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Physical Fitness of the Students of Rajshahi University: A BMI based Pilot Study

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Abstract

The purpose of the present study was to detect physical fitness of the students of Rajshahi University through body mass index (BMI). A sample of size 148 students was collected through 2-stage stratified random sampling and then Advanced Multivariate Technique namely, correspondence analysis, categorical regression and stepwise ridge regression were applied. About 20% students were suffering from malnuitrition problem. In this study we found that a large amount of low age students were suffering from malnuitrition problem due to perhaps they couldn't adjust them selves in a new environment. When the ages were increased the percentage of malnuitrition students were decreased. About 41.0% students had normal BMI but their diastolic blood pressures were low which is a great alarming. The reason about 20% students were malnuitrient, is fully unclear. Due to malnuitrient problem, their health as well as their studies and social activities will be hampered. This was a pilot study, so the university authority should conduct an in-depth study in this regards and should have a plan/protocol to enhance the health condition of the students.

Keywords: Body mass index (BMI), correspondence analysis, categorical regression, stepwise ridge regression, University Student.

AMS Classification: 62P10.

1. Introduction

Health research conducted to better understand what causes a disease, to test how current treatments work, and to develop new treatment. We may conduct such research on malnuitrition through BMI investigation. BMI was first introduced in the mid-1800s, an index based on height and weight that has been used to measure body fat. Body Mass Index (BMI) is a reliable indicator of health and nutritional status of human beings (Garrow and Webster, 1985; Rookus et al., 1987; Must et al., 1991; Naidu et al., 1991; Cole et al., 1995; Pishdad, 1996 and Yanai, 1997. Body Mass Index also known as the "Quetlet's Index" expresses the relationship between the two most widely used parameters to monitor linear and ponderal growth, viz., height and weight, used to indicate whether a person is malnuitrient or normal or overweight or obese.

BMI does not measure fat directly, but research has shown that BMI correlates to direct measures of body fat, such as by underwater weighing and dual energy Xray absorptiometry (Mei et al., 2002). It will, however, overestimate fatness in people who are body builder or athletic. Because of these problems, the body mass index calculator shows extra statistics to help us be informed and judge our own body compared to others of the same height and age. When the value of body mass index (BMI) exceed 35 kg/m2 it has been associated with increased cardiovascular diseases, obesity & increase rate of mortality, with lower value of BMI generally correlating with longer lifespan. Because ethnicity has been shown to require adjustments to the levels of concern for the BMI, care must be taken when comparing different population groups. This variation can be explained by body type (Chatterjee S, Chatterjee P and Dipali Saha, and Wade).When a student's BMI is less than 18.5 then she/he suffer from malnutrition. Malnutrition is a major problem across the world, both in developed and developing countries and deficiencies in some nutrients have been reported to cause diseases which could lead to impaired cognitive development (Johnston et al., 1987). University students are highly weak to malnourishment as during variation to independent living they make their own food selections, asymmetrical routines, physical inactivity due to academic load and lack of time. Physical fitness of University students has decreased day by day and the numbers of malnutrition students are increased. Being physically fit means having the strength and endurance to carryout every day activities without undue stress and still have enough energy to participate in leisure activities and be able to deal with an unexpected emergency

(Mondal, and Bandyopadyay2015). Physical fitness can be thought of as an integrated measure of most, if not all, the body functions (skeletomuscular, cardiorespiratory, hematocirculatory, psychoneurological and endocrine-metabolic) involved in the performance of daily physical activity and/or physical exercise (Bennett and Plum 1996). Physical fitness is influenced by genetic factors and lifestyle factors such as physical activity and nutritional behavior. Student's healthy mental attitude is just as important as physical fitness. At present, the food quality of residential hall and also mess of the Rajshahi University are decreasing and student's nutritional condition shortening day by day. In this situation student's physical fitness needs to be known in a great range. This research also shows that BMI also influenced not only height and weight but also age and diastolic blood pressure.

Study in physical fitness on the student of Rajshahi University is rare. A huge number of students are affected with the problem of lung diseases (Zulficar Ali, 2016). On the other hand, extra-curricular activities including playing indoor and outdoor games of the students are demolishing day by day due to, perhaps, lack of physical fitness. Thus, investigation of physical fitness of the students of Rajshahi University is an emerging issue now a day. Therefore, the purpose of the present study is to investigate physical fitness of the students of Rajshahi University through Body Mass Index (BMI).

2. Materials and Method:

2.1 Materials

This study was carried out in a Rajshahi University student and data was collected from two department Fine arts and Statistics using 2-stage Stratified random sampling. A questionnaire was made and student's height, weight, age, BMI, categorical BMI, age and diastolic blood pressure were recorded. A total of 148 students were a part of this study. Advanced multivariate technique namely, correspondence analysis, categorical regression and stepwise ridge regression was applied.

2.2 Method

Correspondence analysis, a modern multivariate technique, is used to deals with categorical data for converting it to distance and creating perceptual maps. Row profile, column profile, inertia, and chi-squre distance are used to quantify that the distribution across the categories of the column variable, the distribution across the categories of the column variable, the distribution across the categories of variance among the rows and columns of the correspondence table and the percentage of variance explained by each dimension respectively. It is also developed contingency table. Categorical regression quantifies categorical data by assigning numerical values to the categories, resulting in an optimal linear regression equation for the transformed variables and describes the relationship between a response variable and a set of predictor. Stepwise ridge regression screening out the important predictor.

3. Results and Discussion

3.1 Results

3.1.1 Correspondence Analysis

Among the 148 students 29.1% are low age having 8.8% are malnuitrient, 18.9% are normal, and 1.4% are overweight. 54.7% are middle age having 9.5% are malnuitrition, 37.2% are normal, and 8.1% are overweight, and 16.2% are high age having 1.4% are malnuitrition, 11.5% are normal, and 3.4% students are overweight.

Table 1 shows that those who have low age (n=43) from them about 13 (30.2%) students have malnuitrition, about 28 (65.1%) students have normal, about 2 (4.7%) students have overweight. Those who have middle age (n=81) about 14 (17.3%) students have malnuitrition, about 55 (67.9%) students have normal, and about 12 (10.4%) students have overweight. Again those who have high age about 2 (8.3%) students have malnuitrition, 17 (70.8%) students have normal and 5 (20.8%) have overweight. It also indicates that, those who have malnuitrition (n=29) from them about 13 (44.8%) students have low age, about 14 (48.3%) students have middle age, about 2 (6.9%) students have high age.

				Total		
			Thin	normal	overweig	
					ht	
		Count	13	28	2	43
		Expected Count	8.4	29.1	5.5	43.0
	Low Age	% within Age c	30.2%	65.1%	4.7%	100.0%
		% within BMI_C	44.8%	28.0%	10.5%	29.1%
		% of Total	8.8%	18.9%	1.4%	29.1%
		Count	14	55	12	81
<u>ى</u>	Middle Age	Expected Count	15.9	54.7	10.4	81.0
Age_		% within Age_c	17.3%	67.9%	14.8%	100.0%
		% within BMI_C	48.3%	55.0%	63.2%	54.7%
		% of Total	9.5%	37.2%	8.1%	54.7%
		Count	2	17	5	24
		Expected Count	4.7	16.2	3.1	24.0
	High Age	% within Age_c	8.3%	70.8%	20.8%	100.0%
		% within BMI_C	6.9%	17.0%	26.3%	16.2%
		% of Total	1.4%	11.5%	3.4%	16.2%
		Count	29	100	19	148
		Expected Count	29.0	100.0	19.0	148.0
	Total	% within Age_c	19.6%	67.6%	12.8%	100.0%
		% within BMI_C	100.0%	100.0%	100.0%	100.0%
		% of Total	19.6%	67.6%	12.8%	100.0%

Table 1: Cross tabulation between Age and BMI. Here variables are transferred into category.

Those who have normal (n=100) about 28 (28.0%) students have low age, about 55 (55.0%) students have middle age, and about 17 (17.0%) students have high

age. Again those who have overweight (n=19) from them about 2 (10.5%) have low age, about 12 (63.2%) have middle age and about 5 (26.3%) have high age

 Table 2: Overview Column Points

 Overview Column Points^a

		Score in D	imension		Contribution				
					Of Point to Inertia of Dimension		n Of Dimension to Inertia of P		a of Point
Age	Mass	1	2	Inertia	1	2	1	2	Total
low	.284	589	141	.104	.438	.278	.946	.054	1.000
mid	.318	158	.204	.021	.035	.647	.375	.625	1.000
high	.399	.545	062	.120	.527	.075	.987	.013	1.000
Active Total	1.000			.245	1.000	1.000			

a. Principal normalization

In correspondence analysis inertia is greater than .2 then it is enough. In this table (Table 2), indicates that first principal component high age is dominated by second principal component middle and low age. So we found that ages are increased and the numbers of malnutrition students are decreased.

BMI	Di_Bl_Pre								
	low	norm	high	Active					
			-	Margin					
thin	5	24	0	29					
norm	0	41	59	100					
ow	8	0	11	19					
ob	0	0	0	0					
Active Margin	13	65	70	148					

 Table 3: Correspondence Table

Table 3 indicates that there are 5 students who are suffering from malnutrition and their pressure is low. But there are 24 students who have normal pressure and also suffering from malnutrition. The numbers of the students who have normal BMI but high pressure are 59. It means that they survive and control their BMI, but they suffer from tension or frustration as a result their pressure become high.

Another alarming result is 8 students are overweight but their pressure is low. That's why we need to research widely.

Table 4: Column Points

		Score in D	imension		Contribution				
					Of Point to Inertia of Dimension		Of Dimen	sion to Inerti	a of Point
Di Bl Pre	Mass	1	2	Inertia	1	2	1	2	Total
low	.088	1.638	145	.238	.904	.009	.992	.008	1.000
norm	.439	211	490	.125	.075	.486	.157	.843	1.000
high	.473	108	.482	.115	.021	.506	.048	.952	1.000
Active Total	1.000			.478	1.000	1.000			

Overview Column Points^a

In correspondence analysis inertia is greater than .2 then it is enough. In this table (Table 4) indicates that, first principal component low diastolic blood pressure is dominated by second principal component normal and high diastolic blood pressure.

3.1.2 Categorical Regression

Table 5: Model Summary

	Sta Coe	ndardized efficients	df	F	Sig.
	Beta	Beta Bootstrap (1000) Estimate of			
		Std. Error			
Age_c	.219	.073	2	9.076	.000
Di_Bl_Pre_C	230	.077	1	8.924	.003

Coefficients

Dependent Variable: BMI_C

The largest coefficient occurs for Age_c.

Table 5 shows the standardized regression coefficients. Categorical regression standardizes the variables, so only standardized coefficients are reported. These values are divided by their corresponding standard errors, yielding an F test for each variable.

Table 6: Correlations and Tolerance

	Correlations			Importance	Tolerance		
	Zero- Partial Part			After	Before		
	Order				Transformati	Transformation	
					on		
Age_c	.231	.225	.219	.476	.997	.998	
Di_Bl_Pre_C	242	237	230	.524	.997 .998		

Dependent Variable: BMI_C

The zero-order correlation is the correlation between the transformed predictor and the transformed response. For this table (Table 6) indicates that the largest correlation occurs for Di_Bl_Pre_C. Di_Bl_Pre_C has a partial correlation of – 0.237. Removing the effects of the other variables, Di_Bl_Pre_C explains (– 0.237)² = 0.056 = 5.6% BMI_C. Age_calso explains a large portion of BMI.

3.1.3 Stepwise Ridge Regression

Considering that we have to predict the BMI with respect to different variables, since the relationship between the BMI and different variables, e.g., height, weight, sitting height, age, systolic, diastolic blood pressure etc. is linear (Ali and Ohtsuki, 2001). We can consider multiple linear regression of BMI on different variables. But the problem is how many variables are essential to explain the maximum percentage of variation (i.e., R^2). To solve this problem, the method of forward stepwise regression with zero intercept was used (for details, please see Ali and Ohutsuki, 2001; and Draper and Smith, 1966, pp. 169-171)

Predictors	Coefficient	S.E of Coefficient	В	S.E of B	t (142)	p-level
Weight	0.240636	0.037762	0.091744	0.014397	6.372361	0.000000
Age	0.173975	0.039730	0.163508	0.037339	4.378954	0.000023
Sys Bl Pre	0.141529	0.039999	0.026674	0.007539	3.538296	0.000545
Sitting Ht	0.151507	0.040568	0.039290	0.010520	3.734652	0.000271
Height	0.139213	0.040546	0.018361	0.005348	3.433473	0.000781
Di Bl Pre	0.133678	0.039204	0.038674	0.011342	3.409821	0.000847

Table 7: Ridge Regression Summary for Dependent Variable BMI

Like Ali and Ohtsuki (2001), the problem of outliers and influential points were removed through the methods, Mahalanobis-distance (Stevens, 1996) and Cooks distance (Cook, 1977; Cook and Weisberg, 1982).

Applying the forward stepwise multiple ridge regression technique, a stable and highly cross validated model with very low shrinkage (difference between R^2 and cross validity predictive power) had been proposed for predicting BMI of the students of Rajshahi University as:

 $BMI = 0.240636W_t + 0.173975Age + 0.141529Sys + 0.151507SH_t + 0.139213H_t + 0.133678DP$

4. Discussion

It is important to understand student's fitness and BMI during the formative age when university students are entering young adulthood and beginning a base for adult life pattern. Malnutrition is a major problem across the world, both in developed and developing countries. Deng and, Darla Castelli in 40.34% students are overweight, and 13.11% students are obese. Present study report objectively measured physical fitness of the students based on BMI age and diastolic blood pressure. This study specifies about 20% students are suffer from malnutrition,

13% students suffer from overweight. This also shows a large amount students suffer from malnutrition. Joyaraj Nair et al. in their study obtained data from Kollam of Kerala in South India. According to BMI 4.5% students of South India are underweight which is less than in our present study, 31.3% students are overweight but in present study which is small, and 6.3% students are obese but no students from Rajshahi University is obese. Hazizi AS, Hamdi B^a, LeongyM^a Izumi^b in their study data obtained Malaysia, 13.2% Malaysian students are underweight, 10.4% students are overweight and 1.7% students are obese and they found that 5.2% student's blood pressures are high. In their study they did not indicate how many underweight students suffer from low blood pressure and the number of students whose BMI is normal but blood pressure is low and did not specify the age range in where the number of underweight students is increased. But the present study indicates that 17.2% Rajshahi University students are malnuitrition whose pressure is low, 41.0% students showed normal BMI but their pressure is low, 58.0% students are overweight but their pressure is low. It indicates that the junior (first year) students are suffering from underweight and the number is decreased with the increasing of age, implying at the beginning of the University life of the students they have a serious problem of food habit as well as nutrition due to, perhaps, i) don't adjust new environment, ii) law food quality of mess, iii) mental pressure and frustration. The Categorical Regression procedure yields the BMI is explained by the transformed predictors, Age_c and $Di_Bl_Pre_C$, however R^2 is low. To our best knowledge, BMI the predictor method categorical regression and stepwise ridge regression is the first, further the discussion kept limited.

5. Conclusion

The results of this study suggest that Rajshahi University students have lower levels of physical fitness. Future research needs to examine procedures for increasing physical fitness levels among this population group and identify cutpoints related to health outcomes for all fitness components. Further knowledge about health nutrition and its role is necessary in prevention of non-communicable diseases to improve student's fitness especially as future medical specialists counseling their patients about nutrition.

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