight the importance of martial arts in enhancing physical well-being and technical skills in people of all age groups. With this, previous studies demonstrate that martial arts training significantly enhances physical fitness and technical skills in individuals of all ages, improving stability, strength, endurance, cognitive abilities, and overall well-being.

Furthermore, recent studies have investigated the potential of Arnis, the national martial art of the Philippines, as a form of training for improving physical fitness, specifically in terms of balance and functional strength among older individuals. A pilot study by Lipardo et al. [14] conducted a randomized controlled trial to evaluate the effects of a 12-week moderate-intensity Arnis-based program on balance control, fear of falling, and lower limb functional strength in older individuals living in the community. Another study by Barlis et al. [15] was conducted to assess the practicality and efficacy of a workout program based on Arnis, with a specific focus on enhancing static and dynamic balance control. The Delphi approach was employed to incorporate expert feedback into the design and evaluation of the program. This research plan [15] outlined a qualitative exploratory method for creating and customizing an exercise program centered around Arnis, with the explicit goal of diminishing the likelihood of falls and enhancing balance in older individuals.

Therefore, these studies indicate that exercise regimens based on Arnis might greatly enhance important physical health features, such as balance and functional strength, in the aged population. This can potentially decrease the likelihood of falls and increase overall quality of life. Incorporating cultural practices such as Arnis into fitness routines for older adults not only enhances physical well-being but also fosters the conservation of cultural heritage.

Despite existing studies on Arnis as a medium for improving physical fitness, several gaps remain. Current research primarily focuses on the effects of Arnis training on balance and functional strength in older adults, while other important aspects, such as cardiovascular health, agility, and mental health benefits, have not been thoroughly explored. Additionally, many studies lack robust control groups for comparative analysis, limiting the ability to isolate the specific benefits of Arnis training. Furthermore, the reliance on qualitative data and self-reports in existing studies introduces biases, and objective measurements are needed to provide insights into the effectiveness of Arnis [16]. Therefore, the present study examined the effects of Arnis training on key health-related physical fitness components among state university students. This research seeks to contribute to a

more comprehensive understanding of the benefits of Arnis as a form of physical exercise.

Materials and Methods

Participants

The study involved 192 untrained collegiate students from a state university selected through random sampling. The participants were divided into two equal groups: the Arnis Training Group (ATG) and the Random Physical Activity Group (RPAG). The ATG received the Arnis training program, while the RPAG engaged in their preferred physical activities. Table 1 displays the sex distribution of the participants. Nearly half of the Arnis Training Group participants were female, with the rest being male. The Random Physical Activity Group had slightly fewer female participants than males. Both groups consisted of 96 participants, making up a total of 192 individuals in the study.

Table 1. Sex distribution of the Participants

Group	Female		Male		Total	
	n	%	n	%	n	%
Arnis Training Group (ATG)	49	25.52	47	24.48	96	50.00
Random Physical Activity Group (RPAG)	45	23.44	51	26.56	96	50.00
Total	94	48.96	98	51.04	192	100.00

Table 2 presents the participants’ demographic profiles, including height, weight, and Body Mass Index (BMI). The ATG had a higher mean height than the RPAG. Regarding weight, the ATG also had a higher mean than the RPAG. Lastly, the ATG had a lower mean BMI than the RPAG.

Table 2. Demographic profile of the participants

Group	Height (cm)	Weight (kg)	BMI (kg/m ²)
Arnis Training Group (ATG)	176.23±5.21	68.32±8.21	26.32±2.31
Random Physical Activity Group (RPAG)	172.89±3.23	65.55±6.32	27.31±1.68
Total	174.56±2.11	66.96±7.23	26.82±3.21

Ethical considerations

Participants were given a comprehensive briefing on the study, which included an explanation of their rights and the study’s purpose. They were then asked to provide consent by signing a consent form. Following this, a Physical Readiness Questionnaire (PAR-Q) was administered to identify any underlying

medical conditions that could affect participation. All data collected were treated with the utmost confidentiality.

Procedures

The pretesting involved collecting data on the health-related physical fitness components of the participants, which included Cardiovascular Endurance, Strength, Muscular Endurance, and Body Composition. The field tests used were the three-minute step test, 1-repetition max of bench press and squat, one-minute push-up test, plank test, lean body mass, and fat mass measurements. The data collection spanned two days to minimize the fatigue effect of the tests on subsequent assessments. Furthermore, the implementation phase involved applying the training program or physical activity specifically intended for both groups. For the Arnis Training Group, a 10-week Arnis training program consisting of a combination of sparring and Anyo (forms) was implemented. This was conducted under the instruction of a certified Arnis instructor affiliated with the Philippine Eskrima Kali Arnis Federation, the National Sports Association for Arnis in the Philippines. Each week consisted of three sessions, each lasting 60-90 minutes. On the other hand, participants in the Random Physical Activity Group were asked to engage in their preferred physical activities and record them for an hour [17]. This was done with the same duration and frequency of sessions. Lastly, the post-testing was conducted three days after the implementation phase for both groups. The same protocol was used to administer the aforementioned field tests.

Instruments

In collecting data on the health-related physical fitness components, several component-specific field tests were utilized. For cardiovascular endurance, the Three-Minute Step Test was used. Strength was measured through the 1 Repetition Maximum Test of the bench press and back squat. Muscular endurance was assessed through the One-Minute Push-Up Test and the Plank Test. The use of two field tests per fitness component was employed to ensure specificity in body parts. Lastly, for body composition, the Skin Caliper Test was used to measure the lean body mass and fat mass of the participants.

Statistical Analysis

To assess the potential effects of the two training regimens, inferential statistics were employed. For within-group comparisons, the paired t-test was used. On the other hand, comparisons between the two groups or between-group comparisons were conducted using the independent sample t-test. The study adopted $p < .05$ as the standard level of significance.

Results

Table 3 presents within-group comparisons evaluating the effects of the two implementations. For the ATG, significant improvements were observed across most fitness components. Cardiovascular endurance improved, as three-minute step test (TMST) scores decreased by approximately 3.5 seconds ($p < .05$). Strength improvements were evident in both horizontal pushing ($p < .05$) and squatting movements ($p < .05$). Muscular endurance gains were particularly notable, with one-minute push-up test (OMPUT) scores rising by approximately 5 repetitions and planking test (PT) scores increasing by nearly 6 seconds (both $p < .05$). Additionally, lean body mass (LBM) rose, while fat mass (FM) decreased slightly ($p < .05$), highlighting the interventions' effectiveness. For the RPAG, results were mixed. Significant gains were observed in squatting strength ($p < .05$) and core muscular endurance ($p < .05$). However, changes in cardiovascular endurance, horizontal pushing strength, lean body mass, and fat mass were either insignificant or minimal, indicating limited effects on these variables.

The present study includes a sex-specific investigation of the within-group comparisons. Table 4 presents the data for female participants. For the ATG, significant improvements were observed across all fitness components. Cardiovascular endurance increased ($p < .05$), accompanied by notable enhancements in strength

for both horizontal pushing ($p < .05$) and squatting movements ($p < .05$). Muscular endurance in horizontal pushing ($p < .05$) and core strength ($p < .05$) also showed substantial improvements. Additionally, lean body mass increased significantly ($p < .05$), while fat mass decreased significantly ($p < .05$), highlighting the intervention's effectiveness in this group. In contrast, the RPAG showed mixed results. Cardiovascular endurance ($p < .05$) and strength in squatting movements ($p < .05$) significantly improved, as did muscular endurance in horizontal pushing ($p < .05$) and core strength ($p < .05$). Lean body mass also exhibited a significant increase ($p < .05$). However, fat mass changes were insignificant ($p = .13$), and strength in horizontal pushing movements showed minimal improvement ($p = .21$), indicating a more modest impact of the intervention in this group.

For male participants, Table 5 shows that, for the ATG group, cardiovascular endurance exhibited an insignificant decrease, with TMST scores showing no significant change ($p = .15$). However, strength in horizontal pushing movements significantly increased, as indicated by the 1RMBS scores ($p < .05$). Strength in squatting movements also significantly improved, with 1RMBS scores showing a statistically significant rise ($p < .05$). Muscular endurance in horizontal pushing significantly enhanced, as reflected by the OMPUT scores ($p < .05$). Core muscular endurance saw significant improvement, with PT scores showing a significant increase (p

Table 3. Within-group comparison of ATG and RPAG of all participants

Test Variables	PRETEST	POST TEST	t-value	p-value
ATG				
TMST	130.75 ± 5.94	127.23 ± 5.94	4.11	p<.05
1RMBP	56.17 ± 7.44	60.07 ± 7.44	-3.63	p<.05
1RMBS	76.03 ± 6.42	80.78 ± 6.42	-5.13	p<.05
OMPUT	33.27 ± 5.90	38.09 ± 5.90	-5.65	p<.05
PT	65.37 ± 4.81	71.23 ± 4.81	-8.44	p<.05
LBM	66.96 ± 6.81	70.73 ± 6.81	-3.84	p<.05
FM	24.9 ± 4.94	23.705 ± 4.94	1.68	p<.05
RPAG				
TMST	135.11 ± 9.03	136.72 ± 9.03	-1.23	0.065
1RMBP	53.86 ± 9.67	53.02 ± 9.67	0.61	0.036
1RMBS	77.38 ± 4.45	81.15 ± 4.45	-5.86	p<.05
OMPUT	28.12 ± 8.13	26.37 ± 8.13	1.5	0.23
PT	61.62 ± 5.76	63.18 ± 5.76	-1.87	p<.05
LBM	60.21 ± 6.11	63.79 ± 6.11	-4.06	0.12
FM	32.4 ± 9.33	31.48 ± 9.33	0.6	0.64

Note: Mean and Standard deviation are presented as M±SD. Test of significance is at $p < .05$. Legend: ATG- Arnis training group, RPAG- Random physical activity group, TMST- Three minute step test, 1RMBP- 1 Repetition max of bench press, 1RMBS- Back squat, OMPUT- One-minute push up test, PT- Planking test, LBM- Lean body mass, FM- Fat mass.

Table 4. Within-group comparison of ATG and RPAG of female participants

Test Variables	PRETEST	POST TEST	t-value	p-value
		ATG		
TMST	136±6.12	130.35±4.23	7.44	<.05
1RMBP	53.12±5.62	56.12±5.45	-3.75	<.05
1RMBS	72.47±8.96	78.47±6.30	-5.37	<.05
OMPUT	32.12±1.32	35.55±1.89	-14.58	<.05
PT	62.87±4.68	67.47±1.99	-8.86	<.05
LBM	65.21±9.32	70.45±8.92	-3.98	<.05
FM	25±3.12	24.11±1.65	2.47	<.05
		RPAG		
TMST	140.22±1.12	138.23±2.12	8.13	<.05
1RMBP	50.82±10.62	52.23±3.2	-1.25	.21
1RMBS	69.81±5.91	71.14±3.21	-1.94	<.05
OMPUT	25.02±1.82	26.01±3.2	-2.63	<.05
PT	50.87±2.68	51.66±1.24	-2.62	<.05
LBM	55.21±2.35	56.87±6.7	-2.29	<.05
FM	30±6.23	31.65±8.45	-1.54	.13

Note: Mean and Standard deviation are presented as M±SD. Test of significance is at p <.05. Legend: ATG- Arnis training group, RPAG- Random physical activity group, TMST- Three minute step test, 1RMBP- 1 Repetition max of bench press, 1RMBS- Back squat, OMPUT- One-minute push up test, PT- Planking test, LBM- Lean body mass, FM- Fat mass.

Table 5. Within-group comparison of ATG and RPAG of male participants

Test Variables	PRETEST	POST TEST	t-value	p-value
		ATG		
TMST	125.5 ± 9.32	124.1 ± 1.82	1.44	.15
1RMBP	59.22 ± 5.62	64.02 ± 1.62	-8.04	<.05
1RMBS	79.59 ± 4.08	83.09 ± 9.28	-3.38	<.05
OMPUT	34.42 ± 5.82	40.62 ± 5.71	-7.45	<.05
PT	67.87 ± 6.98	74.99 ± 3.78	-8.79	<.05
LBM	68.71 ± 5.20	71.01 ± 2.94	-3.77	<.05
FM	24.8 ± 7.92	23.31 ± 3.62	1.68	.09
		RPAG		
TMST	130.0 ± 12.52	135.2 ± 17.02	-2.41	<.05
1RMBP	56.9 ± 20.62	53.8 ± 18.30	1.1	.27
1RMBS	84.95 ± 18.42	91.15 ± 24.42	-1.99	.06
OMPUT	31.22 ± 20.32	26.72 ± 15.68	1.72	.09
PT	72.37 ± 4.68	74.69 ± 8.78	-2.28	.06
LBM	65.21 ± 21.18	70.71 ± 24.58	-1.66	.10
FM	34.8 ± 12.72	31.3 ± 10.22	2.1	<.05

Note: Mean and Standard deviation are presented as M±SD. Test of significance is at p <.05. Legend: ATG- Arnis training group, RPAG- Random physical activity group, TMST- Three minute step test, 1RMBP- 1 Repetition max of bench press, 1RMBS- Back squat, OMPUT- One-minute push up test, PT- Planking test, LBM- Lean body mass, FM- Fat mass.

<.05). Lean body mass also significantly increased, with LBM scores reflecting a notable rise ($p <.05$). However, changes in fat mass were insignificant, as FM scores showed no significant difference ($p = .09$). For the RPAG group, cardiovascular endurance significantly decreased, with TMST scores indicating a significant change ($p <.05$). Strength in horizontal pushing movements showed an insignificant decrease, with 1RMBP scores not reflecting a statistically significant change ($p = .27$). Strength in squatting movements exhibited a small but insignificant increase, with 1RMBS scores approaching statistical significance ($p <.06$). Muscular endurance in horizontal pushing showed improvement, but the change was not statistically significant ($p = .09$). Core muscular endurance showed an insignificant increase, with PT scores approaching significance ($p <.06$). Lean body mass showed an insignificant increase, with LBM scores not reaching statistical significance ($p = .10$). Fat mass significantly decreased, with FM scores showing a significant reduction ($p <.05$).

The study also included a between-group comparison to determine the superior training regime in terms of improving health-related fitness. An independent sample t-test was used for data analysis. Table 6 presents the results for all participants. The ATG group demonstrated superior cardiovascular endurance, with TMST scores significantly higher than those of the comparison group ($p <.05$). Similarly, ATG exhibited greater strength in horizontal pushing, as measured by the 1RMBP, with a significant difference ($p <.05$). No significant difference was observed in squatting strength between ATG and the comparison group, as evaluated by the 1RMBS ($p = .65$). Additionally, ATG showed higher muscular endurance in horizontal pushing, as indicated by the OMPUT, and stronger core muscular endurance, measured by the PT, with significant differences for both ($p <.05$). ATG also had a higher lean body mass and a lower fat mass, both showing significant differences ($p <.05$),

reflecting overall better physical composition.

Table 7 shows the data for female participants in between-group comparisons. Cardiovascular endurance, as measured by the TMST, revealed that the AT group had a significantly higher score compared to the RPA group ($p <.05$). Horizontal pushing strength, assessed through the 1RMBP, was also higher in the AT group, with a significant difference ($p <.05$). Similarly, squat movement strength, measured by the 1RMBS, demonstrated that the AT group had superior strength compared to the RPA group, with a significant p-value ($p <.05$). Muscular endurance in horizontal pushing, as measured by the OMPUT, showed that the AT group outperformed the RPA group, with a highly significant p-value ($p <.05$). Core muscular endurance, assessed by the PT, indicated that the AT group had superior performance compared to the RPA group, also with a significant p-value ($p <.05$). Lean body mass comparisons revealed that the AT group had a higher lean body mass than the RPA group, with a notable p-value difference ($p <.05$). Lastly, fat mass was lower in the AT group compared to the RPA group, signifying another significant difference ($p <.05$). These findings collectively highlight that the AT group demonstrated superior effects across selected health-related physical fitness components.

Lastly, Table 8 presents the data for male participants in the between-group comparison. Cardiovascular endurance, measured through the TMST, indicated that the ATG group had higher endurance than the RPAG group, with a statistically significant difference ($p <.05$). The ATG group also showed greater strength in horizontal pushing, as assessed by the 1RMBP, and superior muscular endurance in the same activity, as measured by the OMPUT, both with significant p-values ($p <.05$). However, the RPAG group outperformed ATG in squat movement strength, a significant finding ($p <.05$). Muscular endurance of the core, measured by PT, and lean body mass did not show significant

Table 6. Between-group comparison of ATG and RPAG of all participants

Test Variables	ATG	RPAG	t-value	p-value
TMST	127.225 ± 5.94	136.715 ± 9.03	-8.60	<.05
1RMBP	60.07 ± 7.44	53.015 ± 9.67	5.67	<.05
1RMBS	80.78 ± 6.42	81.145 ± 4.45	-0.46	.65
OMPUT	38.085 ± 5.90	26.365 ± 8.13	11.43	<.05
PT	71.23 ± 4.81	63.175 ± 5.76	10.52	<.05
LBM	70.73 ± 6.81	63.79 ± 6.11	7.43	<.05
FM	23.705 ± 4.94	31.475 ± 9.33	-7.21	<.05

Note: Mean and Standard deviation are presented as M±SD. Test of significance is at $p <.05$. Legend: ATG- Arnis training group, RPAG- Random physical activity group, TMST- Three minute step test, 1RMBP- 1 Repetition max of bench press, 1RMBS- Back squat, OMPUT- One-minute push up test, PT- Planking test, LBM- Lean body mass, FM- Fat mass.

Table 7. Between-group comparison of ATG and RPAG of female participants

Test Variables	ATG	RPAG	t-value	p-value
TMST	130.35±4.23	136±6.12	-7.44	<.05
1RMBP	56.12±5.45	53.12±5.62	3.75	<.05
1RMBS	78.47±6.30	72.47±8.96	5.37	<.05
OMPUT	35.55±1.89	32.12±1.32	14.58	<.05
PT	67.47±1.99	62.87±4.68	8.86	<.05
LBM	70.45±8.92	65.21±9.32	3.98	<.05
FM	24.11±1.65	25±3.12	-2.47	<.05

Note: Mean and Standard deviation are presented as M±SD. Test of significance is at $p < .05$. Legend: ATG- Arnis training group, RPAG- Random physical activity group, TMST- Three minute step test, 1RMBP- 1 Repetition max of bench press, 1RMBS- Back squat, OMPUT- One-minute push up test, PT- Planking test, LBM- Lean body mass, FM- Fat mass.

Table 8. Between-group comparison of ATG and RPAG of male participants

Test Variables	ATG	RPAG	t-value	p-value
TMST	124.1 ± 1.82	135.2 ± 17.02	-6.35	<.05
1RMBP	64.02 ± 1.62	53.8 ± 18.30	5.45	<.05
1RMBS	83.09 ± 9.28	91.15 ± 24.42	-3.02	<.05
OMPUT	40.62 ± 5.71	26.72 ± 15.68	8.16	<.05
PT	74.99 ± 3.78	74.69 ± 8.78	0.31	0.76
LBM	71.01 ± 2.94	70.71 ± 24.58	0.12	0.91
FM	23.31 ± 3.62	31.3 ± 10.22	-7.22	<.05

Note: Mean and Standard deviation are presented as M±SD. Test of significance is at $p < .05$. Legend: ATG- Arnis training group, RPAG- Random physical activity group, TMST- Three minute step test, 1RMBP- 1 Repetition max of bench press, 1RMBS- Back squat, OMPUT- One-minute push up test, PT- Planking test, LBM- Lean body mass, FM- Fat mass.

differences between the groups ($p = 0.76$ and $p = 0.91$, respectively). Lastly, ATG exhibited a significantly lower fat mass compared to RPAG, highlighting differences in body composition ($p < .05$).

Discussion

The present study used a group pretest-posttest design which included within-group and between-group comparisons to investigate the effect of the Arnis training program and random physical activity on health-related physical fitness components. Furthermore, the two groups were compared in terms of their effect on the said components.

ATG within-group comparison

For the Arnis Training Group, all of the health-related physical fitness components were improved by Arnis training. A set of previous studies was in support of this claim, suggesting that martial arts improve the physical fitness of an individual. Cardiovascular endurance or aerobic capacity was improved by martial arts training according to the present study. This is the same case for the previous studies by Soo Bahk Do based on the aerobic capacity among the sedentary population [17]. The same is true for MMA athletes [18]. Compared to traditional aerobic classes, martial arts are superior

in improving aerobic capacity. Using the Harvard Step Test, martial arts training has been shown to increase aerobic capacity [19].

For strength, previous studies support the present study by suggesting that martial arts training improves the strength of individuals. Martial arts training significantly enhances strength, as demonstrated in a 12-week program that improved university athletes' strength by Peng [20]. Similarly, Wan [9] confirmed that the effectiveness of martial arts in boosting strength and sports performance. Balance training in martial arts not only enhances balance but also increases strength, thus improving athletic performance [11]. Additionally, core strength training has been shown to significantly boost core stability and strength [21]. These studies collectively highlight martial arts as a potent tool for developing strength among practitioners. In relation to muscular endurance, previous studies supported the claim that martial arts training like arnis improves muscular endurance. Increasing dynamic strength and endurance is crucial for executing combat movements repeatedly in combat sports, emphasizing the essential role of martial arts training for success in these disciplines [22]. Specific martial arts fitness training significantly enhances

strength and endurance among university martial arts practitioners [23].

The present study aligns with existing literature that supports the notion that martial arts training can enhance body composition across various populations. For example, Kung Fu training has been demonstrated to maintain or improve central adiposity among overweight/obese adolescents, suggesting beneficial effects on body composition [24]. In overweight/obese premenopausal women, Chyu et al. [25] observed that 12 weeks of martial arts exercise led to significant changes in body composition, including reductions in fat-free and muscle mass. Furthermore, Tota et al. [26] found that conditioning training in elite mixed martial arts athletes resulted in decreases in body fat mass and improvements in both anaerobic and aerobic performance. Therefore, research on various martial arts disciplines shows they can positively affect body composition by reducing body fat percentage and increasing lean muscle mass [27]. However, the present study contradicts a systematic review and meta-analysis that found no significant benefits of martial arts interventions on body composition in overweight and obese subjects, highlighting the need for further high-quality research [28]. Lastly, the current study additionally examined the sex-specific impact of the ATG on physical fitness. ATG did not lead to improvements in cardiovascular endurance and fat mass for male participants. Exclusively for the female participants. The indicated training led to improvements in all of the components.

RPAG within-group comparison

In the present study, RPAG within-group comparison suggested that all participants experienced improvements in squatting strength and lean body mass. Additionally, random physical activity was found to enhance muscular endurance in horizontal pushing and the core, as well as flexibility in the hamstrings and cardiovascular endurance [16]. However, female participants did not show improvements in the strength of horizontal pushing or lean body mass. The same study also noted that random physical activity improves muscular endurance of horizontal pushing, flexibility of the hamstrings, and cardiovascular endurance [16]. Lastly, male participants showed improvements in cardiovascular fitness and fat mass. Contrary to these findings, the study suggests that there were insignificant changes in muscular endurance of horizontal pushing, flexibility of the hamstrings, and cardiovascular endurance for male participants [16].

Between-group comparison

For between group comparison, it was suggested that except of strength of squatting movement, all of the health-related fitness components were higher in ATG. Various comparative studies examine the contrast between martial arts training

and non-martial arts physical activities, such as general physical fitness programs and sports. Previous research has proven that martial arts training is highly effective in enhancing physical fitness. Comparatively, martial arts training has demonstrated substantial advantages in enhancing physical fitness, as opposed to other fitness programs.

An empirical investigation discovered that the incorporation of martial arts fitness training into regular training significantly improves stability and strength in university practitioners. This makes it a powerful approach to develop fitness in this particular population [20]. A separate study emphasized the efficacy of balance training in martial arts, leading to notable enhancements in sports fitness measures such as balance and functional indices. This research underscores the usefulness of balance training in improving the fitness of martial artists [11]. Furthermore, a comparison analysis conducted on adolescents participating in martial arts, team sports, and non-sports activities revealed that martial arts have a greater positive impact on muscular endurance and flexibility compared to the other forms of physical activity [29]. Moreover, a study by Olaru [30] shown that functional training in martial arts has a substantial impact on enhancing endurance, flexibility, and shoulder girth. This highlights the advantages of integrating functional training methods.

Moreover, apart from squatting strength, all health-related fitness components were higher in the ATG compared to the RPAG. Sex specificity was targeted by the study by providing sex-specific results. Male participants showed no significant differences in muscular endurance of the core and lean body mass, whereas female participants exhibited higher fitness components than those in the ATG. However, overall, the RPAG had lower scores on health-related fitness components, with female participants notably experiencing lower scores across all measured components.

Conclusions

The strength of this study lies in its comprehensive evaluation of the Arnis Training Group (ATG), which showed significant improvements across various fitness components. The ATG demonstrated notable benefits in cardiovascular endurance, strength, muscular endurance, lean body mass, and fat mass. These findings suggest that Arnis training is an effective intervention for enhancing overall fitness, especially compared to the more limited effects observed in the control group. However, the study's limitations include the short duration of the intervention and the absence of a broader range of fitness assessments. Future research should explore the longer-term effects of Arnis training and its impact on psychological outcomes such as

motivation and mental resilience. Additionally, studies could further investigate the benefits of Arnis training in different populations to validate its effectiveness in improving physical health and fitness.

Acknowledgement

The author would like to thank all the participants of the study. Moreover, deepest thanks to Ramon Carlo E. Masagca (Instructor) and John Mathew A. Serrano (University Arnis Coach) for the help provided for the success of this project.

Additionally, sincerest gratitude is also given to the administrators of the university; President, Dr. Teody C. San Andres, OIC-VPAA, Dr. Warlito Galita, VPREI, Dr. Keno Piad, VPAF, Mr. Christopher Plamenco, Research Director, Dr. Joseline M. Santos, and to the Dean of the College of Sports, Exercise and Recreation, Dr. Rafael T. Celso, for their unwavering support. This study is self-funded research.

Conflict of interests

The author declare that there is no conflict of interests.

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Cite this article as:

Lobo J. Enhancing health-related physical fitness through Arnis: effects of a martial arts training program on collegiate students. *Pedagogy of Physical Culture and Sports*, 2025;29(1):12–21. <https://doi.org/10.15561/26649837.2025.0102>

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Received: 02.01.2025

Accepted: 10.02.2025; Published: 28.02.2025