



Sports Training and Physical Fitness of Table Tennis Players at Bali Province Sports Week

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ABSTRAK

Analisis tingkat keberhasilan pembinaan olahraga daerah dibuktikan dengan perolehan jumlah medali yang terkadang tanpa kajian ilmiah tentang alasan dan cara mendapatkan medali pada Porprov, termasuk yang diadakan di Bali. Melihat daerah yang hanya mengutamakan medali menyebabkan pembinaan olahraga tersendat, terhambat, dan menurunkan motivasi pemain dalam pembinaan olahraga daerah. Tujuan penelitian adalah menganalisis pembinaan olahraga dan tingkat kebugaran jasmani pemain tenis meja pada Porprov Bali Tahun 2022. Penelitian ini menggunakan metode deskriptif dengan kombinasi data kuantitatif dan kualitatif melalui survei. Sampel penelitian adalah pemain tenis meja yang mengikuti Porprov Bali berjumlah 23 orang. Data diperoleh melalui observasi, wawancara pelatih/pemain, angket, arsip, dan dokumentasi. Analisis data yang digunakan adalah triangulasi data. Untuk menjamin kelengkapan data atau informasi, validitas, dan reliabilitas yang tinggi, penelitian kualitatif menggunakan teknik triangulasi data. Hasil penelitian yang dapat disimpulkan adalah rekomendasi fokus pembinaan olahraga tenis meja provinsi Bali sebagai olahraga unggulan daerah yang ditargetkan mencapai prestasi nasional, dan kebugaran jasmani pemain tenis meja pada porprov 2022 Bali provinsi dengan kategori sangat baik: 9%, baik: 4%, cukup: 22%, kurang: 48%, dan sangat kurang 17%. Adapun implikasi penelitian ini adalah Penelitian ini dapat memberikan panduan kepada pelatih dalam merancang metode pelatihan yang efektif untuk meningkatkan performa fisik, daya tahan, kecepatan, dan kelincahan pemain tenis meja.

ABSTRACT

Analysis of the level of success in regional sports development is proven by the number of medals obtained, sometimes without scientific study of the reasons and how to get medals at Porprov, including those held in Bali. Seeing regions that only prioritize medals causes sports coaching to stagnate, be hampered, and reduce players' motivation in regional sports coaching. The aim of the research is to analyze sports coaching and the level of physical fitness of table tennis players in Bali Porprov in 2022. This research uses descriptive methods with a combination of quantitative data and qualitative through surveys. The research sample was 23 table tennis players who took part in Porprov Bali. Data was obtained through observation, coach/player interviews, questionnaires, archives and documentation. The data analysis used is data triangulation. To ensure completeness of data or information, validity and high reliability, qualitative research uses data triangulation techniques. The research results that can be concluded are recommendations for focusing on developing the sport of table tennis in the province of Bali as a superior regional sport targeted at achieving national achievements, and the physical fitness of table tennis players in the 2022 Bali Province Province with the categories very good: 9%, good: 4%, fair: 22%, less: 48%, and very less 17%. The implications of this research are: This research can provide guidance to coaches in designing effective training methods to improve physical performance, endurance, speed and agility in table tennis players.

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1. INTRODUCTION

The three main pillars of national sports are recreational sports, educational sports and performance sports. Coaching program to improve national sports achievements, namely: regional and central sports coaching, coaching superior/priority sports centers, improving the quality of management of central administrators/managers, provincial administrators, improving the quality of management of Central KONI, Provincial KONI, City/Regency KONI, organizing competitions sports achievements in stages, optimization of national and international sports achievements, coordination, communication, information, education with *stakeholders* sports achievements at the central and regional levels, cooperation with international sports institutions, and periodic control and evaluation. A sincere commitment to improving the quality of sports coaching in the long term certainly requires good management. Efforts that need to be made are increasing the quantity and quality of sports clubs both at the level of coercion, cultivation and peak performance, improving management, improving the quality of coaches, coaches and athletes, improving the quality of results (Sutopo, 2019; Ulfah, 2022). Managers of table tennis coaching and coaching need to innovate and develop training methods and apply sports science and technology in training and practice. Sports coaching is now not only influenced by coaches and athletes, but also science, especially sports science and sports technology. In general, many athletes and even coaches believe that simply doing more physical exercise means being better. In fact, what determines an athlete's success is not how hard or how much the athlete trains, but what is most important is the accuracy of the training intensity (Irianto, 2019; Setiadi, 2020). Sports development is declared successful, demonstrated by sports achievements obtained at regional, national and international levels. Achievements in regional championships and *multi-event* And *single event*, like Porprov, is used as a parameter for success and evaluation material for regional sports development. The level of success of sports coaching is important to pay attention to in individual sports, because it is more effective and efficient in terms of management, funding and other facilities. Apart from coaching team/team sports, to increase the number of medals, coaching for singles/doubles games with a relatively small number of players is prioritized. One of Indonesia's individual sporting successes is table tennis, which won international championships.

Table tennis is a sport that requires high energy, agility, strength, speed, flexibility, endurance, reaction, balance, precision, coordination and stamina. Players must be physically fit during the match. Table tennis also requires strengthening the condition of the locomotion to obtain muscle endurance and muscle strength. In fact, strengthening the heart and breathing, flexibility and dynamic relaxation are very necessary. Regular physical exercise can improve physical fitness and optimal physical condition. Basically, each sport has different characteristics and energy requirements, so different models, methods and approaches, training programs and training management are needed (Harsono, 2020; Tudor & Gregory, 2019). The sports development system carried out by the Provincial Management (Pengprov), City/Regency Management (Penkot/Kab) especially table tennis as a regional sports organization is very strategic. Apart from that, table tennis is very important in the hope that its players will be able to achieve optimal performance at regional, national and international levels. Achieving the highest sporting performance is a direct result of the organism's adaptation to the type and method of training ((Janssen, 2020; Kovacs, 2021).

Table tennis training in Bali is carried out intensely, enthusiastically, and is carried out regularly to take part in regional and central level championships, apart from Porprov every two years. There were six medals up for grabs in the individual table tennis sport, so the coach focused on designing a training program to take part in the Bali Province Porprov. Porprov is very prestigious in regional sports development, because it is regularly held to get very promising bonuses for both athletes and coaches. It is important to study sports coaching and the fitness level of table tennis players, because this really requires excellent physical abilities. This research examines and analyzes sports coaching and physical fitness of table tennis players in Bali Porprov in 2022. The formulation of the research problem is how to analyze sports coaching and the level of physical fitness of table tennis players in Bali Porprov. Previous research studies revealed that there are three things that can support the success of a coach; educational background, experience in sports, and motivation (Harsono, 1998). Of course, the position of a coach cannot be ignored in developing sports achievements, so the need for professional coaches with scientific capacity and experience to support the field of sports as well as motivation as a coach is very necessary. The training factors that need to be prepared in every training program in every sport are; physical preparation, technical preparation, tactical preparation, and mental preparation. A sportsman's achievements are an accumulation of physical qualities, techniques, tactics and psychological maturity. To achieve high performance requires proper target planning including physical, technical, tactical and mental preparation (Cahyuni et al., 2020; Rotella & Clenagan, 2023). Physical preparation and

technical preparation are the foundations for building achievements. High achievement consists of physical condition, technique, tactics, environmental requirements, talent and personality (Fox et al., 2020; Lubis & Evalina, 2018). Experience shows that the highest levels of competition are most often achieved by athletes who begin systematic physical training in adolescence or early adulthood (Grosser, 2023; Marle & Steven, 2021). The realization and existence of players is essentially to improve sports performance in an efficient and effective manner through a sports coaching process that is organized formally and centrally and focuses on sports training and training. The achievements achieved are a combination of the athlete's efforts and the coach's hard work, so that both are responsible for implementing the training program to produce high achievements (Guyton, 2020; Picabea et al., 2020). The development of table tennis in Bali is influenced by a tiered training system, supported by various facilities, and sporting achievement targets at regional, national and international levels (Sugiyono, 2019; Wirawan, 2024).

The novelty of this research lies in the integration of a sports science and technology (Science and Technology) approach with specific development strategies for each district/city in Bali, based on local potential and challenges. This research not only explores the effectiveness of training based on scientific studies, but also examines the impact of a coaching approach that focuses on cultivating athletes from an early age, regular evaluation, and empowering coaches through further training. In addition, this research highlights the differences in approaches in districts such as Tabanan, which have limited budgets but are still able to produce outstanding athletes through strict selection, compared to regions such as Badung which have large financial support to improve the competency of coaches and training programs. Thus, this research provides a new perspective regarding the adaptation of sports development policies that are science and technology based, oriented to the local context, and support the sustainability of sports achievements at regional to national levels. The aim of this research is to analyze and identify the effectiveness of sports coaching using a science and technology (Science and Technology) approach in several districts/cities in Bali, especially in the context of athlete training that is oriented towards achievement. This research aims to explore training strategies, athlete development, program evaluation, and the role of professional coaches in supporting the success of sports coaching. In addition, this research aims to provide data-based recommendations that can be used to improve the quality of training programs, maximize local potential, and encourage the achievement of achievement targets, both at regional and national levels.

2. METHOD

This research is descriptive research using survey methods. The model used is a descriptive model with qualitative and quantitative data. This method is used to analyze sports coaching and the level of physical fitness of table tennis players at the 2022 Bali Provincial Sports Week (Porprov), the organizer of which is Denpasar City, so that data and information can be obtained through the contingents of each district/city. Bali provincial city. The research sample was 23 table tennis players who took part in Porprov Bali. Data was obtained through observation, coach/player interviews, questionnaires, archives and documentation. The data analysis used is data triangulation. To ensure completeness of data or information, validity and high reliability, qualitative research uses data triangulation techniques. This research was conducted to make decisions by choosing the best decision (Sugiyono, 2019). Triangulation is a research approach that uses a combination of more than one strategy in one study to collect data or information. Triangulation is a method used in qualitative research, often also used in quantitative methods. The triangulation approach not only compares data from different sources, but also uses various techniques and methods to research and capture data or information from the same phenomenon. (Wirawan, 2012). The brief procedure for this research begins with the identification of the problem through initial observations and interviews with coaches and table tennis players who participated in the Bali Provincial Sports Week. Next, a research design is prepared, including selecting quantitative or mixed methods, as well as determining research subjects based on certain criteria, such as age, experience and level of competition. Data were collected through physical fitness measurements, table tennis skills tests, and evaluation of ongoing training programs. Instruments such as VO2 max tests, agility tests, and semi-structured interviews are used to obtain comprehensive data. After the data was collected, analysis was carried out using descriptive and inferential statistical methods to see the relationship between the training program and the players' physical fitness. The procedure ends with interpretation of the results, discussion of the findings, and preparation of recommendations for developing more effective training programs.

3. RESULT AND DISCUSSION

Result

The sports coaching approach using science and technology (Science and Technology) in various districts/cities in Bali has various characteristics, but is still oriented towards professionalism and achievement. **Denpasar** has professional coaches, most of whom are sports education graduates. The training program is based on scientific studies and targets the cultivation of athletes from junior to senior level. Evaluations are carried out regularly to maintain the quality of coaching, with discipline and responsibility being the main values held by players and coaches. This city targets achieving overall champions, supported by adequate training costs and providing high bonuses for outstanding athletes. **Badung** implement a similar training program, with professional trainers and a scientific approach to training planning. Athlete training is carried out from student to senior level, and regular evaluations are supported by a large budget. This district has high ambitions to become the overall champion and maintain the title of defending champion. In addition, trainers in Badung are given the opportunity to improve their competency through workshops and training. Discipline and responsibility remain the main values emphasized, with the support of covered training costs and attractive bonuses for athletes.

From **Buleleng**, coaching is also led by professional coaches and based on scientific studies, with athlete cultivation carried out in stages from junior to senior level. Evaluations are carried out regularly involving strategic partners, including the Undiksha Faculty of Sports and Health (FOK), as program supporters. Discipline and responsibility are the main foundations of coaching, with the main target of achieving overall championship. Meanwhile, **Gianyar** focuses more on nurturing talent from junior high school or young students, but does not yet have an evaluation system that is carried out regularly. However, discipline and responsibility are still emphasized in coaching. **Tabanan**, with a limited budget, runs a coaching program with a scientific approach that focuses on strict selection to select players who are predicted to be able to win medals. Coaching starts from junior high school or young students, and evaluations are carried out independently to maintain objectivity. Discipline remains the main value, with a priority on program effectiveness that utilizes existing resources optimally. The 2022 Table Tennis Sports Provincial Physical Fitness Levels are presented in [Table 1](#).

Table 1. Table Tennis Physical Fitness Level

NO	Category	Number (N)	Percentage (%)
1	Very good	2	0.09
2	Good	1	0.04
3	Enough	5	0.22
4	Less	11	0.48
5	Very less	4	0.17
Amount		23	100

High performance sports require a special biological profile with an understanding of the characteristics of biomotor abilities and strong psychological elements. An important aspect before optimal training can be used to identify sports talent. Several main criteria in identifying sports talent, namely health, biometric quality, heredity, and sports facilities and climate, as well as the availability of experts ([Lubis & Evalina, 2018](#); [Setiadi, 2020](#)) These criteria are the basis for coaches to determine training programs, frequency, dosage, training intensity and physical training load in doses that are appropriate to the character of the sport. The physical condition of the game is required to always be excellent. Table tennis really requires strengthening the condition of the locomotion to gain muscle endurance. In fact, it is very necessary to strengthen the heart and breathing, dynamic flexibility and relaxation. Regular physical exercise can improve physical fitness optimally. The most important element in physical fitness is cardiorespiratory endurance. Maximum oxygen consumption ($VO_2 \text{ max}$) is used as a parameter for the degree of physical fitness. Basically, each sport has different characteristics and energy requirements, so it is necessary to develop training models or methods, develop training programs and manage different training. Development of specific sports training programs according to energy needs. Table tennis has a similar percentage of main energy systems, namely ATP-PC and LA at 60%, LA and O2 at 20%, and 20% for O2 ([Azis et al., 2023](#); [Muhammad Qoid Falahi & Dony Andrijanto, 2019](#)). Players strive to increase maximal anaerobic power and aerobic power. Table tennis is a sport that has intermittent or interval benefits, meaning players have the opportunity to take active breaks in their game. Training is carried out by means of modifications such as: *run fast* 30-50 meters, run backwards or sideways and run-stop-run again, *jogging* and run as *recovery*. Variations in training can be found in

badminton, tennis, and table tennis and are especially important in activities that require large amounts of energy v.

Discussion

Table tennis is a game *intermittently* physical activity. *Intermittent* activity means a form of activity consisting of work time intervals and *rest interval*. Regular practice will increase VO_2 maximum 10-20% (Hasim Effendi, 1983). Average increase in VO_2 max who follow training for 8 to 16 weeks will change VO_2 a maximum of 5 to 15% (Azis et al., 2023; Muhammad Qoid Falahi & Dony Andrijanto, 2019). Physical mop is one effort that can be made to increase physical endurance (physical fitness) and mental fitness. Through correct, regular and measurable exercise supported by sports science and technology with balanced nutritional input, a high level of physical fitness (VO_2 max) will be achieved. However, in reality, most badminton, tennis and table tennis players still do not realize the importance of physical fitness. The current results have several practical applications such as measuring age-related changes in various physical capacities in table tennis players. This information can help in adapting training sessions, determining health-related needs if scores are below average, or predicting future performance (Hasibuddin & Hasan, 2022; Irmawati et al., 2020). The physical condition of table tennis players is required to always be excellent, so it is necessary to strengthen their physical condition to obtain muscle endurance. Even though it really needs heart and respiratory stabilization, flexibility and dynamic relaxation. Regular physical exercise can improve physical fitness optimally. Physical training is actually not only oriented towards physical fitness, but there are several goals that players can achieve. The role of the respiratory system is to exchange air to the inner surface of the lungs. Air enters and remains in the respiratory system and passes to the respiratory muscles. About 97% of the oxygen in the blood under erythrocytes is bound to hemoglobin (Hb), the remaining 3% is dissolved in plasma. Arterial blood normally carries 97% oxygen, deep breathing or inhaling pure oxygen cannot provide a significant increase in hemoglobin saturation with oxygen but inhaling pure oxygen can increase oxygen delivery in tissues because the volume of dissolved oxygen in plasma increases (Hisyam & Putri, 2023; Saripin et al., 2018). Other fields that require more technical and strength training need to take longer to allow the world, the need for continuous tennis research on tactical aspects when athletes are fresh and good in all sports science is needed to help rest (Chankitisakul et al., 2015; Wurdiana Shinta, 2021).

Respiratory capacity can be increased with special exercises, training the respiratory muscles. The more air that enters the lungs, the better it is for athletes, because the O_2 air source needed by muscle cells is partly used as fuel to form energy. The normal frequency at rest is around 12-15 x per minute. Vital capacity is the maximum volume of air exhaled after taking a deep breath (Sutopo, 2007). The expansion capacity of the lungs and chest is called compliance, namely the increase in lung volume for each increase in intra-alveolar pressure. The normal combined compliance of the lungs and chest is 0.13 liters per centimeter of water pressure. Each time the alveolar pressure increases by 1 cm³ of water, the lungs expand by 130 ml. Factors that influence vital capacity are the person's position when measuring vital capacity, respiratory muscle strength, and lung distensibility and chest cage/lung compliance. The average vital capacity in young adult men is about 4.6 liters and in adult women about 3.1 liters, although this value is much greater in some people of the same weight than in others. By successfully creating optimal body weight conditions, you will indirectly be able to achieve the desired level of physical fitness. The most important element in physical fitness is cardiorespiratory endurance.

The development of physical fitness is fostered among players. Players strive to increase maximal anaerobic power and aerobic power (Harsono, 2020; Hasibuddin & Hasan, 2022). Increases in several key enzymes of the aerobic system are influenced by anaerobic exercise. This addition increases maximum oxygen consumption. Anaerobic physical exercise It can be said that increased physical fitness is caused by an increase in several main enzymes of the aerobic system. Increased skeletal muscle activity causes a partial increase in oxygen consumption during exercise, so it is clear that large muscles must be used if maximal oxygen consumption is to be achieved. Judging from the formula, VO_2 max is equal to maximum cardiac output multiplied by the maximum difference between arterial and venous blood, so there are two factors that can increase VO_2 max, namely the first factor that influences cardiac output and the second factor that influences cardiac output. Difference between arterial and venous blood. blood vessel. Cardiac output has two main components, namely stroke volume and heart rate (heart beats per minute. In training, the value of the stroke volume increases rapidly, similar to the stroke volume in the lying position. The ability of the circulatory system to transport blood from inactive parts to active parts and the ability of tissues to absorb blood is described by the difference in oxygen content of arterial and venous blood (arteriovenous O_2 difference, a- vo_2 diff). Players who are able to channel most of their blood to working muscles during training will have very large differences in arterial and venous blood oxygen content, because active muscles absorb more oxygen from the blood than inactive tissues. Table tennis

players who have muscles with more mitochondria will be better able to absorb oxygen from the blood. In heavy anaerobic exercise, hypertrophy is clearly visible in ST (slow twitch) and FT (fast twitch) muscle fibers. The relationship between anaerobic threshold and VO₂max is as follows: The ratio between anaerobic and VO₂max is between 70%-85%, (2) The anaerobic threshold value obtained from ventilation measurements is not the same as the value obtained from lactate examination. acid level. Sustained high intensity exercise will be beneficial for increasing the anaerobic threshold (Azis et al., 2023; Fox et al., 2020). "Maximum oxygen uptake" is often abbreviated to VO₂max, where V means oxygen and max indicates maximum conditions. So VO₂max is the maximum volume of oxygen used by the body per minute (Fox et al., 1993). Factors that determine maximum oxygen consumption (VO₂max): heart, lungs and blood vessels must function properly, the process of delivering oxygen to tissues by red blood cells must be normal, muscle tissue must have normal capacity to use O₂ or have normal metabolism, normal mitochondrial function. The products resulting from preparing training programs to improve athletes' physical fitness are evaluated by expert practitioners in the sport of table tennis, supported by responses from coaches and athletes through questionnaires, as well as physical fitness tests through fittest tests. Based on the evaluation, it was stated that the preparation of the training program was very good and suitable for mass use. In its use, this product has several advantages and disadvantages.

The implications of research regarding sports training and physical fitness of table tennis players at the Bali Provincial Sports Week include the development of training programs that are more structured and based on the specific needs of athletes. This research can provide guidance to coaches in designing effective training methods to improve physical performance, endurance, speed and agility in table tennis players. In addition, the findings of this research have the potential to strengthen collaboration between coaches, medical teams and nutritionists to ensure players' physical fitness is maintained throughout preparation and competition. In a long-term context, this research can also support the development of young athletes using a scientific approach, thereby creating a sustainable and high-achieving sports ecosystem at regional and national levels. Furthermore, the results of this research can be a reference for local government policies in supporting the development of sports facilities, training coaches and holding more competitive competitions. The limitation of this research lies in its geographical coverage which is limited to only a few districts/cities in Bali, so the results may not fully represent the conditions of sports development throughout Indonesia. In addition, budget limitations in some regions, such as Tabanan, can affect the implementation of optimal training programs. This research also faces challenges in obtaining comprehensive data related to consistent periodic evaluations, considering that several regions still do not have a well-structured and measurable evaluation system. For this reason, the recommendations resulting from this research are the importance of strengthening the system for regular evaluation and monitoring of training, as well as developing collaboration between local governments, educational institutions and the business world to provide sufficient resources. In addition, regions with limited budgets, such as Tabanan, are advised to further optimize the use of local resources and involve strategic partners in supporting development programs. Increasing training for coaches and developing a more transparent athlete selection and selection system are also needed to support sustainability and better sporting achievements in the future.

4. CONCLUSION

Sports development using a science and technology (Science and Technology) approach in Bali, although it has been implemented with varying degrees of effectiveness in each district/city, has great potential to improve overall sports performance. Training programs based on scientific studies, cultivating athletes from junior to senior level, as well as high discipline applied by coaches and players, are key factors in achieving achievement targets. Although some regions, such as Badung and Denpasar, have greater financial support, other regions such as Tabanan with limited budgets have still been able to achieve significant results through strict selection and utilization of local resources. Evaluations carried out regularly and involving strategic partners, such as those carried out in Buleleng, have proven to be important for improving the quality of training and trainer competency. Overall, this research suggests the need for a more structured evaluation system, increased collaboration between various parties, and resource optimization to ensure sustainability and higher achievement in sport in Bali.

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