

Small Side Games: Endurance Training Model for Young Soccer Players

Pequeños juegos paralelos: modelo de entrenamiento de resistencia para jóvenes futbolistas

*Ridho Bahtra, *Aldo Naza Putra, *Hadi Peri Fajri, *Nugroho Susanto, **Wilder Geovanny Valencia Sanchez, ***Jihan Faira Zanada, ***Hendra Setyawan, ****Özgür Eken, *****Ratko Pavlovic

*Universitas Negeri Padang (Indonesia), **Universidad de Antioquia UdeA (Colombia), ***Universitas Negeri Yogyakarta (Yogyakarta), ****Inonu University (Turki), *****University of East Sarajevo (Bosnia and Herzegovin)

Abstract. Soccer is a very competitive sport with high intensity, requiring good endurance. The endurance training must be done in a structured, systematic, and continuous way and requires a varied training model that prevents players from feeling bored. This research aims to produce an endurance training model based on small-side games (SSG). The research employed a research and development (R&D) method. The sample involved 105 U-18 soccer players divided into a small group test and a large group test. The small group tests were carried out at the PSTS Tabing Club with a sample size of 25 people. Meanwhile, the large group trials were carried out at SSB Putra Wijaya, SSB Elang Nusantara, SSB Semen Padang, and Padang United with a sample of 20 people each. Data in this research were collected through observation and interviews. They were collected using a list of interview questions and a Likert-scale questionnaire. This research produced an endurance training model based on small-side games (SSG) with 15 exercise variations. The research concludes that this training model is suitable for young soccer players. The model has characteristics resembling real soccer games so that players will be motivated during training sessions.

Keywords: Model Development; Small Side Games; Young Players; Soccer.

Resumen. El fútbol es un deporte muy competitivo y de alta intensidad por lo que requiere buena resistencia. El entrenamiento de resistencia debe realizarse de forma estructurada, sistemática y continua y requiere un modelo de entrenamiento que sea variado y que no aburra a los jugadores. Esta investigación tiene como objetivo producir un modelo de entrenamiento de resistencia basado en juegos de lado reducido (SSG). El método de investigación utilizado es la investigación y desarrollo (I+D). La muestra de este estudio fue de 105 jugadores de fútbol sub-18 divididos en dos grupos: una prueba en grupo pequeño y una prueba en grupo grande. Se llevaron a cabo pruebas en grupos pequeños en el club PSTS Tabing con un tamaño de muestra de 25 personas, y se llevaron a cabo pruebas en grupos grandes en SSB Putra Wijaya, SSB Elang Nusantara, SSB Semen Padang y Padang United, cada uno con una muestra de 20 personas. Las técnicas de recolección de datos en esta investigación fueron a través de la observación y la entrevista. Los instrumentos utilizados para la recolección de datos fueron un listado de preguntas y un cuestionario mediante escala Likert. Esta investigación produjo un modelo de entrenamiento de resistencia basado en juegos de lado pequeño (SSG) con 15 variaciones de ejercicio, y se puede concluir que este modelo de entrenamiento es adecuado para su uso. Este modelo de entrenamiento es muy adecuado para jóvenes futbolistas, con características que se asemejan a los partidos de fútbol reales para que los jugadores estén motivados durante los entrenamientos.

Palabras clave: Desarrollo de modelos; pequeños juegos secundarios; jugadores jóvenes; fútbol.

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Ridho Bahtra

ridhobahtra@fik.unp.ac.id

Introduction

Soccer is a very complex sport that requires all components of performance. To achieve success, soccer players must be good at technical, physical, tactical, and mental skills (Longo et al., 2019; Martínez-Cabrera et al., 2020; Metaxas, 2021) because this sport requires technical, tactical, physiological, and psychological skills during the game (Michailidis et al., 2022; Michail et al., 2021; Sarmiento et al., 2018). Apart from that, there are many actions carried out by players during the match, both actions with the ball and actions without the ball. Soccer is an intermittent sport and one of the factors needed is physical fitness. Players need to develop and improve aerobic and anaerobic endurance (Michaildis et al., 2024). The many actions carried out by players make their mobility and distance traveled during the game even greater. Soccer players cover quite long distances. Player movements in a match can cover a distance of 8-12 km. Other scholars argue that the distance soccer players cover ranges from 10 to 12 km (Bahtra, Tohidin, et al., 2023; Budijanto & Kurniawan, 2020; Domčeková et

al., 2023; FIFA, 2015; Papadopoulos et al., 2022; Vasileios et al., 2018). Michailidis (2022) even claims that the players cover a distance of 10 to 14 km with an average peak heart rate and VO₂ max above 80%. In addition, players make 300 acceleration and deceleration attempts. This figure is more than 18% (Owen et al., 2020). At higher levels, players often run about 2.5 to 3.5 km. The anaerobic thresholds average was 1.5 to 2.5 km and 0.6 to 1.2 km (Afyon et al., 2015). For these reasons, one factor needed to travel long distances and perform well at the same time in this sport is physical fitness or endurance.

Endurance is the body's ability to withstand fatigue during long-term activities accompanied by rapid recovery (Bahtra, Putra, et al., 2023; Bompa & Haff, 2009; Festiawan et al., 2020; Hyballa et al., 2016; Sidik et al., 2019). Endurance is very important in improving the aerobic and anaerobic systems in the body (Rodríguez et al., 2019; Saputra et al., 2024). If players dream of being a professional players, they need to develop and improve aerobic and anaerobic endurance as early as possible (Michaildis et al., 2024). One indicator to determine an

athlete's endurance is VO₂ max capacity. VO₂ max is the body's ability to maximize oxygen use during maximal effort (Metaxas, 2021; Potosí-Moya et al., 2024). It is the best indicator of aerobic endurance, which is used as a parameter of physical fitness (Sepriani et al., 2024; Syamsudin et al., 2023). Maximum oxygen uptake rate (VO₂ max) is one of the most physiologically used parameters in sports (Riboli et al., 2022). In soccer, VO₂ max is closely related to a player's ability to run at high intensity during a match (Bradley et al., 2013).

Plenty of research has investigated the VO₂ max needed for a soccer player. Scholars believe that international soccer teams' VO₂ max capacity is between 55 – 68 ml/kg/minute (Bahtra et al., 2020; Hoff, 2007; Miloš Stojković et al., 2017). Others claim that the minimum VO₂ max requirement for soccer players is 50 – 64 ml/kg/min (Coppola & Raiola, 2019; Slimani et al., 2019; Sidik et al., 2019). In general, professional soccer players use oxygen intake at a maximum working speed corresponding to a VO₂ max of between 55 and 65 ml/kg/minute (Modric et al., 2021). Similarly, (Marcos et al., 2017) reported that VO₂Max values vary widely, between 50 to 75 ml/kg/min.

Because soccer matches require high endurance and VO₂ max, the players need continuous, systematic, and targeted training. Coaches must carefully consider the choice of training method since it might affect the player's ability and motivation in training. One form of exercise that is often used by coaches in training sessions is Small Side Games (SSG) (Rabano-Muñoz et al., 2023; Mauro et al., 2023). It is a popular exercise that has been widely used by professional and amateur soccer teams (de Dios-Álvarez et al., 2023). Increasing endurance, agility, and strength as well as developing technical and tactical skills can be done simultaneously with SSG training (Francesco Sgrò et al., 2018; Seeger, 2015). To increase endurance and develop technical and tactical skills at the same time, you can do training with the ball such as SSG (Evangelos et al., 2012; Sergey et al., 2017).

From several theories described above, the author created a new training model based on small-sided games. An effective form of training is training that resembles a real match, one of which is a small-sided game (Pamungkas et al., 2024). SSG is an exercise with a structure similar to the real game, with smaller areas, modified rules, and fewer players (Gómez-Carmona et al., 2018). SSG training performed over several weeks can improve technical skills, tactical understanding, speed, strength, and endurance performance (Claus et al., 2017). One form of exercise that is often used by coaches in training sessions is small-side games (Rabano-Muñoz et al., 2023; Mauro et al., 2023). SSG is an exercise played on a smaller field, with a small number of players and adapted rules (Owen et al., 2020; Zanetti et al., 2022). SSG encourages an integrated approach to soccer training as it benefits movement specificity and participation in decision-making (Hammami et al., 2018; Sujana et al., 2023).

Small-side game training is soccer training that has many advantages. In SSG, coaches can manipulate player characteristics to improve their performance. Small-side games (SSG) are a popular exercise that has been widely used by professional and amateur soccer teams (de Dios-Álvarez et al., 2023). SSG is known to improve the performance of team sports athletes in their technical, tactical, or physical abilities (Clemente et al., 2016). SSG which emphasize ball control (MAI) can increase the physical condition of young soccer players compared to other SSG formats. These conditioning games can be used to increase endurance specifically in soccer players (Trombiero et al., 2023). Apart from improving the physical condition of players, SSG also helps train players' tactical understanding and decision-making when playing (Borges et al., 2022)

In developing this training model, researchers modified the training according to the principles and training load for the physical conditions of soccer. Based on all this, this study's purpose is to develop an endurance training model based on small-side games for soccer players U-18.

Materials and Methods

This research employed the research and development (R&D) approach. It specifically developed an endurance training model based on small-side games. The research referred to the theory of (Borg & Gall, 1983) involving 10 general steps, namely: 1) Research and collecting information, 2) Planning, 3) Developing an initial form of the product, 4) Performing a preliminary field test, 5) Conducting main product revisions, 6) Performing a main field test, 7) Revising the operational product, 8) Testing operational field, 9) Revising the final product revision, and 10) Disseminating and implementing the products.

Participant

The subjects were 105 soccer players divided into small and large groups. Small group trials consisted of 25 players from the PSTS Tabing Club. Meanwhile, the large group trials were carried out at SSB Putra Wijaya, SSB Elang Nusantara, SSB Semen Padang, and Padang United, with a sample size of 20 people each. The characteristics of the sample were soccer players U-18 who had quite good technical skills.

Data Collection Techniques and Instruments

Data in this study were collected using observation, interview, and survey techniques. The observation was conducted at the training location, while the interviews were conducted with the players and coaches. The instruments used in this study were a list of questions and questionnaires. The question list was used as a guide during the interview, while the questionnaire was used to obtain data about the feasibility of the designed model. The questionnaire consisted of 6 indicators and 60 statements. This questionnaire was validated by 3 experts, namely soccer experts, coaching experts, and linguists, and thus considered suitable for use. The questionnaire was developed based on the four-point

Likert scale (Sugiyono, 2010). The rating scale and categories in the prepared questionnaire can be seen in the Table 1 below.

Table 1.
Likert Scale

Scale	Category
1	Disagree
2	Mildly Disagree
3	Agree
4	Strongly Agree

Data Analysis Techniques

After collecting the data, they were analyzed using a descriptive statistical analysis. Data analysis includes all activities to clarify, analyze, use, and draw conclusions from all the data that have been collected. Since the study generated quantitative and qualitative data, the analysis was also conducted by these two approaches. Qualitative data were obtained through field observations and interviews with the research subjects. On the other hand, quantitative data were obtained from questionnaires that had been distributed and filled in by the research subjects. The results of data calculations were classified into four feasibility categories after being converted to percentages using the following scale (Arikunto, 2010).

Table 3.
Input from the Validator

Validator	Input
Validator 1	Attention to and understanding of endurance training methods
	Training loading (intensity, volume, sets, and duration) must be appropriate to endurance training
	The form of training that has been created should not make the players bored during the training process
	Several forms of exercise that are similar should be chosen only one (simplified)
Validator 2	Attention to the organization of the exercise
	Attention to training load to increase endurance
	Coaching points for training need to be added and explained further so that the training objectives can be achieved
	It is necessary to consider variations in training that are appropriate to achieve VO2max training goals.
Validator 3	The language used must be easy to understand
	Anticipate training equipment that can cause delays in the planned time so that training goals are not achieved.
	The exercises are made to suit the player's playing ability
	The duration of each exercise must be appropriate to the exercise to increase VO2Max
	Attention to the training area created, and whether the form of exercise created is sufficient
	Attention to the organization of the exercises that have been prepared

The next step after validation by experts is small group trials. The sample in the small group trial was the PSTS Tabin club players, totaling 25 people. The results of small group trials show that of the 6 aspects, all of them are in a good category with the following scores: 1) the aspect of training objectives with a score of 84.5%, 2) training methods and variables with a score of 87.3%, 3) material (a form of exercise) score 85.2%, 4) facilities and infrastructure score 84.7%, 5) language score 88.4%, and 6) attractiveness score 83.9%. From the results of this trial, an average score of 85.88% was obtained and was in the good category.

The next step taken was a large group trial. The sample in the large group trial is SSB Putra Wijaya, SSB Elang

Table 2.

Score of Percentage	Category of Feasibility
<40%	Not feasible
40% - 55%	Less feasible
56% - 75%	Fairly feasible
76% - 100%	Feasible

Result

As mentioned previously, the ultimate purpose of this research was to produce a training model that can be used by soccer players. It developed an endurance training model based on small-side games. This research has undergone several stages to produce the final model. The training model prepared in the initial stage consisted of 20 exercise variations. To ensure the validity of these variations, the model was validated by 3 experts, namely 2 soccer experts and 1 coaching expert. These experts are experienced people with professional licenses. They validated the model based on several aspects, such as training objectives, methods and variables, forms, loads, languages, facilities, and infrastructure. As a result, they decided to discard 5 forms (variations) of training, leaving 15 to proceed to the next stage. Validation results from experts can be seen in Table 3 below.

Nusantara, SSB Semen Padang, and Padang United, each club took a sample of 20 people. The results of small group trials show that of the 6 aspects, all of them are in a good category with the following scores: 1) the aspect of training objectives with a score of 86.5%, 2) training methods and variables with a score of 91.4%, 3) material (form of exercise) score 88.8%, 4) facilities and infrastructure score 88.2%, 5) language score 90.2%, and 6) attractiveness score 87%. From the results of this trial, an average score of 88.68% was obtained and was in the good category. Based on the results of small-group and large-group trials, it can be concluded that this training model is suitable for use. A complete summary of the results of small-group

trials and large-group trials can be seen in Table 4 and Figure 1 below

Table 4.

Result in Small and Large Trial Group

Aspect	Small group trials	Large group trials	Category
Objective	84,50%	86,50%	Good/Feasible
Method and Variable	87,30%	91,40%	Good/Feasible
Form of Exercise	85,20%	88,80%	Good/Feasible
Facilities	84,70%	88,20%	Good/Feasible
Language	88,40%	90,20%	Good/Feasible
Attractiveness	83,90%	87%	Good/Feasible

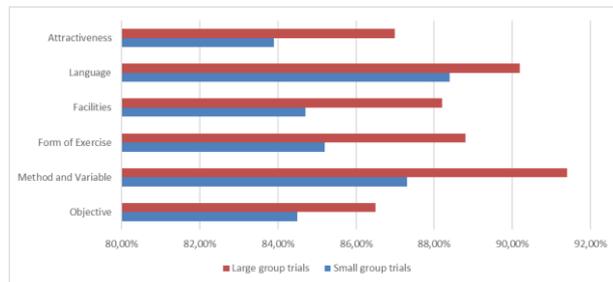


Figure 1. The Result Small and Large Trial Group

Discussion

The research results revealed that the endurance training model based on small-side games is suitable for use. This result is by several literatures which reveal that SSG training can improve endurance abilities. SSG training can increase the aerobic endurance of U-17 soccer players (Bahtra, Tohidin, et al., 2023; Arianto & Setyawan, 2019). The advantage of SSG is that it increases soccer-specific endurance and develops technical and tactical abilities in specific game conditions (Halouani et al., 2014). Small-side games can improve heart rate response and are effective in improving a player's endurance (Sannicandro & Cofano, 2023). There is a significant influence of small-sided game training on the aerobic capacity of young Satria soccer players (Wahyudianto et al., 2020). When coaching soccer athletes, it is necessary to consider choosing the right Small Sided Game training method and paying attention to the player's VO2 max (Yudi et al., 2024). The use of SSG in training sessions allows coaches to replicate, through task constraints, unpredictable and varied game scenarios, similar to those found in competitive matches (Moniz et al., 2021)

An increase in the endurance of soccer players will be achieved if they train intensively. Improving aerobic performance requires optimal and efficient training through effective training sessions and applying the correct methodology (Rivera et al., 2021). Intensive endurance exercise, especially aerobic exercise, will increase oxygen consumption (Mackała et al., 2020). Providing energy in the body when exercising is very dependent on aerobic capacity. During a match, around 90% of the total energy supply comes from the aerobic energy system, so it is very important to maintain and improve a player's abilities in this area (Hoppe et

al., 2013). Good endurance will help soccer players to be able to withstand fatigue for a long time (Yuniana et al., 2024).

Soccer players need good endurance and VO2 max, so coaches must be able to improve them. One way that can be done is to design an exercise model that can increase endurance. Soccer training should be done with a ball because it suits the character of soccer itself. In physical condition training, you can do training with the ball such as SSG, technical drills, or exercises according to the player's playing position (Seeger, 2015; Strudwick, 2016). Players who have good endurance will increase their performance in matches. players will cover greater distances, greater number of sprints, and have a greater number of engagements with the ball (Curry, 2019; RUSSELL et al., 2016). In a soccer match, players will cover long distances if they have a high VO2 max (Papadopoulos et al., 2023).

In a competition, increasing the VO2 max by 11% will increase the distance traveled by 20%, playing time will be 23% longer, and the number of sprints will increase significantly (100%) (Ahsan & Ali, 2021). Apart from that, small side games or endurance training with a ball has advantages, including: 1) apart from improving endurance it also improves technical skills, 2) eliminates players' boredom, 3) helps coaches more easily organize and control training, and 4) increase player motivation during training (Alexander & Mier, 2011). The physiological response to effort in young athletes, namely the increase in the maximum oxygen uptake (VO2max), is influenced by several factors such as genetic endowment, developmental rate, body composition, age, or gender (Mercê et al., 2022)

Training models in soccer continue to develop, one of which is endurance training carried out with a ball. There are many advantages if physical conditioning training is done with a ball. Therefore, coaches have to improvise in providing physical training, such as endurance training using balls. However, not only these exercises but coaches can also modify new training models so that more training models will be available. This will increase the reference for coaches in providing endurance training to players, especially young players.

Conclusion

Based on the results and discussion above, it can be concluded that the endurance training model based on small-side games (SSG) is suitable for training to improve the endurance abilities of football players, especially young players (U-18). Young players have emotional characteristics that are still unstable and get bored easily. Thus, in endurance training, which can sometimes be very boring, it is necessary to provide training models that are more varied and attractive so that motivation in carrying out the training process can be maintained. This research suggests that Small Side Games (SSG) based endurance training is a form of training that can be used to cover the weaknesses of young players in the endurance training process.

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Datos de los autores:

Ridho Bahtra	ridhobahtra@fik.unp.ac.id	Autor/a
Aldo Naza Putra	Aldoquino87@fik.unp.ac.id	Autor/a
Hadi Peri Fajri	hadiperyfajri@fik.unp.ac.id	Autor/a
Nugroho Susanto	nugrohosusanto@fik.unp.ac.id	Autor/a
Wilder Geovanny Valencia Sanchez	wilder.valencia@udea.edu.co	Autor/a
Jihan Faira Zanada	jihanfaira.2022@student.uny.ac.id	Autor/a
Hendra Setiawan	hendra7777setyawan@uny.ac.id	Author/a
Özgür Eken	ozgureken86@gmail.com	Author/a
Ratko Pavlovic	pavlovicratko@yahoo.com	Author/a