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**MULTIPLE REGRESSION ANALYSIS FOR PHYSICAL FITNESS VARIABLES  
PREDICTING YOGASANA PERFORMANCE****Chandra Shekhar Singh<sup>1\*</sup>, Prof. Neelam K Sharma<sup>2</sup>**<sup>1</sup>Research Scholar, Department of Physical Education, Lovely Professional University,  
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Phagwara Punjab India,**Abstract**

**Background/Aim-** The rising popularity of yoga competitions reflects a desire for enhanced performance, showcasing the interplay of yoga, strength training, and mental well-being. Regular practice fosters a positive mindset. This study aimed to link yogic performance with physical fitness measures and develop a predictive regression model.

**Methodology-** 25 yoga practitioners between the ages of 10 and 15 were chosen for the study, which was conducted in the Delhi-NCR region. Yoga performance served as the dependent variable, whereas sit-ups, push-ups, balance, and flexibility served as the independent physical fitness variables for the study.

**Result-** The results of however, owed that flexibility and yoga performance had a significant positive relationship, however there was little correlation between sit-ups, push-ups, and balance and yoga performance. The regression equation developed for the study reads: Yoga Performance=31.684+1.848 (Flexibility).

**Conclusion-** The practice of yoga and meditation was found to be correlated with engagement in physical activity, as well as adherence to a vegetarian or vegan dietary regimen. Healthcare workers should be mindful of the potential susceptibility of those who practice yoga and meditation to engage in drug use. However, the numerous beneficial connections between yoga and meditation and various positive health behaviors justify its inclusion in preventive medicine and healthcare.

**Keywords:** Competitive Yoga, Physical Fitness, Predication and Multiple Regression, Flexibility

**1. Introduction**

“Getting the mastery over the skill or the activity, which we are performing in our life.”

One could argue that yoga embodies the principles of the scientific method as they are applied to the realm of physical wellness. The phenomenon in question exerts an influence on various dimensions of an individual, including their physical, mental, emotional, psychic, and spiritual realms. The term "yoga," denoting the concept of "unity" or "oneness" in the English language, originates from the Sanskrit term "yuj," which signifies the act of "linking."

Enhancing health is a primary objective of yoga. There exists a prevalent notion that the practise of yoga necessitates the execution of very advanced bodily contortions and exceptional flexibility [1]. The approach utilised for cultivating and nourishing organisms is characterised by its holistic aspect [2]. Yoga has been often referred to as a "fundamentally subjective

science" by numerous individuals. The interconnectedness of the spiritual, mental, and physical components constitutes the divisions within it [3, 30]. The primary objective of yoga is to foster the development of cognitive and perceptual self-regulation, with the attainment of emotional balance and tranquilly. The subject matter possesses comprehensive inclusivity, significant value, and broad universality in relation to its applicability and significance [4].

Previous research has demonstrated that engaging in yoga practice yields positive effects on both physical and mental well-being, alongside enhancing cognitive clarity and self-awareness [5]. Engagement in yoga can facilitate the cultivation of self-awareness, a crucial attribute for effectively confronting and surmounting various challenges [6]. During the practice of Yog asanas, individuals engage in a series of bodily movements involving twisting and turning, followed by subsequent stretching and relaxation of the muscles that were previously exerted. The physical activities or postures, known as asanas, within the practice of yoga contribute to the enhancement of overall health by promoting improved immunity circulation [29, 31], increased muscle flexibility, and heightened energy levels [7]. These benefits are achieved through the facilitation of enhanced oxygen intake and the elimination of waste. The practice of yoga's asanas has been observed to facilitate relaxation and enhance overall wellness among its practitioners [8].

The term 'Yogasana' is an acronym of two separate Sanskrit words, 'Yuj' signifying 'unite' & 'Asana' referring to 'body position.' The athletic event of Yogasana deals with the physical components of yoga and includes participants practicing yogic postures. Players are rated on the challenge associated with their positions, their coordination, their control, adaptability and their endurance. Yoga and Yogasana vary in that Yogasana lays emphasis on the body's part whereas Yoga focuses on the psychological and spiritual components of the practice. Yogasana contests have existed for millennia, but the present structure of the sport was developed in 1989 with the first World Yogasana Championship held in Pondicherry in India.

The Ministry of Youth Affairs and Sports of the Indian government has just approved the inclusion of yoga asana as a recognized competitive sport. The event took place on December 17, 2020, during a gathering that was attended by Shripad Yesso Naik, the Minister of AYUSH, and Kiren Rijiju, the Minister of Youth Affairs and Sports. Yoga tournaments in India has a significant historical background [9]. The concept posits that the inaugural yoga tournament, bearing resemblance to contemporary iterations, took place approximately two centuries ago. The introduction of yoga to Western countries can be attributed to Swami Vivekananda around the 1890s. Bureau et al. (2020) conducted a study on the promotion and visibility of yoga by traversing the continents of North America and Europe [10].

The establishment of the Yoga Federation of India occurred in 1974, and it received formal recognition from the Indian Olympic Association during the period spanning from October 1998 to February 2011. Since its establishment in 1991, yoga has been involved into a range of sports events in India. These include the all-India inter-university game, the National school games in 2000, and, starting in 2022, the Khelo India Youth Games. Additionally, yoga has been a component of the Khelo India University Games and the National Games since 2022 [11]. According to the International Yoga Sports Federation (2020), Yoga has undergone

significant development as a prominent athletic pursuit, enabling children to cultivate a wide range of skills and participate in elite-level competitions as previously indicated [12].

Multiple regression analysis is a statistical method that involves establishing a mathematical model to examine the relationship between multiple variables. This model can be either linear or nonlinear. By utilizing sample data, this analysis determines the dependent variable while considering one or more independent variables [13]. Multiple regression analysis is a statistical model that examines the linear relationship between numerous independent variables and multiple dependent variables, also referred to as many-to-multiple regression [14]. Multiple linear regression is a statistical analysis technique that examines the association among a dependent variable and two or more independent variables. It explores the notion that the occurrence of a certain phenomenon is influenced by the frequency of other related events [15]. The establishment of mathematical models that establish relationships among multiple variables can be achieved by the application of multivariate regression, which is a statistical approach. The utilization of multiple regression analysis has been extensively employed within the realm of sports (Li, Wang, Gu, & Cao, 2022) [16]. The primary aims of this study were to firstly, to ascertain correlation between yogic performance and certain measures of physical fitness, and secondly, to develop a multiple regression model for the purpose of predicting yogic performance [16].

## **2. Materials and methods**

### **2.1 Selection of subjects**

The study involved the selection of 25 yoga players aged 10 to 15 from the Delhi-NCR region.

### **2.2 Selection of variables**

In this study, sit-ups, push-ups, balance, and flexibility were selected as the independent variables to measure physical fitness, while yogic performance served as the dependent variable.

### **2.3 Administration of test**

#### **2.3.1 Push-Ups:**

Push-ups are a helpful assessment technique for the evaluation of upper body strength and endurance. To carry out this exercise, it is necessary to have a floor mat, stopwatch, and chair. The experimental protocol entails the participant adopting a conventional push-up stance, wherein the hands and toes are in contact with the floor. The body and legs are aligned in a straight manner, with the feet positioned slightly apart. Furthermore, the arms are fully extended at shoulder-width, forming a 90-degree angle at the elbows. The individual maintains proper alignment of the back and knees while performing a controlled descent of the body, aiming to either make contact with the ground or a predetermined target. Following this, they proceed to return to the starting position by fully extending their arms. The sequence persists uninterrupted until the participant reaches a state of physical fatigue or successfully completes a pre-established quantity of push-up exercises in a synchronised fashion. The scoring for this exercise is based on the total count of push-ups accomplished within a one-minute time frame. This metric serves as an indicator of the student's performance and competency in the upper body strength and endurance assessment.

#### **2.3.2 Sit-Ups:**

A good evaluation tool designed specifically to evaluate the muscular endurance of the hip-flexor and abdominal muscles is the sit-up. The necessary equipment for this activity includes

a floor mat or carpet and a stopwatch. In order to execute a sit-up, individuals are directed to assume a supine position on a carpet or mat, with their knees flexed at an approximate angle of 90 degrees and their feet resting level on the surface. The recommended position for the hands is to rest them on the upper region of the thighs. Additionally, the individual should actively activate their abdominal muscles, thereby stabilizing the lower back and initiating a controlled upward movement of the upper body. It is important to note that this movement should be executed without relying on the neck or head for momentum. Subsequently, the motion is reversed in order to revert back to the initial position. The scoring procedure for this exercise entails the accumulation of the total count of sit-ups accomplished within a duration of one minute. This process serves as a means of evaluating the student's performance and endurance in the muscle groups associated with the abdomen and hip flexors.

### **2.3.3 Flexibility:**

The main objective of this evaluation is to determine the range of motion and flexibility of the posterior chain and lower extremities. In order to conduct this assessment, a sit and reach box is utilised as the requisite apparatus. During the examination, the individual is positioned in a seated posture on the ground, with their lower limbs fully extended in an anterior direction. Participants position their feet, with shoes removed, in a manner where the soles are placed flat against the sit and reach box, ensuring that they are spaced apart at a width equivalent to the shoulders. The tester aids in the maintenance of proper alignment by ensuring that both knees remain in contact with the floor. The participant subsequently maximises their extension along the measuring line, aligning their hands vertically with palms oriented downwards. The measurement of distance achieved is conducted by maintaining the starting reach for a minimum duration of two seconds. The scoring procedure involves administering three trials to each subject, wherein their best score, measured in inches, is documented as a measure of their back and lower body flexibility.

### **2.3.4 Balance:**

The objective of this examination is to examine the individual's overall capacity for maintaining balance. In order to carry out this experiment, it is necessary to have a level and stable surface, a chronometer, as well as writing materials such as paper and a writing utensil for the purpose of documentation. The individual should initiate the process by disengaging their footwear and thereafter positioning their hands on their hips. Subsequently, the individual will proceed to place their non-supporting foot in contact with the inside region of the knee of the supporting leg. In order to engage in a practical exercise, the participant is allotted a duration of one minute to acquaint oneself with the concept of balance. Subsequently, individuals are instructed to elevate the heel, achieving equilibrium on the metatarsal region of the foot. The commencement of the stopwatch occurs simultaneously with the elevation of the heel from the ground. The cessation of the stopwatch is triggered by the occurrence of any of the subsequent events: The hands disengage from the hips, allowing for swivelling or movement of the supporting foot in either direction. The non-supporting foot ceases contact with the knee, while the heel of the supporting foot makes contact with the floor. The scoring system is determined by the cumulative time in seconds, where the most favourable score is selected from three attempts. The purpose of this evaluation is to evaluate an individual's overall body balancing capability.

## **2.4 Statistical Analysis**

A Pearson Correlation analysis was undertaken in order to investigate the association between physical fitness characteristics and Yogic performance. Furthermore, the researchers utilized a Multiple Linear Regression analysis in order to construct a prognostic model for performance. The statistical significance was determined using a significance level of  $\alpha = 0.05$ . The statistical calculations were conducted utilizing SPSS version 26. In addition, we utilized a scale to evaluate the magnitude of the correlations, categorizing them as trivial ( $<0.10$ ), small ( $0.10-0.29$ ), moderate ( $0.30-0.49$ ), large ( $0.50-0.69$ ), very large ( $0.70-0.89$ ), and virtually perfect ( $>0.9$ ) Hopkins et al., (2000) [17].

**3. Results**

Yoga encompasses a comprehensive array of mind-body practices aimed at promoting mental and physical well-being. These practices encompass physical postures and exercises, breathing methods, deep relaxation practices. Research studies have demonstrated that the practice of yoga and meditation practices can effectively mitigate the perception of stress and enhance mood. The body of research examining the therapeutic advantages of yoga has seen consistent growth over the past thirty years. This research currently encompasses controlled clinical studies investigating a range of mental health disorders, including depression and anxiety.

**3.1 Physical characteristics**

**Table No. 1 physical characteristics of selected subjects.**

Table No. 1 physical characteristics of selected subjects.		
Age (years)	Body Mass (kilogram)	Height (cm)
14±1.25	66±5.75	161.7±6.20

Table 1 shows the physical characteristics of the selected subjects, offering descriptive statistics for their age, body mass, and height. The data indicates that the subjects have a mean age of 14 years  $14\pm 1.25$ , suggesting that maximum individuals in the group are close to this average age, with limited variation. In terms of body mass, the mean value is  $66\pm 5.75$ . This implies that there is a bit more variability in body mass among the subjects. Lastly, the average height of the selected subjects is  $161.7\pm 6.20$ , signifying a moderate level of height variability within the group.

**3.2 Physical fitness**

Table 2 Physical fitness		
Physical Fitness Variable	Mean	Std. Dev.
Sit-Ups	28.44	7.49
Push-Ups	19.60	8.47
Balance	29.36	9.16
Flexibility	15.05	7.18

The findings from table 2 present the descriptive statistics for various physical fitness variables among the selected subjects. These variables are crucial in assessing the subjects' physical capabilities and overall fitness. The data reveals that, on average, the subjects performed approximately 28.44 sit-ups, indicating some variability in sit-up performance within the group. For push-ups, the mean is 19.60, suggesting a moderate degree of variation in this fitness

measure. In terms of balance, the subjects achieved an average score of 29.36, signifying a more substantial level of variability in balance capabilities. Finally, flexibility, a mean of 15.05, demonstrates variation in the subjects' flexibility levels.

### 3.3 Yogic performance

<b>Table No. 3</b> Yogic performance of selected subjects.				
<b>Independent Variable</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Dev.</b>
<b>Yogic Performance Score</b>	26	85	59.50	21.368

Table 3 provides descriptive statistics related to the Yogic performance of the selected subjects, offering key insights into their achievements in this area. The data reveals a range of Yogic Performance Scores, with the lowest score recorded at 26 and the highest at 85. The mean score for Yogic performance among the subjects is 59.50±21.368, indicating that maximum of subjects' scores tend to cluster around this mean, while there is notable variability in performance scores across the group. These statistics shed light on the diversity in Yogic performance within the selected subjects, showcasing a wide range of scores and the degree of dispersion from the mean.

### 3.4 Correlation between Physical fitness variables and Yogic performance

<b>Table No. 4</b> Correlation analysis of Physical fitness variables and Yogic performance						
		<b>Performance</b>	<b>Sit-ups</b>	<b>Push-ups</b>	<b>Flexibility</b>	<b>Balance</b>
<b>Performance</b>	<b>Pearson Correlation</b>	1	0.274	-0.225	0.622**	0.271
	<b>Sig. (2-tailed)</b>		0.185	0.280	0.001	0.190
** . Correlation is significant at the 0.01 level (2-tailed).						
* . Correlation is significant at the 0.05 level (2-tailed).						

Table 4 provides a correlation analysis of the relationship between various physical fitness variables and Yogic performance among selected subjects. The Pearson Correlation coefficients are used to quantify these relationships, shedding light on the degree of association between the variables. Firstly, there is a positive correlation of .274 between Yogic performance and the number of sit-ups completed, indicating a weak positive relationship. However, this correlation is not statistically significant at the 0.05 level (2-tailed). Secondly, there is a negative correlation of -.225 between Yogic performance and the number of push-ups completed, suggesting a weak negative relationship. Again, this correlation is not statistically significant at the 0.05 level (2-tailed). Conversely, there is a substantial positive correlation of .622\*\* between Yogic performance and balance, which is statistically significant at the 0.01 level (2-tailed). This finding implies a strong positive relationship between balance and Yogic performance. Lastly, there is a positive correlation of .271 between Yogic performance and flexibility, indicating a weak positive relationship. Similar to the correlation with sit-ups and push-ups, this correlation is not statistically significant at the 0.05 level (2-tailed).

**3.5 ANOVA table showing F-value for the obtained model.**

Table No. 5 ANOVA table showing F-value						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4235.820	1	4235.820	14.492	0.001 <sup>b</sup>
	Residual	6722.680	23	292.290		
	Total	10958.500	24			
A. Dependent Variable: Performance						
B. Predictors: (Constant), Flexibility						

Table 5 presents an ANOVA (Analysis of Variance) table displaying F-value for obtained regression model. This table is instrumental in assessing statistical significance of the model's fit. The analysis includes two key components: the regression model and the residuals.[31] The regression model's sum of squares is 4235.820, with 1 degree of freedom (df), resulting in a mean square of 4235.820. The corresponding F-value is 14.492, and it is statistically significant at the 0.001 level (denoted by "b" in the Sig. column). The residual sum of squares is 6722.680, with 23 degrees of freedom, yielding a mean square of 292. 290.The total sum of squares is 10958.500, considering 24 degrees of freedom. The F-value in the ANOVA table is a crucial statistic for evaluating the significance of the regression model.

**3.6 Regression coefficient of selected variable**

Table No. 6 Regression coefficient of selected variable and their t-values and partial correlation						
Sample		Coefficients of Unstandardized		Coefficientsof Standardized Beta	t	Significant
		B	Std. Error			
1	(Constant)	31.684	8.067		3.928	.001
	Flexibility	1.848	.485	.622	3.807	.001
a. Dependent Variable: Performance						

Table No. 6 displays the regression coefficients for the selected variable and their associated t-values, along with the standardized coefficients (Beta) and significance levels. The "Constant" has a regression coefficient (B) of 31.684, with a standard error of 8.067. The associated t-value of 3.928 is statistically significant at the 0.001 level (denoted by "Sig."). This suggests that the constant term plays a significant role in predicting "Performance." "The independent variable, "Flexibility," has a regression coefficient (B) of 1.848, with a standard error of 0.485. The standardized coefficient (Beta) for "Flexibility" is 0.622, indicating its influence on "Performance" while considering the units of measurement. The associated t-value of 3.807 is also statistically significant at the 0.001 level, highlighting the significant contribution of "Flexibility" to the prediction of "Performance". Since F-value for regression model is highly significant, the model is reliable. Since the other variables Sit-ups, push-ups and balance are not highly significant and not significant predictability in estimating the yoga performance.

**4. Discussion**

The findings of this research shed light on the factors influencing yogic performance and relationship between various physical fitness variables and yoga. The results may not come as a surprise, but they provide a statistical foundation for explaining why yoga is effective, as commonly believed by laypeople. In this study, flexibility was identified as the key factor affecting competitive yoga performance [18,19]. It's noteworthy that the regression equation developed for yogic performance was based on flexibility, indicating its significant impact. This indicates that flexibility levels have a significant impact on competitive yoga performance. On the other hand, sit-ups, push-ups, and balance variables had less of an impact on yogic performance [20]. Despite the fact that these are important aspects of physical fitness (Singh Hardyal, 1991), only flexibility was included in the developed regression model [21]. This conclusion is consistent with previous studies highlighting the role of yoga in increasing range of motion over an eight-week period. It's important to note that the study subjects were national-level players with significant experience, which likely explains why flexibility was the most influential variable. Longer yoga practice encourages the ability to hold poses for extended durations, allowing muscles to stretch deeper. According to a number of studies, increasing one's flexibility through the practice of yoga for a period of eight weeks results in greater range of motion [22].

Physical activity and yoga have different ways of influencing physical fitness, cognitive performance, and self-esteem. Some of the possible mechanisms are mentioned below. Physical activity benefits physical wellbeing by changes in biological cardiovascular disease risk-factor profiles in children such as lower blood pressure, favorable lipid and lipoprotein levels and reduced adiposity [23]. Physical activity benefits physical health by affecting cardiovascular risk factors in children, including blood pressure, lipid levels, and adiposity (Table No. 2). The findings presented in the current study align with previous research on the relationship between physical fitness variables and Yogic performance, while also shedding new light on the role of flexibility. The descriptive statistics provided in this study, specifically the physical fitness variables of sit-ups, push-ups, balance, and flexibility, offer valuable insights into the subjects' physical capabilities, a practice consistent with previous studies [24]. This understanding is pivotal for assessing individuals' fitness levels and determining how they may perform in Yogic activities.

The analysis of Yogic performance, as detailed in Table No. 3, parallels the approach of previous studies by evaluating the minimum, maximum, mean, and standard deviation of Yogic Performance Scores [25]. This information is essential for comprehending the distribution and variations in the subjects' Yogic performance within the study cohort.

Table No. 4, which features the correlation analysis between physical fitness variables and Yogic performance, reaffirms the significance of flexibility. The strong and statistically significant positive correlation found between flexibility and Yogic performance is in line with earlier research highlighting the impact of flexibility on yoga performance [26]. It underscores the idea that individuals with greater flexibility tend to exhibit superior Yogic performance.

In terms of predicting Yogic performance, the ANOVA table (Table No. 5) is a common approach in line with existing literature [27]. The F-value and associated p-value provide a statistical assessment of the model's significance. In this case, it confirms that the regression



model is statistically significant, suggesting that physical fitness variables can indeed predict Yogic performance effectively.

Table No. 6 focuses on the specific role of flexibility in predicting Yogic performance, offering standardized coefficients (Beta) and their significance levels. This is consistent with earlier research that highlighted the influence of flexibility as a crucial factor in determining yoga performance [28].

The study underscores the substantial role of flexibility in predicting Yogic performance, aligning with previous research findings. Notably, the study goes further by emphasizing that other physical fitness variables, such as sit-ups, push-ups, and balance, may have a lesser impact on Yogic performance. Overall, these results contribute to our understanding of the multifaceted relationship between physical fitness and Yogic performance, emphasizing the pivotal role of flexibility in yoga effectiveness, which is consistent with and builds upon existing scientific knowledge.

### Conclusion

The popularity of competitive yoga is steadily increasing, resulting in heightened expectations for improved performance. The primary objective of this study is to investigate the relationship between physical fitness variables and yoga performance. The study's findings indicate a substantial positive association between flexibility and yoga performance, while an insignificant link was observed between sit-ups, push-ups, balance, and yoga performance. The regression equation derived for the study was as follows:  $\text{Yoga Performance} = 31.684 + 1.848 \times \text{Flexibility}$ . The reliability of the regression equation is supported by the R<sup>2</sup> value of 0.622. To clarify, the flexibility variable used into the regression equation accounts for 62.2% of the overall variance seen in yoga performance, indicating a substantial level of explanatory power.

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