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The 12 Weeks General Preparation Phase Exercise Improve Body Composition on Female University Basketball Athletes

Fairuz Puti Asri[1], Eko Juli Fitrianto[2], Hermanto[3], Lilik Herawati[4*]

[1] Medical Programme, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia
[2] Sports Science Programme, Faculty of Sports and Health Sciences, Universitas Negeri Jakarta, Indonesia
[3] Sports Coaching Education Programme, Faculty of Sports and Health Sciences, Universitas Negeri Jakarta, Indonesia
[4]Department of Medical Physiology and Biochemistry, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

Corresponding author. Email**:** lilik_heraw@fk.unair.ac.id

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Abstract. General Preparation Phase (GPP) exercise is the initial point in training periodisation, focusing on the foundation construction for physical capability, basic technique, and mental preparedness of an athlete prior to entering specialised training period. At this stage, physical exercise was conducted with high volume and moderate intensity intended to raise aerobic capacity and bio motor components in general as part of anatomical adaptation process, preparing the body for a more specific load in accordance with specific sports demand. This experimental study aims to explore the effects of GPP exercise on basketball players' body composition, consisting of body fat percentage and muscle mass, measured using BIA (Bio-Electric Impedance Analysis), then analysed using paired t-test. Participants for this study were 24 female basketball players from Universitas Negeri Jakarta Varsity Basketball Club who performed GPP for 12 weeks. The result showed there was a 7.70% decrease in body fat percentage, and an increase of 4.42% in muscle mass after GPP of training. It can be concluded that practising GPP has an impact on body fat percentage and muscle mass of the subjects.

Keywords: General Preparation Phase; Body Fat; Muscle Mass; Healthy Lifestyle

INTRODUCTION

Training periodization is a systematic approach in designing physical training programme that assign focus and training load gradually to achieve optimal and safe physical adaptation. For basketball players, general preparation phase is a fundamental step that allow athletes to develop elementary physical capacity before beginning specialised training period and competition (Pliauga et al., 2018). Training periodization supports macro (weekly) and meso (monthly) structure for the subsequent adaptation of physical capacities in accordance to competitive season, whereas management of training load and focus during the general preparation phase will influence neuromuscular adaptation and performance capacity envisioned at the main competition (Pliauga, Lukonaitiene, et al., 2018).

General Preparation Phase (GPP) combine several physical components that are complementary to build a strong and measurable performance groundwork. Primary components in this phase consists of general strength development through exercise using submaximal until maximal intensity to enhance specific muscle capacity prepared to perform for basketball game (Chiang et al., 2025; Mexis et al., 2025). Furthermore, GPP training also focuses on aerobic and anaerobic capacity by executing a continuous training with interval to support recovery and maintain performance during basketball game (Mexis et al., 2025).

The main goal of GPP is to establish general physical capability that reinforce specific preparation phase (SPP) training, in order for athletes to enter the season with adequate physiological capability to endure a demanding game with high intensity (Mexis et al., 2025). Neuromuscular repairment such as increase in jump height and horizontal explosive-power capacity (sprinting) being repeated during game, and resistance towards performance decline due to accumulated exhaustion are the benefits of a structured GPP (Mexis et al., 2025; Pliauga, Lukonaitienė, et al., 2018). Biochemical responses to basketball training also show measurable diversifications in oxidative stress, inflammation, and muscle damage markers, suggesting that structured training affects systemic physiological regulation (Herawati et al., 2025). In a practical sense, structured GPP may help coaches to determine adaptation of bio motor components (strength, explosive-power, and endurance) that are measurable, therefore optimizing probable performance enhancement and injury prevention management to support competition phase (Chiang et al., 2025; Chou et al., 2021; Pliauga, Lukonaitiene, et al., 2018).

GPP is a critical period where basketball athlete's body fat percentage tends to go through significant change in response towards training volume and intensity increase which induce relative energy deficit and boost metabolism that happened during training period.

Several studies reported a decrease in body fat percentage occur in elite and sub-elite athletes enrolled in a structured training speme with duration of 2-6 weeks (Díaz-Martínez et al., 2024; Ploudre & Mayhew, 2018; Zelenović et al., 2025). Observing body composition during GPP period is critical because alteration in body fat percentage and free fat mass directly affect speed, explosive-power, and endurance, which are key determinants for on-field performance (Juli Fitrianto et al., 2024; Nishisaka et al., 2022). Longitudinal study evaluated body composition before and after pre-season which showed a decrease in body fat percentage (% body fat) and an increase in free fat mass in group that implemented structured training programme, meanwhile during competition season changes in body composition tends to be fewer or fluctuating, thus periodical measurement deemed essential to determine the adaptation towards the training programme held (Beljic, 2020; Juli Fitrianto et al., 2024; Ploudre & Mayhew, 2018). Body fat percentage can be measured using standard procedure such as DXA (Dual-Energy X-ray Absorptiometry) or ADP (Air Displacement Plethysmography) which provide highest accuracy, or with a device that support foot-to-foot BIA (Bioelectrical Impedance Analysis) (Beljic, 2020; Ploudre & Mayhew, 2018).

Various studies on collegiate teams and professional showed increase in fat free mass or muscle mass percentage during intensive training period in pre-season phase, indicating that GPP is the prime-time course to accumulate muscle mass (Gantulga et al., 2025; He et al., 2025; Shaun et al., 2022). During GPP, adaptations compose muscular hypertrophy (increase muscle mass) through muscle cross-sectional area expansion, alongside neuromuscular adaptation which improve power produced and reduce perceived fatigue following repeated physical efforts (Albaladejo et al., 2019; Ferioli et al., 2018). Muscle mass increase not only contributing toward maximum strength, but also toward explosive-power capacity needed for optimal performance in continuous and dynamic game (Gantulga et al., 2025; Xue, 2023).

METHOD

This study used an experimental, one group pre-test and post-test design to analyse the effect of general preparation phase on body composition of university female basketball athletes. Research population consisted of 28 female basketball collegiate athletes from Universitas Negeri Jakarta (UNJ), all of which were included using the total sampling method. After exclusion criteria were applied, four athletes could not complete the entire series of exercise principles, thus total sample that were analysed was 24 athletes.

Research subjects were female aged 19 – 24 years old, in good health, recorded as an

active member of UNJ Basketball Varsity Club, and did not perform heavy loaded physical activity a week prior to the study. Subjects were excluded if they were unable to participate the research procedures completely or injured during intervention execution.

The participants of this study, 24 female UNJ varsity basketball athletes, an were measured and recorded. Their height, weight, body mass index, and blood pressure average is in the normal range (Table 1).

Table 1. Participants Characteristics

	n	$\bar{x}$	±	*sd*	min	max
Height (cm)	24	159.83	±	5.58	151.00	170.00
Weight (kg)	24	52.96	±	7.63	38.00	66.00
BMI (kg/m^2)	24	20.69	±	2.59	16.02	26.44
Systolic (mmHg)	24	116.67	±	4.82	110.00	120.00
Diastolic (mmHg)	24	77.91	±	5.75	70.00	90.00

Note: n = number of participants; $\bar{x}$ = mean; *sd* = standard deviation; min = minimum value; max = maximum value

GPP training was imposed on 24 female athletes from UNJ varsity basketball club, with GPP training programme implemented for 12 weeks with a frequency of three sessions per weeks with a total of 36 training sessions. The training protocol adopted the GPP periodization structure used by UNJ basketball team, including warm-up, core, and recovery phases in a total duration of 60 – 90 minutes per session. In this approach, various components of physical capacity which includes aerobic base training, strength endurance, aerobic + anaerobic threshold, and anaerobic + lactate tolerance, are trained in accordance to the micro-cycle structure of the protocol. Data were collected before and after the GPP intervention using the Xiaomi Body Composition Scale 2 to measure body fat percentage and muscle mass.

RESULT AND DISCUSSION

Result

Data from this study were grouped into two: (1) Pre-test body composition (body fat% and muscle mass) before GPP (Y_{21}), and (2) Post-test body composition (body fat% and muscle mass) after GPP (Y_{21}) (Table 2).

Table 2. Research Variables Description

	Time	n	$\bar{x}$	±	*sd*	min	max
Body Fat %	Pre	24	28.01	±	3.02	21.50	35.60
	Post	24	26.01	±	1.23	22.81	29.33
Muscle Mass	Pre	24	40.95	±	1.07	38.56	43.60
	Post	24	42.85	±	1.05	39.81	45.11

Note: n = number of participants; $\bar{x}$ = mean; *sd* = standard deviation; min = minimum value; max = maximum value; Pre =

before GPP intervention; Post = after GPP intervention

Normality test was done using Shapiro-Wilk test, all results showed to have a p-value ≥ 0.05, proving that the data distribution were normal. Based on the results, the p-value for body fat percentage was 0.898 ≥ 0.05, indicating that H0 is rejected; the p-value for muscle mass was 0.001 < 0.05, indicating that H0 is accepted; and the p-value of 0.942 ≥ 0.05 also indicates acceptance of H0. These findings show that the variance of body fat percentage is heterogenous, whereas the variance of muscle mass is homogeneous.

To determine the differences in body composition score (body fat % and muscle mass) of female collegiate basketball players in UNJ, further data analysis was conducted using a paired t-test. Based on the hypothesis testing at a significance level of α = 0.05, it can be concluded that there were statistically meaningful differences in body composition scores (body fat % & and muscle mass) among the female basketball players at Universitas Negeri Jakarta. It can be deduced from the difference of initial and final body composition scores before and after conducting general preparation phase, in both body fat percentage (Table 3 & Figure 1) and muscle mass (Table 4 & Figure 2), that GPP training does affect body composition scores, lowering body fat percentage and raising muscle mass, in collegiate female basketball athletes.

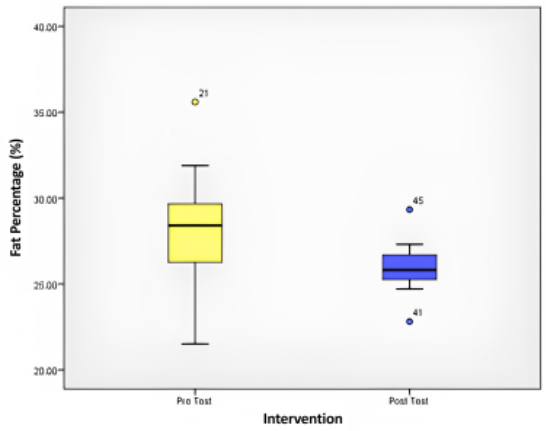

Figure 1. Difference in Body Fat Percentage (%) Before and After the Intervention

Table 3. Pre – Post Test Body Fat Percentage Change

Body Fat %					
Pre					
n	$\bar{x} \pm sd$	Δ	% Δ	t	p-value
24	28.01 ± 3.02				
Post					
n	$\bar{x} \pm sd$	-2.00	-7.70	-4.832	0.000**
24	26.01 ± 1.23				

Note: n = number of participants; $\bar{x}$ = mean; *sd* = standard deviation; Δ = absolute change (post–pre); % Δ = percentage change;

t = t-test statistic; p-value = significance value; * = statistically significant; ** = highly statistically significant

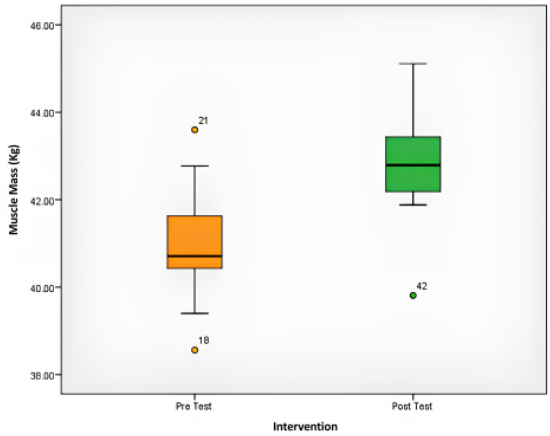

Figure 2. Difference in Muscle Mass (kg) Before and After the Intervention

Table 4. Pre – Post Test Muscle Mass Change

Muscle Mass (kg)					
Pre					
n	$\bar{x} \pm sd$	Δ	% Δ	t	p-value
24	40.95 ± 1.07				
Post					
n	$\bar{x} \pm sd$	1.90	4.42	8.441	0.000**
24	42.85 ± 1.05				

Note: n = number of participants; $\bar{x}$ = mean; *sd* = standard deviation; Δ = absolute change (post–pre); % Δ = percentage change; t = t-test statistic; p-value = significance value; * = statistically significant; ** = highly statistically significant

Discussion

Studies showed that GPP training that combines several strength training components, conditioning, and aerobic-anaerobic components has an impact on body fat percentage and muscle mass of basketball players. Strength or weight training produce a moderate fat reduction if combined with energy deficit and additional exercise, consistently raising free fat mass (FFM) through hypertrophy mechanism and neuromuscular adaptation (Juli Fitrianto et al., 2024; Mexis et al., 2023). Aerobic exercise and high intensity interval training (HIIT) effectively reduce body fat especially when integrated with strength training, its' effect relies on exercise duration and energy intake, commonly maintaining or slightly increasing FFM if protein intake is adequate (Juli Fitrianto et al., 2024; Ploudre & Mayhew, 2018; Russell et al., 2025). This proves that pre-season training programme when periodised and integrated strength, conditioning, and plyometric is most consistent in lowering fat percentage while maintaining or increasing fat free mass in basketball athletes (Díaz-Martínez et al., 2024; Juli

Fitrianto et al., 2024; Mexis et al., 2023; Zelenović et al., 2025).

Muscle mass increase occurred in GPP which concurred with previous studies, strength training with submaximal until maximal weight that pressed on low to moderate repetition (6-8 RM for example) tends to increase lean body mass consistently during 6-12 weeks training period (Albaladejo et al., 2019; Papadakis, 2025). Weight variation and total training load throughout pr-season phase closely linked with the degree of change in body composition and physical performance, whereas its' effects depended on programme phase and individual characteristics of the athlete (Dobbin et al., 2018; Ferioli et al., 2018). Other studies findings suggested that pre-season programme that systematically combined strength training and plyometric showed increase in jump and sprint ability which supports the idea of muscle hypertrophy transfer to explosive-power that can be applied in competitions (de Pedro-Múñez et al., 2025; Tromaras et al., 2024).

CONCLUSION

Based on the study findings, it can be concluded that GPP enhance the body fat percentage and muscle mass of female collegiate basketball athletes. Body composition showed a decrease of 7.70% in body fat percentage while it increased 4.42% in muscle mass after GPP training.

REFERENCES

Albaladejo, M., Vaquero-Cristóbal, R., & Esparza-Ros, F. (2019). Efecto del entrenamiento en pretemporada en las variables antropométricas y derivadas en jugadores de baloncesto de élite (Effect of preseason training on anthropometric and derived variables in professional basketball players). *Retos*, *36*, 474–479. https://doi.org/10.47197/retos.v36i36.68535

Beljic, A. (2020). *Pre-Season To Post-Season Changes In Physiological And Performance Metrics Of Division I Collegiate Basketball Players* [California State University]. http://hdl.handle.net/20.500.12680/8p58pn115

Chiang, C.-Y., Chiang, Y.-C., Chang, C.-C., Morrison, M., & Weakley, J. (2025). Annual Training Load and Jumping- and Sprinting-Characteristic Changes During a Periodized Training Plan in a Division I Male Championship Basketball Team. *International Journal of Sports Physiology and Performance*, *20*(12), 1732–1738. https://doi.org/10.1123/ijspp.2025-0167

Chou, C.-C., Wang, F.-T., Wu, H.-H., Tsai, S.-C., Chen, C.-Y., Bernard, J. R., Kuo, Y.-C., & Liao, Y.-H. (2021). "The Competitive Season and Off-Season": Preliminary Research concerning the Sport-Specific Performance, Stress, and Sleep in Elite Male Adolescent Basketball Athletes. *International Journal of Environmental Research and Public Health*, *18*(24), 13259. https://doi.org/10.3390/ijerph182413259

de Pedro-Múñez, Á., Álvarez-Yates, T., Serrano-Gómez, V., & García-García, O. (2025). Changes in Sprinting and Jumping Performance During Preseason in Professional Basketball Players. *Journal of Functional Morphology and Kinesiology*, *10*(3), 339. https://doi.org/10.3390/jfmk10030339

Díaz-Martínez, A. S., Vaquero-Cristóbal, R., Albaladejo-Saura, M., & Esparza-Ros, F. (2024). Effect of pre-season and in-season training on anthropometric variables, somatotype, body composition and body proportion in elite basketball players. *Scientific Reports*, *14*(1), 7537. https://doi.org/10.1038/s41598-024-58222-4

Dobbin, N., Gardner, A., Daniels, M., & Twist, C. (2018). The influence of` preseason training phase and training load on body composition and its relationship with physical qualities in professional junior rugby league players. *Journal of Sports Sciences*, *36*(24), 2778–2786. https://doi.org/10.1080/02640414.2018.1473993

Ferioli, D., Bosio, A., Bilsborough, J. C., La Torre, A., Tornaghi, M., & Rampinini, E. (2018). The Preparation Period in Basketball: Training Load and Neuromuscular Adaptations. *International Journal of Sports Physiology and Performance*, *13*(8), 991–999. https://doi.org/10.1123/ijspp.2017-0434

Gantulga, R., Sumiyabeis, T., & Erdenepurev, L. (2025). Effects of strength training on body structure and muscle development in female basketball players: A case study of the NUM "falcons" team. *Proceedings of the Mongolian Academy of Sciences*, 29–46. https://doi.org/10.5564/pmas.v65i02.4391

He, C., Zhu, D., & Hu, Y. (2025). Physiological adaptations and practical efficacy of different blood flow restriction resistance training modes in athletic populations. *Frontiers in Physiology*, *16*. https://doi.org/10.3389/fphys.2025.1683442

Herawati, L., Sari, G. M., Argarini, R., Irwadi, I., Wibowo, S., Wiriawan, O., Syaifudin, A., Pamungkas, Y., Handrito, R. P., Adi, S., Rahayuni, K., Azmy, U., & Safii, N. S. (2025). Profile of oxidative stress, inflammation, and muscle damage in professional athletes and recreational basketball players. *Retos*, *65*, 235–245. https://doi.org/10.47197/retos.v65.111599

Juli Fitrianto, E., Hermanto, & Fitranto, N. (2024). Pengaruh Latihan Tahap Persiapan Khusus Terhadap Komposisi Tubuh Pemain Bola Basket Putra Universitas Negeri Jakarta. *Jurnal Ilmiah Sport Coaching and Education*, *8*(1), 45–52. https://doi.org/10.21009/JSCE.08106

Mexis, D., Nomikos, T., & Kostopoulos, N. (2025). Effect of Three Pre-Season Training Protocols with Different Training Frequencies on Biochemical and Performance Markers in Professional Female Basketball Players. *Applied Sciences*, *15*(4), 1833. https://doi.org/10.3390/app15041833

Mexis, D., Nomikos, T., Mitsopoulos, N., & Kostopoulos, N. (2023). Effect of a 6-Week Preseason Training Protocol on Physiological and Muscle Damage Markers in High-Level Female and Male Basketball Players. *Sports*, *11*(11), 229. https://doi.org/10.3390/sports11110229

Nishisaka, M. M., Zorn, S. P., Kristo, A. S., Sikalidis, A. K., & Reaves, S. K. (2022). Assessing Dietary Nutrient Adequacy and the Effect of Season—Long Training on Body Composition and Metabolic Rate in Collegiate Male Basketball Players. *Sports*, *10*(9), 127. https://doi.org/10.3390/sports10090127

Papadakis, Z. (2025). Impact of a Four-Week NCAA-Compliant Pre-Season Strength and Conditioning Program on Body Composition in NCAA Division II Women's Basketball. *Journal of Functional Morphology and Kinesiology*, *10*(3), 266. https://doi.org/10.3390/jfmk10030266

Pliauga, V., Lukonaitienė, I., Bradauskienė, K., Klizienė, I., Conte, D., & Stanislovaitienė, J. (2018). The Effect Of Block And Traditional Periodization Models On Jumping And Sprinting Dynamics During The Simulated Basketball Games. *Baltic Journal of Sport and Health Sciences*, *1*(108), 17–24. https://doi.org/10.33607/bjshs.v1i108.5

Pliauga, V., Lukonaitiene, I., Kamandulis, S., Skurvydas, A., Sakalauskas, R., Scanlan, A. T., Stanislovaitiene, J., & Conte, D. (2018). The effect of block and traditional periodization training models on jump and sprint performance in collegiate basketball players. *Biology*

of Sport, *35*(4), 373–382. https://doi.org/10.5114/biolsport.2018.78058

Ploudre, A., & Mayhew, J. (2018). Comparison of Techniques for Tracking Body Composition Changes Across a Basketball Season. *International Journal of Exercise Science*, *11*(4), 425–438. https://doi.org/10.70252/OXVM9894

Russell, J. L., Baker, B. S., Mercer, R. A. J., & McLean, B. D. (2025). Examining the Influence of Season Phase, Age, and Anthropometrics on Body Composition Trends in National Basketball Association Athletes. *Journal of Strength & Conditioning Research*, *39*(2), 227–233. https://doi.org/10.1519/JSC.0000000000004959

Shaun, K., Aston, D., & R Drew, S. (2022). Body Composition Changes in College Basketball Players Over Summer Training. *International Journal of Sports and Exercise Medicine*, *8*(5). https://doi.org/10.23937/2469-5718/1510232

Tromaras, K., Zaras, N., Stasinaki, A.-N., Mpampoulis, T., & Terzis, G. (2024). Lean Body Mass, Muscle Architecture and Powerlifting Performance during Preseason and in Competition. *Journal of Functional Morphology and Kinesiology*, *9*(2), 89. https://doi.org/10.3390/jfmk9020089

Xue, Y. (2023). Reactions On Physical Fitness Triggered By Core Strength Training In Male College Basketball Players. *Revista Brasileira de Medicina Do Esporte*, *29*. https://doi.org/10.1590/1517-8692202329012022_0339

Zelenović, M., Arsenijević, R., Alexe, C. I., Aksović, N., Cojocaru, M., Čaušević, D., Ceylan, H. I., & Alexe, D. I. (2025). In-Season Physical and Physiological Variations in Junior Basketball: A Longitudinal Analysis. *Applied Sciences*, *15*(22), 12045. https://doi.org/10.3390/app152212045