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Research Article

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Empirical analysis of climate conditions influencing physical training

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ABSTRACT

This article aims at analyzing the empirical effects of different climatic conditions on the path and level of physical training of athletes. First, it builds the hypothetical model between climatic conditions and sports training through setting the observational variables of the climate and sports training and on the basis of reviewing the relevant literature. Then, it collects the relevant data from the designed questionnaire and investigation of the influence of the climate on the athletic training. Last but not least, the software, AMOS, conducts data processing and test the degree of fitting of the hypothetical model. The study found that the variation of temperature has a great influence on the physical training and mental training of athletes but little on the tactical training and technical training among the four major factors. It also provides a scientific basis for athletes to do sports training under different climate conditions.

Keywords: Climate Conditions, Physical training, Influence

INTRODUCTION

The athletic training is taken under some specific meteorological and climatic conditions, which limit and affect the way and content of athletic sports and have a significant influence on the athletic training[1-3]. Meanwhile, the climatic conditions affect emotion, behavior and health of athletes which will have a great effect on their performance of the athletic abilities. As a significant exogenous factor, different climate will have an influence on athletes' physiological or even psychological functions. The law of nature, "the fittest survives in natural evolution", tells us that we need to establish training plans suiting the measures to differing conditions of time and location according to climatic features and its variation trends, in order to help athletes work effectively in their athletic training. Otherwise, if the training could not be fit in climatic condition, there will be a negative effect on athletic training.

LITERATURE REVIEW

Many domestic and foreign scholars have made great achievements in researching the influence of climate on athletic training [4-5]. According to Wikipedia, climate refers to the statistical data in specific time and region, which includes temperature, humidity, barometric pressure, wind power, precipitation, the number of atmospheric particles and many other climatic elements. And among them, temperature, humidity, barometric pressure and wind power are the four main factors to have an influence on the athletic training. H·YiHe Berger, a scholar who do some research on the relationship between the changes of climate and athletic training earlier than others, first proposed that athletic training should be in nature, that is, athletes should take advantage of climatic conditions in training. Adams and other scholars had research on the influence of temperature on athletic training. They believed that high temperature is good for physical metabolism. Feng Mingling also got a conclusion that boxing aerobics are effective for losing weight in high temperature by researching the influence of simulated high temperature on body elements. Yang Xiao fan and other scholars, who have studied on the impact of climate on physical education, claimed that the changes of atmosphere, meteorology, temperature and regional environment and other climatic conditions will have directly influence on athletic training. Equation of time, barometric pressure, temperature, humidity, air current,

solar radiation, climate, weather and other factors will have disadvantages of athletic ability, and restrain its development, which was indicated by Li Juju and other researchers. Ji Jianmin and other scholars discovered that high temperature and humidity does not have essential impact on the training of canoe. It is clear that, domestic and foreign scholars research on the relationship between climate and athletic training [7-10].

But there are two unsolved questions: first, how does climate influence athletic training, i.e. the ways of impact; and the second is the degree of influence of climate on athletic training, i.e. the influencing coefficient. These are the main purpose of this paper.

RESEARCH DESIGN

Methods of Research

Since the main purpose of this paper is to indicate the paths and degree of influence of climate on athletic training, the method of research is Structural Equation Modeling, which is an analysis tool. This is because in this research, climate and athletic training are two variables, which cannot be directly measured. So it is impossible to study the relationship of them in a direct way. Some observable variables should be used to manifest which include temperature, humidity, barometric pressure and wind power. And athletic trainings can be represented by physical training, technical training, tactical training and psychological training. Besides, traditional statistical method is not proper for this complex relationship between these variable quantities, while Structural Equation Modeling (SEM) has advantage to solve this problem.

SEM is a very good method in social scientific research. Traditional statistic methods usually cannot solve problems existing in such fields as social science, economy, market, management and so on, which need to address the relationships between multiple causes and effects, or some variable qualities that cannot be measured directly, i.e. latent variable. But SEM can avoid the shortages of traditional statistic methods and act as a major tool of analyzing multi-data.

Definition of Variables and Research Structure

This research aims at exploring the relation between weather ξ , the external latent variable and athletic training η, the internal latent variable. If the external latent variable is measured by the following four observable variables including temperature, humidity, atmospheric pressure and wind, which can be written as X_i , $i \in (1,2,3,4)$, then the matrix of $X = \lambda_X \xi + \sigma$ can express the relation between the two latent variables. If the internal latent variable is measured by the following four observable variables including physical training, physical and psychological training, tactical and technical training, and then the matrix of $Y = \lambda_Y \eta + \varepsilon$ can express the relation between the two latent variables. The structural model $\eta = \mathrm{B}\eta + \Gamma\xi + \zeta$ can also express the relation the two latent variables, among which B 、 Γ 、 ζ represent structural coefficient matrix and residual error. Then the research structure can be shown as Figure 1.

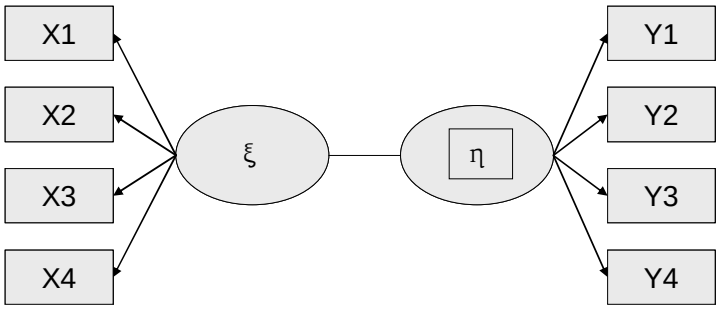

Figure 1. Research Structure

SAMPLE AND DATA PROCESS

Questionnaire and Sample

In order to acquire the research data on the relation between climate change and athletic training, this paper designs a questionnaire about how the four observable variables including temperature, humidity, atmospheric pressure and wind affect another four observable variables including physical training, skill training, strategy training and psychological training. There are 16 questions in this questionnaire, each of which uses 5 points in the Likert scale to show the degree of their influence between each variable. After the questionnaire is completed, it is tested by some of the players in a small scale to check its desirability. After it has been rectified, it is used formally for research in four municipalities and 18 provincial capitals, which started in June 2013 and ended on September 30th

2013. There are as many as 363 electronic questionnaires that have been sent and 316 are returned. After the invalid ones are excluded, there are as many as 261 valid questionnaires, which constitute to 71.9% in questionnaires.

Data Process

Parameter Estimation

Since there are 261 research samples, which is an average scale, it is improper to adopt the maximum likelihood method, which is set to default by AMOS, but the Bayesian estimation should be used to estimate parameter in the original modals, which can test the difference between the actual statistics and the assumed models and test whether the parameter estimation is remarkable. Graph one is the parameter estimation of the initial models, which includes standard error（S.E.）, critical ratio (C.R.) and remarkable value of P.

In the parameter estimation of the initial models, there are no negative errors and the path coefficients between four external latent variables and four internal latent variables are all positive, featuring the external variables has a positive effect on the internal variables, which is in line with the theoretical assumed path coefficients.

Model-fitting

The parameter estimation is standardized using AMOS7.0, and then standardized path coefficients of the initial models have been achieved (Table 1).

Table 1. Parameter Estimation of Original Model

Path	Estimate	S.E.	C.R.	P
X1→Y1	1.000			
X1→Y2	0.899	0.256	3.100	0.006
X1→Y3	0.203	0.133	1.683	0.231
X1→Y4	0.211	0.198	1.366	0.186
X2→Y1	1.000			
X2→Y2	1.231	0.304	2.332	***
X2→Y3	1.309	0.313	2.568	0.006
X2→Y4	1.000			
X3→Y1	0.687	0.432	3.109	0.008
X3→Y2	1.000	0.500	2.132	0.006
X3→Y3	0.842	0.339	1.861	***
X3→Y4	1.222	0.324	3.022	0.003
X4→Y1	1.000			
X4→Y2	1.643	0.288	2.893	0.005
X4→Y3	1.201	0.503	3.101	***
X4→Y4	0.807	0.496	4.236	***

**** P<0.001*

And the standard path coefficients of original model can be calculated by AMOS 7.0 (Figure 2).

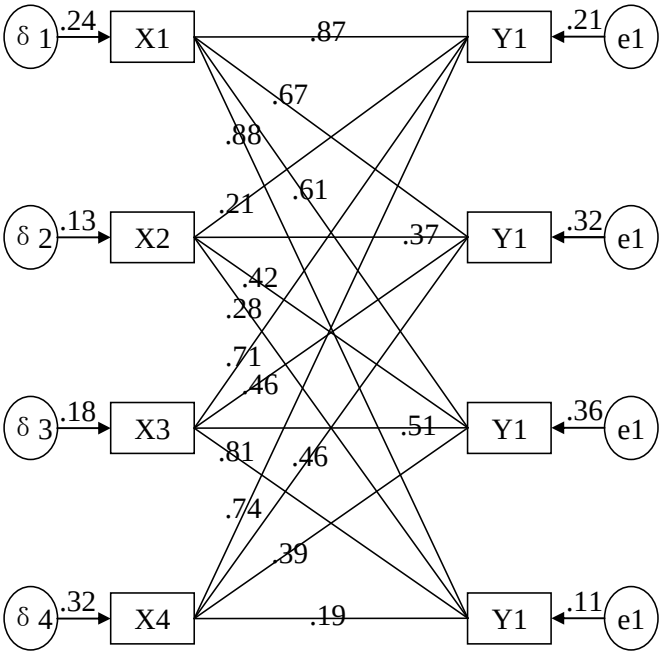

Figure 2. The Standard Path Coefficients

RESULTS AND DISCUSSION

It is found that climate condition does have an influence on the athletic training. Here are some details:
As for the four variables, temperature X_1 has the largest impact on the athletic training, whose average influencing coefficient is up to 0.72. Then pressure X_3 follows, whose average influencing coefficient is 0.62. However, another two variables including wind power X_4 and humidity have less influence on the athletic training, whose influencing coefficient is 0.44 and 0.32 respectively.

As for the four measuring variables in the athletic training, the most vulnerable to climate condition is the physical training Y_1, whose influencing coefficient can be 0.63. Then the psychological training follows, whose influencing coefficient is 0.54. However, the tactical and technical training are less vulnerable to the climate, whose influencing coefficients are 0.49 and 0.48 respectively.

The temperature X_1, the most influential climate condition, has the most serious influence on the players' physical training and psychological training, whose influencing coefficients are 0.87 and 0.88 respectively. Moreover, pressure X_3 also has a remarkable influence on players' trainings both physically and psychologically, whose influencing coefficients amounts to 0.71 and 0.81. All of these influential positive researches on how climate conditions including temperature, humidity, barometric pressure and wind power have an influence on the athletic training provide theoretical bases for players to conduct a scientific training by making a proper use of the climate condition.

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