



REVIEW ARTICLE

Physical Activity Training Methods to Improve the Physical Condition of Volleyball Players: A Systematic Review

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Abstract

Study purpose. The study was aimed to identify exercise techniques used to improve the physical condition of volleyball players through literature studies.

Materials and methods. A systematic review of these previous studies was conducted. We studied articles published between 2014 and 2023 that explained how to prepare volleyball players to have better physical condition. Scopus, Web of Science, Google Scholar, and PubMed were used for the electronic search. We collected all the articles that discussed how to improve physical performance through exercise.

Results. To improve the physical condition of volleyball players, 50 publications used exercise techniques, which were categorized based on the physical condition that was evaluated and repaired. The following techniques are some of the ones that can be used: Neuromuscular, unilateral and bilateral, ballistic, plyometric exercises, combined weight and plyometric, mixed training with optimal load, COD & plyometric complex, strength, combined strength, eccentric trainings, repetitive sprint, resistant/non-resistant sprint, resistance training, exercises with elastic band, core training, combined core training; small-sided games training, aerobic interval training, blood flow restriction, intermittent training, and anaerobic speed endurance.

Conclusions. Following a thorough analysis, a number of training regimens were found to be effective in enhancing volleyball players' physical attributes, including muscular strength, aerobic and anaerobic endurance, speed and acceleration, explosive power, flexibility, agility, and balance.

Keywords: systematic review, physical activity, physical condition, volleyball

Introduction

The amount of activity and physiological reactions that occur throughout a volleyball game represents the physical challenges that come with playing it. Related physiological reactions are related to the psychological state of the individual. This is in line with what Aziz stated that Individuals can overcome the problems they face appropriately and effectively, able to manage the stress experienced, which is characterized by commitment, challenges, and control (Aziz et al., 2023). To provide alternative solutions,

intensive individual counselling is needed. Rababa said Client Encounter¹. Counselling is the process of interaction between a counsellor and clients to assist individuals in understanding themselves, overcoming personal, social, emotional, or academic problems, and reaching maximum potential in various aspects of life (Rababa et al., 2022). Likewise, volleyball players need a qualified psychological state and physical condition. Subekti suggests. Physical condition is the degree of state of a person's body, be it in prime condition or not (Subekti et al., 2021). Therefore, volleyball players need to be in top physical condition to handle the physical demands of playing at a high level of competition. Training sessions are a component of efforts to meet physical demands and include a systematic plan to achieve long-term career goals or formal preparation to

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compete. Sistiasih said Volleyball is one of the most popular sports in all directions, especially in Indonesia, volleyball is a new prima donna with quite a lot of enthusiasts (Sistiasih & Pradana, 2022). Volleyball matches or competitions have been running a lot.

The most important component of volleyball training is physical conditioning, which aims to maximize physiological capacity and advance bio motor abilities. Physical training can also be achieved in its style which is directed from a structural and developmental point of view towards the training objectives as volleyball has complex technical and tactical content. Only off-ball events are used to identify components of physical condition. A volleyball player is a functional unit that functions as a whole; As a result, their performance cannot be broken down into individual parts. This leads to the design of training programs that suit the demands of the sport. As a result, the purpose of the study was to test the training techniques used to improve the physical condition of volleyball players and to summarize the findings of each study. So that the process of physical conditioning exercises for volleyball games can be seen.

Physical training can also be done in its own style directed from a structural and developmental point of view towards the training goals because volleyball has complex technical and tactical content. Off-ball activities themselves are used to identify components of physical condition. The volleyball player is a functional unit that functions as a whole. As a result, their performance cannot be broken down into individual parts. This leads to the design of an exercise program that suits the demands of the sport. As a result, this study aims to investigate the training techniques used to improve the physical condition of volleyball players and explain the findings of each study, so that the process of physical conditioning exercises that go along with the game of volleyball can be observed.

Materials and methods

Database and Search Profile

Electronic searches on Google Scholar, Web of Science, Scopus, and PubMed were used to conduct this systematic review. "Training" and "Volleyball" are keyword combinations used for electronic searches. There are four phases to the search approach. First, 650 articles were found by electronic searches of the Google Scholar, Web of Science, Scopus, and PubMed databases. 450 articles were deleted

in the second stage of filtering, which involved 200 article titles and abstracts. In addition, 85 items were omitted for various reasons, leaving 115 articles. In the third step, the full paper is reviewed and analyzed, starting with the title, abstract, methodology, results, and discussion, as well as conclusions. After carefully examining the articles, 65 were expelled for failing to meet the requirements for inclusion. The fourth step involves reading related papers. No new studies are included at this time. As a result, there were a total of 50 publications under systematic review (Figure 1). The inclusion and exclusion criteria are described in table 1.

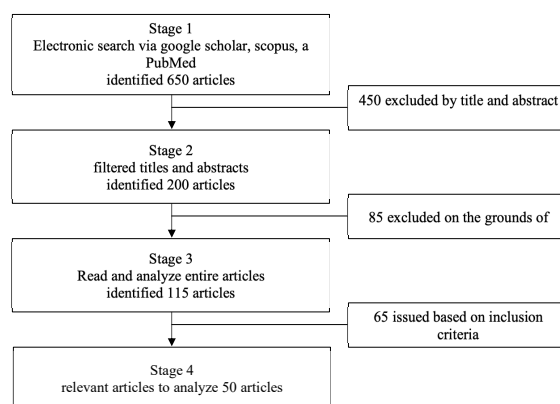


Fig. 1. Article identification flowchart in systematic review

This systematic review was done using electronic searches on Google Scholar, Web of Science, Scopus, and PubMed. Keyword combinations like "Volleyball" and "Training" are utilized in electronic searches. The search strategy is broken down into four steps. First, an electronic search of the Scopus, Web of Science, Google Scholar, and PubMed databases yielded 650 articles. The second round of screening, which included 200 article titles and abstracts, resulted in the removal of 450 articles. There are now 115 articles after an additional 85 things were excluded for various reasons. The third phase involves reviewing and analyzing the entire manuscript, beginning with the headings, abstract, methods, findings, discussion, and conclusion. 65 articles were excluded after a thorough assessment because they didn't adhere to the inclusion criteria. To complete the fourth phase, related papers must be read. Not currently listed are any new studies. Consequently, the systematic review has 50 papers (Figure 1). In addition, table 1 explains the inclusion and exclusion criteria.

Table 1. Inclusion and exclusion criteria of a systematic review of physical activity

Inclusion Criteria	Exclusive Criteria
Last ten years (from January 2014 to March 2023) articles published.	Articles using samples between the ages of 15 and 30.
Published in English.	Articles that utilize a group of volleyball players who have cerebral palsy/special needs.
There is no further research other than experiments.	Players from other sports, outside of volleyball, are also used as samples in the article.
Volleyball players between the ages of 15 and 30 made up the sample of men and women included in the study.	Training sessions are not described in the paper.
The instruction is fully explained.	
Comparative study is a research methodology, and it affects physical activity.	
Physical activity is used as a method of exercise.	
The study findings explain changes in the physical condition evaluated.	

Methodological quality assessment

The quality of the articles studied was evaluated using 11 PEDro (Physiotherapy Evidence Database) criteria and had been assessed for methodological quality. Quality articles are critical to assist users in overcoming barriers such as lack of time and critical thinking skills as well as making it easier to integrate high-quality clinical research into clinical practice. Clinical practice guidelines and systematic reviews are not evaluated. According to Moseley et al. (2020), articles with a score of eight to eleven were rated as having high methodological quality, those with a score of four to seven as medium, and those with a score of four or less were low (Moseley et al., 2020).

Results

Number of Results Reviewed

On an electronic search through Google Scholar, Web of Science, Scopus, and PubMed, 650 articles were identified and found no duplicate articles. Then 400 articles were filtered by title and abstract, leaving 200 articles to reread. The results left 115 articles reviewed in total. Of the 115 articles, 85 were omitted to 50 articles meeting the notability criteria based on the PEDro scale. This article is grouped by physical condition (table 2).

Exercise Significance Results

Of the 50 articles selected and reviewed, regardless of gender, age, level of professionalism, novice or elite players, or type of training conducted, overall, 50 selected articles revealed significant results on the physical condition of volleyball players.

Discussion

Plyometric training

Plyometric training is an exercise program that increases strength and speed (Anitha et al., 2018). Volleyball players need to do this exercise because they need to be able to react quickly and strongly when attacking and defending (Meszler & Vácz, 2019). Thus, plyometric training has been shown to increase explosive action (Vetrovsky et al., 2019). This can be explained by the fact that different types of exercises are performed, which may have an impact on the results of the exercises (Moran et al., 2019). As Fischetti points out, et.al. (Fischetti et al., 2018), which combined weight training and plyometric exercise in a three-group experiment, it produced different benefits when combined with other activities (Bouteraa et al., 2020). One group did only weight training, one group did weight training and plyometric exercises, and one group served as a control (Peitz et al., 2018). Results

Table 2. Characteristics and results of physical condition training methods for volleyball players

Author, Year	Physical Condition Variable	Training Type	Sig.(p)
Copic et al. (2014)	Body composition and muscle strength	Predictors of jumping performance	Sig.
Manshoury et al. (2014)	Flexibility of hamstrings and posterior trunk muscles	The special protocol consisted of two parts: pilates exercises and volleyball exercises.	Sig.
Zwierko et al. (2014)	Agility and passing skills	Extensive experience with volleyball training reduced signal conductivity time through visual pathway	Sig.
Bojanić et al. (2015)	Coordination, speed, explosive strength, repetitive strength and flexibility	Motor skills	Sig.
Papadopoulou (2015)	Balance, and performance	Energy intake and balance on the athletic performance	Sig.
Kalaja et al. (2015)	Speed and accuracy	Effect of caffeine	Sig.
Sattler et al. (2015)	Power and strength	Playing position and competition level	Sig.
Pereira et al. (2015)	Strength performance	Training strategy of explosive strength	Sig.
Stöggel et al. (2015)	Motor abilities and anthropometrics	Predictor motor ability	Sig.
Harmandeep et al. (2015)	Flexibility, muscular endurance, power, cardio-respiratory endurance	Six-week plyometrics on vertical jumping ability	Sig.
Čdmenlđ et al. (2016)	Flexibility, muscular endurance, power, cardio-respiratory endurance	Plyometric training on different surfaces	Sig.
Pion (2015)	Flexibility, muscular endurance, power, cardio-respiratory endurance	Selected plyometric training exercises	Sig.
Vaverka et al. (2016)	Power and strength	Arm swing on countermovement vertical jump	Sig.
Krističević, Tomislav, Madić, Dejan (2016)	Accuracy	Game-based conditioning training	Sig.
Ahmadvand et al. (2016)	Retention and transferring the progress	Mass & distributed practice	Sig.
Boichuk et al. (2018)	Coordination, speed, explosive strength, repetitive strength and flexibility	Physical development parameters and conditioning abilities	Sig.
Alishah et al. (2017)	Flexibility, muscular endurance, power, cardio-respiratory endurance	Attentional focus on the performance	Sig.

Table 2. Continued

Author, Year	Physical Condition Variable	Training Type	Sig.(p)
Faizrahmanov et al. (2017)	Endurance	Effectiveness of the performance of certain game actions	Sig.
Brazo-Sayavera et al. (2017)	Speed, power, accuracy	Acute effects of block jumps	Sig.
Trajković et al. (2017)	Speed, power, accuracy	Weighted jump warm-up on vertical jump	Sig.
Gjinovci et al. (2017)	Flexibility, muscular endurance, power, cardio-respiratory endurance	Functional movement patterns	Sig.
Challoumas & Artemiou (2018)	Coordination, speed, explosive strength, repetitive strength and flexibility	Predictors of attack	Sig.
Czaplicki et al. (2017)	Strength and power	Biomechanical assessment	Sig.
Stojanovic et al. (2018)	Body composition	Short-term preseason combined training	Sig.
Hale et al. (2019)	Power, agility and strength	8-week conditioning program	Sig.
Arte, Yanse et al. (2020)	Power, agility and strength	Plyometric exercise and arm muscle strength	Sig.
Tsoukos et al. (2019)	Anthropometric and motor performance	Variables are decisive factors	Sig.
Vivekanth, B. Vallimurugan (2020)	Flexibility, muscular endurance, power, cardio-respiratory endurance	16-week combined strength and plyometric training program	Sig.
Trajković & Bogataj (2020)	Motor competence and physical performance	Neuromuscular training	Sig.
Ramirez-Campillo et al. (2020)	Strength and power	Plyometric jump training	Sig.
Freitas-Junior et al. (2020)	Power, agility and strength	Improvement in vertical jump	Sig.
García-de-Alcaraz et al. (2020)	Power and strength	Analysis of jump load during	Sig.
Wong & Leung (2020)	Physical fitness	Physical disabilities	Sig.
Andrade et al. (2021)	Performance, flexibility, muscular endurance, power, cardio-respiratory endurance	Training load and recovery	Sig.
Gonçalves et al. (2021)	Flexibility, muscular endurance, power, cardio-respiratory endurance	Neuromuscular jumping performance	Sig.
Ahmadi et al. (2021)	Strength performance	Plyometric jump training	Sig.
Nasrulloh et al. (2021)	Power	Squat training and leg length	Sig.
Lima et al. (2021)	Agility and passing skills	Reliability of a reactive agility test	Sig.
Albaladejo-Saura et al. (2022)	Physical fitness	Maturity status on kinanthropometric and physical fitness	Sig.
Nishanbayevich (2022)	Flexibility, muscular endurance, power, cardio-respiratory endurance	Developing physical qualities	Sig.
Issa (2022)	Anaerobic capacity, functional indicators	Interval training and drinking vital water	Sig.
Cieśluk, (2022)	Basic technical elements	Repeated short-term physical exercise	Sig.
Achilleopoulos et al. (2022)	Balance and technical skills	Proprioception and balance training program	Sig.
Tesfaye & Hundito (2022)	Performance	Physical fitness training	Sig.
Mamirzhon (2023)	Physical qualities	Development of the physical qualities	Sig.
Sulaymanov Qurbanali (2023)	Physical condition	Special physical training	Sig.
Kaszuba et al. (2023)	Physical performance	Caffeinated chewing gum	Sig.
Slovák et al. (2023)	Power, agility and strength	Predicting the volleyball spike jump height	Sig.
Rebelo et al. (2023)	Performance, flexibility, muscular endurance, power, cardio-respiratory endurance	Preseason triphasic resistance training program	Sig.

after six weeks of training showed that, when compared to weight training alone, plyometric exercises improved sprint, acceleration, and deceleration, as well as jumping,

more effectively (Zghal et al., 2019). A gradual increase in plyometric exercise volume results in better results for improved muscle performance (Stojanović et al., 2017).

Strength training

Strength is the most important component and is the basis for other components of physical condition and is one of the components of physical condition that is needed in almost all sports (Gäbler et al., 2018). Therefore, improving the ability of the strength component is very important to get the attention of trainers. Strength is a component of physical condition that can be improved to the maximum extent, according to the needs of each sport that requires (Jamka et al., 2022). The strength needs of weight lifting, will be much different from those of sports games (Murlasits et al., 2017). Muscle strength can also be defined as the power or tension of muscles to perform repetitive or continuous work against resistance in a maximal effort (Jamka et al., 2021).

Endurance training

Endurance is one of the main elements in motor skills, which is the result of students' psychological capacity to support movement at a certain time (Fathir et al., 2021). Muscular endurance is the ability of muscles to maintain movement with high intensity or static exercise (Fathir et al., 2021). Endurance expresses a state that emphasizes the capacity to perform continuous work in an aerobic atmosphere. Endurance is the ability to perform activities for a long period of time without significant fatigue (Fathir et al., 2021). Endurance in terms of muscle work is the ability to work a muscle or group of muscles in a certain period of time, while from the energy system is the work ability of body organs in a certain period of time (Krzy et al., 2021).

Neuromuscular training

The majority of studies in adolescents look at neuromuscular training as a method that combines strength, balance, and agility (Eken & Bayer, 2021; López-Samanes et al., 2018). In prepubertal exercise (age 8 years) in the experimental group showed after 12 weeks considerable improvements in flexibility, balance, and countermovement of vertical jump height. The neuromuscular training program improves performance in vertical jump, one right foot jump, and one left foot jump (López-Samanes et al., 2018; Zemková & Hamar, 2018; Zeng et al., 2022). This showed that participating in a 6-week neuromuscular training program improved certain athletic performance metrics and modified movement patterns in female volleyball players during jumping tasks (Zemková & Hamar, 2018). After completing a 7-week neuromuscular training program, the experimental group showed an increase in hamstring strength, allowing them to maintain muscle performance (Concha-Cisternas et al., 2023a). Basically, a 6-week neuromuscular training program dramatically improves agility (Concha-Cisternas et al., 2023b).

Resistance training

Strong muscles are very important for volleyball players because they facilitate movements used in sports, such as running and jumping (Behm & Colado Sanchez, 2013; Faigenbaum et al., 2022). Protein in muscle cells is stimulated by resistance exercise, which increases the capacity of muscles to produce strength (Nóbreiga & Libardi, 2016).

Resistance training using a nonlinear periodization model significantly increases muscle strength and strength without compromising speed and agility (Borde et al., 2015; Mann et al., 2014). The main purpose of resistance training is to tear or cause microscopic damage to muscle cells, which the body then repairs quickly to recover and become stronger (Pallarés et al., 2021).

Circuit training

Circuit exercises should be chosen to change muscle groups, with better effort and faster recovery (Dhiman, 2022). Rest intervals between 60-90 seconds with 1-3 minutes between circuits. In line with the purpose of the stages concerned with preparation, and especially the purpose of anatomical adaptation, exercises should be chosen to develop the field of the bodies for the better as the prime mover (Sari et al., 2021). Bompa and Buzzichelli (2018) revealed that the advantages of training using Circuit are: a) improving various components of physical condition simultaneously in a relatively short time., b) each sportsman can train according to his own progress, c) each sport can correct his own progress, d) training is easy to supervise, e) saving time, because with a relatively short time it can accommodate many people practicing at once.

The circuit should not be used as a test or to make comparisons between sportsmen. Comparing sportsmen is unfair, because of the speed of performance. Instead, achievements need to be only compared to the abilities of previous sportsmen (Uchenwoke et al., 2020). The circuit can be used in the first week of anatomical adaptation. Start by testing the athlete for RM 1 to calculate the load for the main movements (J. Kim et al., 2018). Choose Circuit stations according to the needs of the sport being trained. A certain progress must be followed, depending on the level of the athlete and training background (Tsegay et al., 2021). For easier exercisers with little or no background in strength training, start with exercises using their own body weight (Tsegay et al., 2021).

Intermittent training

The capacity to repeat high-intensity exercise is very important because volleyball games are sporadic. To increase the physical demands with the actual requirements of the competition, intermittent exercise training can be carried out (García-Pinillos et al., 2017). A sportsman undergoes intermittent training for 12 weeks (2-3 sessions per week), consisting of sprints with 4-8 sets per session and a work period of 10 minutes. 30 seconds, with a recovery period of 10 to 30 seconds, shows important variation in aerobic performance (S. H. Kim et al., 2017). Therefore, because it reduces lactic acid buildup and injury hazards, intermittent training is a simple training strategy, especially for young athletes (Haller et al., 2018). The recovery phase, in which the heart rate is considered low if it lasts more than 30 seconds, is another important phase to watch out for, as the study suggests (Zemkov & Pacholek, 2023).

High-intensity interval training

According to (Chrøis et al., 2020) using HIT will increase endurance. Upregulation of aerobic and anaerobic

metabolism to energy requirements is a contributing factor in this increase. High-intensity interval training programs are used to increase cardiorespiratory capacity, according to some studies (Rabbani et al., 2019). On the other hand, the results of high-intensity interval training programs may also vary. A 12-week high-intensity interval training program can produce positive changes in muscle fitness, flexibility, and metabolic parameters in children (Taylor et al., 2021). The speed, acceleration, and agility of the experimental group improved significantly after completing an 8-week high-intensity interval training program (Fakhri et al., 2020). When paired with other forms of exercise, they also produce a wide range of maximum results (Byrd et al., 2019).

Functional training

Strength, endurance, coordination, and balance are just a few of the different measurements of muscle fitness that are thought to aid functional training (Babu et al., 2019). Functional training involves special physical exercises that build strength throughout the human body (Cheng et al., 2020). When performing exercises correctly during functional training, the mobility and stability of the athlete will increase. The likelihood of accidents occurring during the effort is reduced by this greater capability (Box et al., 2019). According to Deblauw et al. (Deblauw et al., 2021), functional training for 6 weeks with 4 sessions per week in the form of circuits improves agility test scores. The first two weeks involved three laps at each station, each lasting 20 seconds with a 90-second break in between. Weeks 3 and 4, three laps at each station, each lasting 30 seconds, with a 90-second break in between. Weeks 5 and 6, three laps at each station, each lasting 40 seconds, with a 90-second break in between.

Unilateral and Bilateral training

Unilateral and bilateral training tactics have arisen as a result of the explosive action of the modified neuromuscular system. Both of these exercises are equally effective in promoting strong growth and increased strength (Hung et al., 2019; Liao et al., 2022). These two exercises when combined can have a huge impact (Núñez et al., 2018). Training the 11-year-old volleyball player unilaterally and bilaterally and combining the two exercises, found that the results varied. 13 of the 21 performance indicators showed significantly greater changes after 6 weeks of training when unilateral and lateral training were combined, compared to 6 and 3 for unilateral and bilateral training, respectively (Eliassen et al., 2018; Jacksteit et al., 2021; Ramirez-Campillo et al., 2018). To significantly improve performance during high-intensity, short-term explosive activity, a combination of these two exercises would be more beneficial (Gonzalo-Skok et al., 2019; Sun et al., 2018).

Conclusions

After a thorough analysis, it was found that many training programs to improve the physical condition of volleyball players, including strength, aerobic and anaerobic endurance, muscle strength, speed and acceleration, flexibility, agility, explosive power, and balance.

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Conflict of interest

There are no conflicts of interest in this work, according to the researcher.

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Методи тренування фізичної активності для покращення фізичного стану волейболістів: систематичний огляд

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 12 с., 2 табл., 1 рис., 108 джерел.

Мета дослідження. Метою дослідження було визначити методики виконання фізичних вправ для покращення фізичного стану волейболістів на основі аналізу літературних джерел.

Матеріали та методи. Проведено систематичний огляд даних попередніх досліджень. Ми досліджували статті, опубліковані між 2014 і 2023 роками, в яких пояснювалися аспекти підготовки волейболістів з метою покращення показників фізичного стану. Для електронного пошуку використовувалися наукометричні бази даних Scopus, Web of Science, Google Scholar і PubMed. Ми зібрали всі статті, в яких було обговорено способи поліпшення рівня фізичної продуктивності за допомогою фізичних вправ.

Результати. Для покращення фізичного стану волейболістів у 50 публікаціях застосовувалися методики фізичних вправ, які було розподілено за категоріями залежно від показників фізичного стану, що оцінювались та корегувались. Нижче представлено деякі з таких методик, які можна застосовувати в цьому випадку: нервово-м'язові вправи, односторонні та двосторонні, балістичні, пліометричні, комбіновані вагові та пліометричні вправи, змішані тренування з оптимальним навантаженням, вправи зі швидкою зміною напрямку (ШЗН) та пліометричний комплекс, силові, комбіновані силові, ексцентричні тренування, повторний спринт, спринт з опором/без опору, тренування із опором, вправи з використанням еластичної стрічки, тренування для зміцнення м'язів кору (цілий комплекс м'язів, які відповідають за стабілізацію таза, стегон і хребта, підтримку внутрішніх органів), комбіноване тренування м'язів кору; ігри з обмеженим простором, аеробне інтервальне тренування, обмеження кровотоку, інтервальні тренування та анаеробна швидкісна витривалість.

Висновки. Після ретельного аналізу було встановлено, що низка тренувальних програм виявилася ефективною щодо покращення фізичних якостей волейболістів, зокрема показників м'язової сили, аеробної та анаеробної витривалості, швидкості та прискорення, вибухової сили, гнучкості, спритності та рівноваги.

Ключові слова: систематичний огляд, фізична активність, фізичний стан, волейбол.

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