

Model for Explaining Factors Influencing Achievement of Female Aquatic Athletes in West Java: A Path Analysis

Boyke Mulyana^{1,*}, Syifa F. Syihab², Novrizal Achmad Novan¹, Asti Dewi Rahayu Fitrianiingsih²

¹Sport Coaching Department, Faculty of Sport and Health Education, Universitas Pendidikan Indonesia, Indonesia

²Nutrition Study Program, Faculty of Sport and Health Education, Universitas Pendidikan Indonesia, Indonesia

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Abstract This study aims to identify the key factors contributing to the athletic success of West Java's aquatic athletes. A sample of 104 athletes aged 12 and above, who were members of various aquatic clubs in West Java, participated in the study. Utilizing path analysis technique, a survey of causal relationships was conducted to examine the direct and indirect effects of research variables. Through an online survey, female swimmers from West Java responded to the questionnaire. Path analysis was used to obtain a model fit to the survey data with a statistical significance of $P < 0.05$. The initial hypothesis stated that the involvement of parents, the coach's role, the availability of infrastructure, the athletes' dietary habits, and their motivation affect the athlete's performance. The majority of athletes were still in junior and senior high school, where they were in the stage of development known as "train to train." With a coefficient value of 0.35 and a significance level of 0.001, the path analysis revealed that, among all the variables, the availability of infrastructure had the greatest effect on the performance of female aquatic athletes. Moreover, the path analysis model produced an adequate representation of the data with a CFI value of 1.000.

Keywords Female Athletes, Achievement, Path Analysis, Aquatic, Swimming

1. Introduction

Among swimmers, those with more physical ability would place a higher value on health and fitness, enjoyable friendships, competitive skills, affiliation, and status [1]. As an athlete's abilities improve, the attractiveness of the sport, the balance of mental and emotional components in the athlete's life, and sports-related elements will motivate an athlete to excel in a high-performance competitive sports environment [2]. However, different people participate in sports for different reasons, but it is believed that motivation is the most essential factor that affects a person's performance potential. [3]. Over the past few decades, Nicholls' 1984 theory of achievement goals has significantly influenced the study of sports by shedding light on how the motivational climate created by coaches can influence athletes' emotional, cognitive, and behavioral outcomes [4].

An athlete's objective tendencies determine how they see their sporting environment. Many researchers have studied the motivations of athletes from diverse areas since objective trends are the basis for understanding motivation, achievement, and why athletes act differently in different contexts [5-7]. While motivation is commonly misunderstood in sports, arousal from competitive pressure is also often interpreted as motivation. Low and high arousal are not the same and do not indicate motivation [8]. Thus, athletes must maintain their organic and social

existence; therefore, many other factors related to performance can be mentioned besides motivation. On the other hand, many sports administrators, coaches, parents, and athletes feel that if the components of athlete training, such as persistence, international publicity, and financial capital, remain constant, all competitions will have the same chance of success [9]. In addition, the variables that determine an athlete's success include intrinsic skill, personal drive, and external influences such as family, coaches, facilities, and a scheduled competition calendar [10]. Therefore, this study aims to determine the effect of parental support, coaches, dietary habits, and perception of facilities on the performance of female aquatic sports athletes.

2. Methods

2.1. Study Design

This study is a survey of causal relationships using path analysis to examine the direct and indirect effects of each variable using a cross-sectional methodology. The Medical and Health Research Ethics Committee (MHREC) of the Faculty of Medicine, Public Health, and Nursing at Gadjah Mada University, Special Region of Yogyakarta, Indonesia, has granted research ethics approval with approval number KE/FK/0962/EC/2022.

2.2. Participants

The research population consisted of female aquatic athletes from West Java who were at least 12 years old, participated in this activity voluntarily, and could communicate effectively. The respondents over the age of 18 signed informed consent, while parents or coaches signed for the respondents under the age of 18. From 28 May to 30 September 2022, 104 aquatic athletes in West Java Province participated in a quasi-sampling data collection effort. Data were collected on synchronized swimmers, divers, and water polo players, among other aquatic athletes.

2.3. Instrument

This study employed six variables: two endogenous variables including motivation and achievement, and four exogenous variables namely the parents' role, the coach's role, infrastructure, and dietary habits. The instrument's validity and reliability were evaluated using a Google Form survey with 30 participants. There was a total of 85 valid questions with a high level of reliability among the results (Cronbach's alpha: 0.758).

Following is a description of the question items and the measurement technique for each variable.

1. Athletes' achievements were evaluated based on their greatest accomplishment over the past five years, with the following categories: a) International level: gold medal = 10 points, silver medal = 9 points, and bronze medal = 8 points; b) National level: gold medal = 7 points, silver medal = 6 points, and bronze medal = 5 points; c) Regional level: gold medal = 4 points, silver medal = 3 points, and bronze medal = 2 points; and d) Athletes who had never won anything = 1 point.
2. Twenty questions regarding health, career, receiving praise from teachers and peers, and having fun comprised the athlete's motivation survey. In addition, a questionnaire [11] and a few additional questions about athlete motivation related to economic factors were used. The measurement employed a Likert scale (1-4) with categories of strongly disagree, disagree, agree, and strongly agree.
3. The parent's role consisted of 17 questions using a questionnaire compiled by [12], which included parental support and participation, and rewards from parents for achievements. The measurement used a Likert scale (1-4) with categories of strongly disagree, disagree, agree, and strongly agree.
4. The coach's role consisted of 10 questions using a research questionnaire [13] which included preferences for coaches, coach discipline, training systems, training evaluation systems, and communication with coaches. The measurement used a Likert scale (1-4) with categories of strongly disagree, disagree, agree, and strongly agree.
5. The infrastructure consisted of 10 questionnaire questions regarding the infrastructure of the training ground made by the researcher, which contained the completeness of the equipment, standardization of the equipment, cleanliness of the training ground, security of the training ground, service of the officers, and management of the swimming pool. The measurement used a Likert scale (1-4) with categories of very unfulfilling, not fulfilling, fulfilling, and very fulfilling.
6. Dietary Habit consisted of 27 questions using the Adult Eating Behavior Questionnaire (AEBQ) which included psychological conditions when eating, eating patterns, and meal times [14]. The measurement used a Likert scale (1-4) with categories of strongly disagree, disagree, agree, and strongly agree.

2.4. Statistical Analysis

All statistical analyses were conducted using version 17

of STATA. The transformation of ordinal to interval data using the Method of Successive Intervals (MSI) marked the beginning of data processing. In addition, the linearity and multicollinearity assumptions were tested. To determine the relationship between two variables, a linearity test was performed; the data were considered linear if their P value is less than 0.05. In addition, a test for multicollinearity was performed to determine the correlation between variables. In the analysis, a VIF value of less than 5 indicated that there was no multicollinearity between variables [15].

To test the hypotheses of the previously proposed model, a path analysis was conducted. Maximum likelihood estimation was used to test the significance and fit statistics of the path model coefficients with a 95% confidence interval. In addition, calculations were performed to determine the direct, indirect, and total effect of exogenous variables on endogenous variables. The obtained model was subsequently evaluated by comparing the suitability criteria with the results of calculations utilizing the Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Standardized Root Mean Square Residual (SRMR) [16]. The RMSEA quantifies the deviation of a model's parameter values from the covariance matrix of the population. If the value of RMSEA is less than 0.05, the model is a close fit, whereas a value between 0.05 and 0.08 indicates a good fit. CFI is an additional index used for small samples; it compares the model's fit to the null model if there are no correlated variables. If the CFI value is 0.90, it indicates an acceptable model fit, while a value greater than 0.95 indicates a good model fit [17]. SRMR is the square root of the difference between the residuals of the sample covariance matrix and the hypothesized covariance model. The SRMR range values range from 0 to 1, and the fitted model has a value of less than 0.05 [18].

3. Results

3.1. Age Category and Education

The data utilized were primary data obtained through the completion of a questionnaire that included personal questions but excluded others. 104 aquatic athletes from various aquatic clubs in West Java Province, Indonesia participated in the study. Table 1 reveals that 60.6% of female aquatic athletes in West Java were aged 11 to 15 years old. Some of them reached the train-to-train stage based on the stages of development in long-term athlete development. Currently, the majority of athletes were still enrolled in school, with 43.2% having completed elementary school, 35.6% having completed secondary school, and 21.2% having completed high school.

Table 1. Respondent Characteristic

Characteristic	Frequency (n=104)	Percentage
Age		
Training to Train (11-15 y.o)	63	60.6%
Training to Compete (15-21 y.o)	25	24.0%
Training to Win (>18 y.o)	16	15.4%
Education		
Elementary School	45	43.2%
Secondary School	37	35.6%
High School	22	21.2%

3.2. Path Analysis

In addition, the direct and indirect effects of exogenous variables on endogenous variables were calculated. The standardized path coefficient was used to describe the magnitude of the independent variable's (exogenous) influence on other variables that were treated as dependent or endogenous.

Table 2. Path Analysis Results of Factors Influencing Achievement and Motivation of Female Aquatic Athletes in West Java Province

Association of variables	Unstandardized (b)	Standardized (β)	p
Direct effect			
Achievement \leftarrow Motivation	0.18	0.25	0.007
Achievement \leftarrow Parents' role	0.14	0.20	0.012
Achievement \leftarrow Coach's role	0.10	0.27	0.002
Achievement \leftarrow Infrastructure	0.27	0.35	0.001
Achievement \leftarrow Dietary habits	0.30	0.30	0.001
Indirect Effect			
Motivation \leftarrow Parents' role	0.23	0.23	0.048
Motivation \leftarrow Coach's role	0.19	0.19	0.010
Motivation \leftarrow Infrastructure	0.22	0.22	0.009
Motivation \leftarrow Dietary habits	0.25	0.25	0.002

3.3. Direct Effect toward Athlete’s Achievement of Standardized Coefficient

Table 2 displays the value of the standardized path coefficient (β) between the variables and the athletic performance of female athletes. The motivation of athletes had a positive value of 0.25 and a significance level of 0.007. These results indicated that a one-point increase in motivation would result in a 0.25-point increase in achievement. The parental role variable had a coefficient of 0.20 and a significance level of $p = 0.012$, indicating that an increase in parental role would increase the achievement score by 0.20. With a p-value of 0.002, the coach's participation could increase the achievement score by 0.27 points. Infrastructure had the highest direct influence coefficient, 0.35, and the lowest p-value, 0.001. The value of the dietary habits coefficient was slightly less than the value of the infrastructure coefficient, 0.30 with a p-value of 0.01. Infrastructure was the most influential variable in enhancing the performance of the female aquatic athletes, according to the results of calculating the value of the standardized path coefficient (β) for all variables studied. In other words, every increase of one point in infrastructure satisfaction would increase 0.35 achievement points for the female aquatic athletes.

3.4. Indirect Effect toward Athlete’s Motivation of Standardized Coefficient

Table 2 reveals that the standardized path coefficient (β) between the role of parents and the motivation to become a professional aquatic athlete with the highest achievement in the previous five years had a positive value of 0.23 and a p-value of 0.048. These findings indicate that an increase in the score for parental role by 1 point would increase motivation by 0.23 points. The role of the coach had a positive value of 0.19 and a p-value of 0.010; therefore, for every 1 (one) increase in the trainer's role score, the motivation score would increase by 0.19. The infrastructure variable had a positive 0.22 path coefficient with a significance level of 0.009, which had the effect of increasing the motivation score by 0.22. The dietary habits variable had a positive value of 0.25 with a value of $p = 0.002$; therefore, if the score of dietary habits increases by 1 point, the motivation score will increase by 0.25. This shows that dietary habits had the greatest indirect effect on motivation compared to all other variables that affect motivation. Figure 1 depicts the model of path analysis results from exogenous variables to endogenous variables.

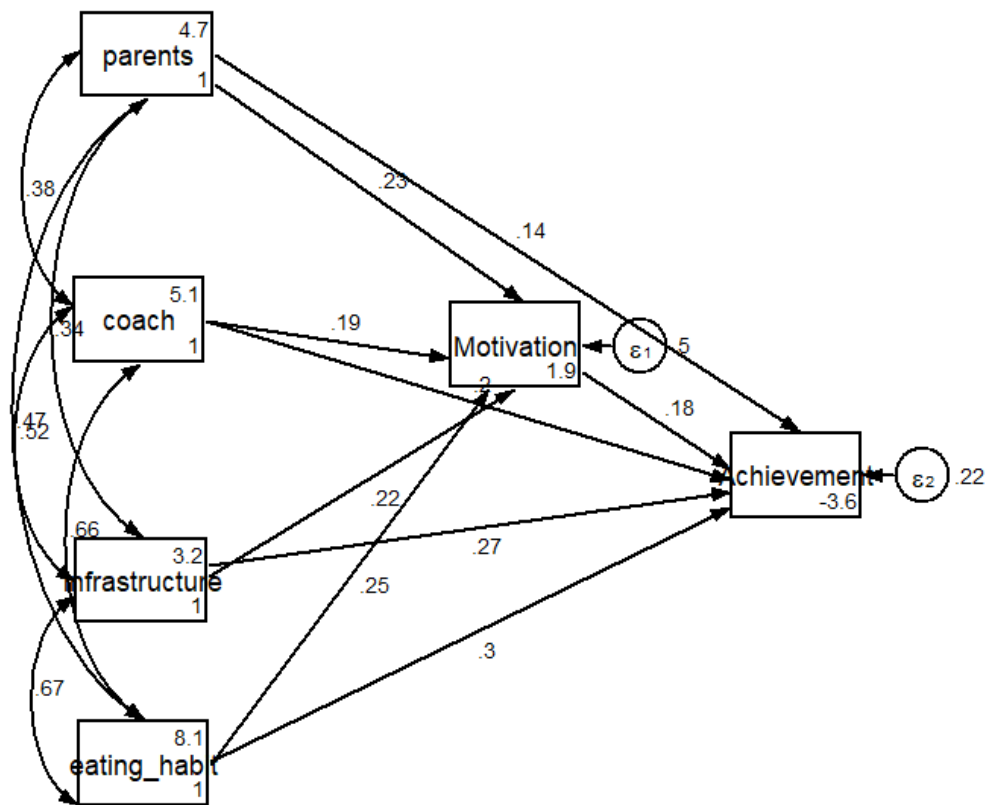


Figure 1. Path analysis examining factors related to motivation and achievement of aquatic athletes in West Java.

The resulting model was then evaluated based on the conformity index of multiple indicators, including RMSEA, CFI, and SRMR, relative to the acceptance level of each indicator. Table 3 presents the results of the calculation of the suitability of the path analysis model used in this study. Based on the results of model testing, the RMSEA value was 0.001, the CFI value was greater than 0.90, and the SRMR value was less than 0.05; therefore, it can be concluded that the model was statistically fit and met all of the requirements.

Table 3. Various Fit Indices of the Model

Fit Statistic	Value	Criteria	Conclusion
Population Error (RMSEA)	0.001	≤ 0.08	Fit
Baseline Comparison (CFI)	1.000	> 0.9	Fit
Size of Residuals (SRMR)	0.001	< 0.05	Fit

4. Discussion

The purpose of this study is to examine the relationship between the accomplishments of female aquatic athletes and the roles of their parents, coaches, infrastructure, and their dietary habits via the role of motivation as a mediator. The findings revealed that these variables had a direct and significant impact on the performance of athletes. Consequently, a robust model with a statistically significant fit has been developed based on the data analysis, providing valuable insights into the factors impacting the success of female aquatic athletes. This model can serve as a valuable tool for identifying these factors and guiding the development of programs aimed at enhancing athletes' motivation and success.

4.1. Training Infrastructure

Expertise in sports is influenced by a variety of variables, including training-related variables such as training facilities [19]. A training facility or infrastructure is a location for physical activity that includes all training components and equipment. Access to training grounds, access within training grounds, and access to training equipment constitute adequate infrastructure [20]. The availability of infrastructure and facilities is crucial to the growth and improvement of national and international athletic accomplishments [21].

The findings revealed that infrastructure had the greatest direct influence on the achievement of female aquatic athletes in West Java Province. When data collection was carried out, the athletes were known to be practicing in facilities rented by the swimming club, where they took shelter. Swimming equipment, accessories, and clothing were items that each athlete must own

individually. Swimming accessories such as swimming fins, earplugs, swim goggles, snorkels, swim caps, and swim clothes were not provided by the club. Some of the swimming pools used adhered to international standards, while others did not. Likewise, swimming competition equipment and swimming safety equipment at the athlete's training ground were known to be incomplete. The completeness of athlete facilities and equipment is critical to the success of swimming training program implementation [22-24]. In addition, swimming pool conditions, especially sanitation, were also known to affect the health of athletes [25-27].

In Indonesia, it is a privilege for the majority of sports to have access to training facilities, which can be managed by the government or the private sector [28]. One of the factors influencing the success of swimming athletes in an exercise program is the availability of training facilities and equipment. This is consistent with the findings of [29], in which only 25% of the coaches reported that the facilities at the swimming practice they used were "good." Collaboration between stakeholders is required through organizational preparation, athlete and coach development, and the provision of diverse facilities and infrastructure to support the development of swimming in Indonesia [30].

4.2. Dietary Habits

The global participation of female athletes in various sports continues to rise. Women, athletes and non-athletes alike, frequently struggle with their dietary habits, but it is known that female athletes are at a greater risk for developing eating disorders than non-athletes [31]. The consumption of harmful drugs or additives, irregular menstrual cycles, fatigue, and lack of sleep place female athletes at risk for eating disorders [32].

The findings of this study indicated that dietary habits had a strong and concurrent effect on the performance of aquatic athletes. If an aquatic athlete lacks healthy dietary habits and nutrition knowledge, they are likely to suffer from an eating disorder. Eating disorders are a condition characterized by symptoms such as fasting, consuming very little food or dieting, vomiting food, binge eating, and the use of laxatives or diet drugs, and are prevalent among female athletes, particularly adolescents [32-34]. A study of female swimmers revealed that low energy availability (EA) is prevalent, particularly among synchronized swimmers. Swimming athletes are more susceptible to eating disorders (ED) because their sport requires a thin physique [35]. A lack of energy has numerous effects, including delayed puberty, stunted bone development, and bone deposition [36]. Not only women but also men are at risk for developing athlete triad syndrome if their energy availability is inadequate [37]. In addition, eating disorders can have a negative effect on performance, and can make athletes more susceptible to viral infections [38] and injury [39], and reduce their response to exercise [40].

4.3. Coach's Role

One of the driving forces behind an athlete who devotes his or her life to sports is motivation. Athletes' motivation can be bolstered by internal factors such as the satisfaction of pleasure and the pursuit of challenges. External factors such as money, other people's attention, and publicity are also known to increase an athlete's motivation [41,42]. Coaches are known to be able to instill in athletes an intrinsic desire to practice and improve their skills [43]. The coach can increase motivation by providing suggestions for increasing motivation, such as setting optimal challenges, creating a conducive and structured initial environment with clear guidelines, or providing mentoring and feedback throughout training [44].

The coach is a figure who plays a significant role in the present and future success of an athlete. They play a pivotal role in fostering caring, nurturing relationships among players, ensuring that athletes, particularly with young athletes, where they experience a sense of belonging, care, and respect both as players and as individuals [45,46]. The coach is an expert who contributes to the growth and development of athletes. Athletes can promote their self-development by maintaining a positive relationship with their coach. A motivated athlete is more likely to concentrate on how to improve performance and accomplishments [15]. Compared to parents and peers, coaches are recognized as having the greatest impact on the personality and mental health of athletes [47].

Athletes are known to benefit from coaches who encourage healthy dietary habits. Coaches have been identified as having a crucial role in the establishment and maintenance of dietary health among athletes [48]. Coaches are aware that even mild eating disorders can result in serious health issues and decreased performance in athletes [49]. Coaches with good nutritional knowledge and the ability to identify athletes' eating disorders are known to be able to motivate athletes to have better performances and greater accomplishments [34].

4.4. Parents' Role

Families, particularly parents, play an essential role in a child's growth and socioemotional development [50]. While the coach's role remains consistent throughout an athlete's career, it is recognized that the significance of parents evolves at each stage of the athlete's development. With increasing age and changes in the developmental phases, specifically initiation (4–12 years), specialization (11–18 years), and investment–mastery (15–30 years), the role of parents in the success of athletes diminishes [51]. These findings are consistent with the literature review [47], which stated that parents contribute qualitatively and quantitatively to supporting autonomy rather than athlete competence and participation in sports, but their effect is less than that of coaches and peers.

Although fathers and mothers motivate their children to exercise differently, both are primary providers in terms of financial and emotional supports [52]. Positive parental support is essential to the success of an athlete's career [53]. A study [54] found a correlation between parental support and children's enthusiasm and enjoyment of swimming. By this, other studies indicate that parents of dedicated athletes are typically pleased and delighted to be able to attend competitions or tournaments, and frequently accompany their children to training sessions [55,56].

In addition to providing psychological support, it is common for parents, particularly fathers, to put pressure on their child athletes to exceed their capabilities. A study revealed that paternal control had a direct correlation with adolescents' motivation, boredom, and fatigue, while the mother's influence was neutralized by the father's interpersonal style of control [57]. Due to a lack of communication and attention from parents, world-class elite athletes frequently feel misunderstood, unsupported, and under pressure when competing [58].

In adolescence and young adulthood, the role of parents shifts from providing instrumental and social support in childhood to providing financial and emotional support [51]. For athletes to receive adequate psychological support from parents, coaches, and peers, an environment that encourages their participation in sports is required. Positive psychological experience and competence should be the major components of young athletes' participation in sports, as proposed by the International Olympic Committee [59]. To prevent athlete fatigue and boredom, coaches and parents can implement educational interventions [60]. These interventions aim to create a team and family environment that fosters a higher-quality sports experience and greater well-being among athletes [61].

5. Conclusions

Young female aquatic athletes in West Java Province face a multitude of challenges as they strive for success. The results of the study suggest that various factors, including the influence of parents and coaches, dietary habits, and the availability of infrastructure, have a significant impact on shaping individuals' motivation and level of achievement. The findings also indicate that the success of aquatic athletes in West Java is most influenced by the availability and completeness of infrastructure, surpassing other variables. The inadequate provision of training and competition preparation facilities has a detrimental effect on their performance. The development of aquatic sports in Indonesia necessitates collaborative efforts among stakeholders. This can be accomplished through the implementation of organizational preparations, comprehensive athlete and coach training, and the establishment of a diverse range of facilities and

equipment.

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