

EVALUATION OF OBESITY RISK AMONG THE STUDENT COMMUNITY IN VIGAN CITY, PHILIPPINES USING RISK INDICES

J.F. Jenolin Bruna¹., Dr. D.B. Jabaraj²

Dr. Alma B. Segismundo³., Dr. RM. Narayanan⁴ & Dr. T. Felixkala⁵

¹ Student, Doctor of Medicine, University of Northern Philippines, Vigan city, Philippines,

³ Head Department of Biology, College of Arts and Sciences, University of Northern Philippines, Vigan city, Philippines,

^{2,4,5} Dr M.G.R Educational and Research Institute, Deemed to be University, Chennai, India.

ABSTRACT

Background: Overweight is one of the most prominent risk factors for obesity in increasing mortality and morbidity among all age groups. Students are more prone to obesity due to lifestyle with less physical activity and disordered eating habits and thereby are prone to obesity-related health hazards. Aim of the study was to identify the risk and its causes.

Methods: Risk assessment was carried out through a study poll towards estimating the probability of obesity across 28 causative factors. Stratified random sampling and Slovin's formula was used to determine the respondents. An innovative approach for computing obesity risk indices was developed based on the responses obtained from the given questionnaire.

Results: The study resulted with 47.64% of students exposed to obesity risk and further sub-divided into three critical variables as 24.22% risk in behavioural factors, 15.85% risk in environmental factors and 7.57% risk in societal factors.

Conclusion: Increased stress level, refraining from rest with no enough sleep and parental gene or innate nature contributes to the risk of obesity among the population. Stress leads to irregularity in diet, lack of exercise and addiction, each being considered as an independent factor as a cause of obesity. Students with overweight/obese parents or relatives tend to gain weight quickly, which contributes to the number of calories people eat and burn up. The impact of inadequate sleep and improper eating time leads to the secretion of the signal hormone ghrelin that increases appetite and leptin, which indicates the satiety state of the body.

Keywords – Obesity Risk Index, Stress, Inadequate Sleep, Body Mass Index, Environmental Factors, Behavioural Factors.

I. INTRODUCTION

The increasing trend of obesity among adolescents and young adults is a worldwide phenomenon and is considered as one of the significant public health challenges of the 21st century. The impact of obesity of an individual on social functioning and economic well-being can be devastating as a medical consequence. Therefore, it is regarded as a complex condition because it arises from multifaceted interactions of genetic and environmental factors. Gudegowda recognized overweight and obesity as an “escalating epidemic” affecting both developed and developing countries [1].

Obesity is defined as abnormal or excessive fat accumulation in adipose tissue, beyond the amount required for normal body function that may impair health and is the fifth leading cause for death globally. Body Mass Index (BMI) is the most commonly used measure to define obesity. Overweight is a predisposing factor for obesity which leads to many chronic diseases, like high blood pressure or diabetes.

Students are more prone to obesity due to lifestyle with less physical activity and disordered eating habits and thereby are prone to obesity-related health hazards. If bodyweight is not reduced, it may lead to obesity and further lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. Since this obesity and overweight becomes an alarming sign, it is necessary to prevent this by young adult based approaches like lifestyle changes and health education. Thus an attempt was made to assess the risk of obesity exposed students among the College of Arts and Science, University of Northern Philippines, Vigan City, Philippines.

I.1 Significance of the study

Taking the risk into consideration of obesity-prone students, the health department should focus on determining the health status of the students and other individuals. Furthermore, to develop balanced diet strategies to control body weight, as well as increase the number of necessary gyms and physical fitness centres to minimize weight and help lead a healthier life. Learning institution can conduct associated seminars in the campus to gain better insight on possible risk factors, and that will pave way for the students to avoid certain habits in their daily life practices to lead a healthy life.

II. LITERATURE REVIEW

Obesity can be defined as a condition of abnormal or excess fat accumulation in adipose tissue beyond the amount required for the healthy body function to the extent that health may be impaired. The prevalence of overweight and obesity is commonly assessed by using body mass index (BMI), defined as the weight in kilograms divided by the square of the height in meters (kg/m^2). The World Health Organization (WHO) Asian classification classifies underweight as having a Body Mass Index (BMI) of less than 18.5, normal weight as of 18.5 to 22.9 kg/m^2 , overweight as 23.0 to 24.9 kg/m^2 , obese I as 25.0 to 29.9 kg/m^2 , and obese II as greater than or equal to 30 kg/m^2 [2].

According to Schienkewitz professional students are more prone to increased body fatness due to their lifestyle habits with less physical activity [3]. Further, they are prone to be of disordered eating habits and more sedentary lifestyle and thereby are prone to overweight, leading to obesity and related health hazards. Journal of Obesity and weight loss medication (2015) comments, management in reducing excess weight remains a modern challenge because of the rapid evolution of unfavorable lifestyles. Due to numerous co-morbidities, obesity represents severe health and socio-economic problem worldwide.

Environmental factors like high-fat foods, super-sized portions, fast food consumption play a significant role in the occurrence of obesity. Individuals are addicted to high fat and calorie, highly palatable foods from fast-food restaurants with the promotion of predominantly caloric dense, relatively inexpensive foods are considered to be the cornerstones of the "toxic" environment.

Behaviour is one of the factors influencing weight gain. BMI has strong evidence of weight gain and associated with skipping breakfast, eating junk food or carbonated drink. Drinking coffee, taking meals while watching televisions, eating chocolates/sweets/desserts daily after food, munching between meals leads to weight gains [4]. There is a high prevalence of weight gain with the use of tobacco and alcohol. The busy schedule of students in college hours with less time for lunch/breakfast contributes to the habit of drinking tea/coffee/fruit juices more frequently throughout the day.

Having at least one overweight parent and spending >4 hrs each day on sedentary activities such as watching television and/or computer games are risk factors for obesity and/or overweight [5]. Physical activity at home for at least 30 minutes seemed to be a protective factor. The genetic factor is also considered as a risk for overweight in children and adolescents. Individuals who are not involved or less time (<30 minutes) engagement in games at home/school/college are nearly three times more likely to be obese. Family dietary habits may also contribute to weight gain among family members.

Body mass index increases as people age and since most diseases associated with weight gain are diseases that typically manifest themselves in older individuals. Weight reduction efforts would be more productive and more comfortable to implement on a population of twenty-year-olds than less adequate on a population of forty-year-olds. Students more commonly involve in unhealthy food habits as this is due to their stressful study time that involves social isolation, the pressure of examination, discrepancies between expectation and reality that brings out the psychological stress. Parents' with high level of education are aware of their wards' habits and those adolescents are less likely to smoke, drink, and gain weight or to use illegal drugs [6]. Risk of childhood weight gain was higher in children with rich financial background. Children of employed fathers are 40% more prone to be obese than the children of fathers who are not employed. Family income is also another major factor associated with weight gain rates which tend to decline among children in families with low income. Those who are exposed to a more luxurious socio-economic environment have higher BMI, most probably affected by diet and physical activities [7]. Eating a proper diet with an active lifestyle is the most effective means to prevent and treat the occurrence of overweight and obesity [8].

Students have good knowledge and attitude regarding obesity and its risk factors but failed in practising necessary measures to control and prevent it. As such, students have good knowledge and a positive attitude towards obesity but lack of appropriate behaviour and practices [9]. The study reinforces on the risk assessment of obesity among the students to prevent weight gain and lead a healthy life free from life-threatening diseases.

III. METHODOLOGY

The participants of the study were the students of the College of Arts and Sciences enrolled during the school year 2018-2019 in the University of the Northern Philippines, Vigan City. Stratified random sampling and Slovin’s formula was used to determine the respondents of the study.

About 28 influential causative factors were categorized into three domains such as, 1) Environmental factors, 2) Behavioral factors, 3) Social factors which are responsible for the leading cause of obesity. Out of which we have circulated questionnaires to different sectors like age, sex, course, cluster of people with different body mass index, various religions, educational levels and employment of parents and monthly family income of the sample population. Each question listed in the corresponding domain is circulated to the respondents for their responses.

The response obtained was categorized based on the distribution of ten relevant clusters (as indicated by the sample in figure 1) were classified into four different groups with an assigned severity value of 4 for very high, 3 for high, 2 for medium, 1 as low.

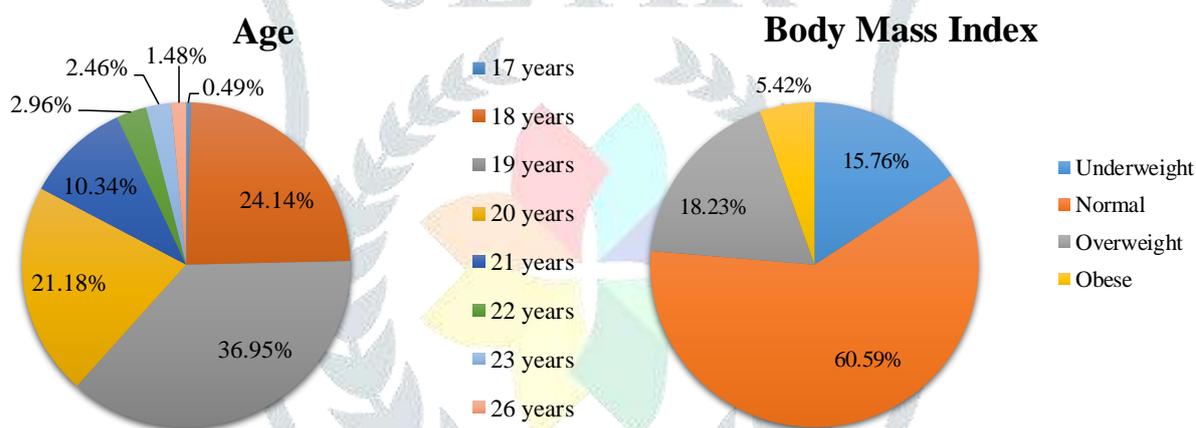


Figure 1. Distribution of the respondents according to age and BMI

Further a score has been calculated by the summation of the multiplicative product of severity value by the number of response for each relevant topic and all 28 influential causative factors, $Score = \{\sum Severity\ value \times\ number\ of\ response\}$ as exemplified in Tables 1-3. After the score is obtained, the risk index is determined for each influential causative factor as the ratio of score to the total number of responses $Risk\ Index = \left\{ \frac{score}{total\ response} \right\}$ as indicated in Tables 1-3. Once the risk index is obtained, the highest risk index value is assigned as rank one, and the next highest value is given as rank two and so on. After the risk index and rank are assigned, the average risk index ARI is obtained by $ARI = Average \left\{ \frac{Risk\ Index \times rank}{\sum Risk\ Index} \right\}$ and are shown in Tables 1-3. After obtaining the average risk index, each relevant topic is further subjected to estimation of overall average risk indices for each causative factor, as shown in Table 4. Further, the Obesity Risk Index ORI is estimated by the equation given below

$$ORI = \sum Overall\ Average\ of\ RI_n \times W_n / N (\sum W) \text{ where } N = 3 \text{ in our case.}$$

Where as, $W_n =$ weighted values of Overall ARI, $W =$ Weight values of each factor

From table 5, the highest overall average risk index value is assigned with a weight value of 3, the next highest overall average risk index value is given as weight value 2, and the lowest overall average risk index value is given as weight value 1. In this case ‘N’, which is the number of significant factors, is 3, and the sum of all the weight value is 6, i.e. (3+2+1). Hence in our study the $N (\sum W)$ is estimated as $3 \times 6 = 18$.

$$\text{Percentage of risk contribution PRC} = \frac{OARI \times \text{Weight values}}{N(\Sigma W)} \times 100.$$

To compute the Obesity Risk Index for the entire study the ORI is calculated in the equation below.

$$\text{ORI} = \frac{\Sigma OARI \times \text{Weight values}}{N(\Sigma W)} \times 100.$$

IV. RESULTS

Example Computations for the estimation of Average Risk Index (ARI)

The following tables 1-3 show the sample computations of influential causative factors under each major criterion in relation to different clusters.

Table 1. Type of Environmental Risk Factors for the relevant topic BMI

Indicators questions	Degree of Severity				BODY MASS INDEX							
	4	3	2	1	Score	Total response	Risk Index	Rank	Rank X Risk index	Rank*RI/ sum of RI	Average Risk index	% contribution
	<18.5	18.5-22.9	23.0-24.9	>25								
Advertising and marketing of high-density foods and soft drinks.	28	108	35	10	603	181	3.33	3	9.99	0.33	1.47	2.51
Large supermarkets.	23	108	31	10	581	172	3.38	1	3.37	0.12		0.95
Availability of junk foods in most of the places.	31	114	36	10	636	191	3.32	5	16.64	0.72		5.41
Establishment of fast food and restaurants in any given area.	29	113	35	11	626	188	3.32	6	19.97	1.01		7.59
Social deprivation (due to low socioeconomic status, poor education, poverty)	23	73	21	7	408	124	3.29	7	23.03	1.40		10.52
Availability of recreational areas for physical activity.	24	87	27	11	488	149	3.27	8	26.20	1.99		14.97
Rich socio-economic status of the family.	23	90	26	9	493	148	3.33	4	13.32	1.35		10.14
Availability of drugs – Steroids, Oral Contraceptive pills, Insulin.	17	60	21	9	346	109	3.17	9	28.56	4.37		32.84
Stress.	28	114	33	10	621	185	3.35	2	6.71	2.00		15.01

Table 2. Type of Behavioural Risk Factors for the relevant topic BMI

Indicators questions	Degree of Severity				BODY MASS INDEX							
	4	3	2	1	Score	Total response	Risk Index	Rank	Rank X Risk index	Rank*RI/ sum of RI	Average Risk index	% contribution
	<18.5	18.5-22.9	23.0-24.9	>25								
Consumption of fast foods.	30	118	35	11	648	194	3.34	2	6.68	0.18	2.06	0.81
Consumption of healthy unprocessed food.	25	100	30	10	550	165	3.33	3	10.00	0.30		1.33
Skipping breakfast.	24	83	25	8	463	140	3.30	7	23.15	0.78		3.44
High fat diets.	23	90	27	10	497	150	3.31	6	19.88	0.75		3.32
Snacking in between meals.	22	102	29	10	549	163	3.36	1	3.36	0.14		0.64
Eating chocolates or other sweets.	29	110	33	11	608	183	3.32	4	13.28	0.67		2.97
Alcohol consumption.	23	82	22	11	451	138	3.26	10	32.68	2.00		8.82
Tobacco use.	13	42	14	3	239	72	3.31	5	16.59	1.27		5.60
Weight gain associated with cessation of smoking.	15	37	14	5	225	71	3.16	11	34.85	3.58		15.77
No regular eating patterns and time.	23	82	23	10	453	138	3.28	8	26.26	4.00		17.62
Not enough sleep.	24	81	26	9	459	140	3.27	9	29.50	9.00	39.63	

Table 3. Type of Social Risk Factors for the relevant topic BMI

Indicators questions	Degree of Severity				BODY MASS INDEX							
	4	3	2	1	Score	Total response	Risk Index	Rank	Rank X Risk index	Rank*RI/ sum of RI	Average Risk index	% contribution
	<18.5	18.5-22.9	23.0-24.9	>25								
Reduction in exercise.	27	108	34	11	599	180	3.32	2	6.65	0.25	1.84	1.72
Sedentary lifestyle.	25	84	27	7	474	143	3.31	4	13.25	0.57		3.92
TV watching more than 5 hours/day.	17	58	21	4	333	100	3.33	1	3.33	0.17		1.15
Playing computer games for more than 2 hours/day.	15	65	20	8	358	108	3.31	3	9.94	0.61		4.14
Fat children become fat adults.	15	44	16	7	261	82	3.18	8	25.46	1.96		13.34
Pregnancy – can eat more or randomly.	14	70	26	7	393	120	3.27	5	16.37	1.68		11.38
Gain weight if you have obese friends or relatives.	16	51	18	7	297	92	3.22	7	22.59	3.49		23.66
Obese/overweight parents.	22	60	19	6	347	107	3.24	6	19.45	6.00		40.65

Similarly, we have estimated the average severity index values of other clusters such as age, sex, course, religion, educational level of parents, and occupation of parents and monthly family income of the sample population. The following table 4 shows the overall average risk index of the three significant factors concerning the different individual clusters.

Table 4. Overall average risk indices for major factors in relation to different clusters

CLUSTERS	3 MAJOR CRITERIA		
	ENVIRONMENTAL FACTORS	BEHAVIORAL FACTORS	SOCIAL FACTORS
Age	1.34264	1.17166	1.23330
Sex	1.62438	1.38566	1.60151
Course	1.83170	1.53821	1.30973
Body mass index	1.47969	2.06425	1.84463
Religion	1.77996	1.60705	1.18776
Fathers' educational attainment	1.42771	1.45416	1.60063
Mothers' educational attainment	1.78213	1.68660	1.39505
Fathers' occupation	1.73797	1.66540	1.75394
Mothers' occupation	1.11635	1.76400	1.39554
Family monthly income	0.14384	0.19327	0.31964
Overall Average Risk Index	1.42664	1.45303	1.36417

The following table 5 shows the estimated computation on the percentage of risk exposed among the sample population (n=3933).

Table 5. Estimated Obesity Risk index and percentage of risk exposed

Risk factors of Obesity	Average risk index	Weight value	Average risk index X weight value	% of risk contributed
Environmental factors	1.42664	2	2.85328	15.85156
Behavioural factors	1.45303	3	4.35909	24.21717
Social factors	1.36417	1	1.36417	7.57872
	Sum of weight value 18		Sum of overall average risk index X weight value	8.57654
			ORI = sum of overall average risk index X weight value / sum of weigh value	0.47647
			% of risk exposed	47.64744

Based on the calculation through question survey for ten relevant clusters, three significant factors and twenty-eight influential causative factors leads to 24.217% risk on behavioural factors followed by 15.85% risk on environmental factors and 7.57% social risks. As shown in Table 8, the total percentage of the sample population exposed to obesity risk is 47.64%.

V. DISCUSSION

The cause of obesity and overweight includes the imbalance between calorie intake and consumption and also comprises of age, gender, genetic predisposition, psychological makeup (stress and risk-taking attitude), socio-economic status, environmental factors and other behavioural patterns (smoking, diet, nutrition, alcohol) of an individual.

Substantially, from the received responses among the sample population, 24.217% risk is encountered in behavioural factors, as shown in Table 8. Three major influential causative factors causing risks include “No enough sleep”, “No regular eating patterns and time” and “Tobacco use”. The impact of inadequate sleep and improper eating time leads to the secretion of the signal hormone ghrelin, which increases appetite and leptin, which indicates that the body is satiated. This can lead to increased food intake without compensating energy expenditure. Increased consumption of cigarettes increases the nicotine content in our body cells which sequentially activates the fat content in our body.

Environmental risks of 15.85% include the following major influential causative factors – “Stress”, “Availability of drugs - steroids, oral contraceptives, pills, insulin”, and “Rich socio-economic status of the family”. Stress is an essential factor that contributes to obesity as it leads to irregularity in diet, lack of exercise and addiction, each being considered as an independent factor leading to obesity. Addiction to drugs has been linked to dysfunction in the brain’s reward system towards obesity. Overconsumption of drugs such as steroids, Oral contraceptive pills and Insulin can trigger a gradual increase in the reward threshold — requiring more palatable high-fat food or reinforcing drug to satisfy the craving over time.

The three major influential causative factors constituting for 7.57% social risks include - “Having obese / overweight parents”, “Having obese / overweight friends / relatives”, and “Pregnancy – who can eat more and randomly”. Students with overweight / obese parents or relatives tend to gain weight easily, which contributes to the number of calories people eat and burn up. It has been long known that tend to gain weight runs in families. Although early studies estimated that hereditary influence accounted for 80% of the tendency to gain weight, more recent data indicated that 33% of the BMI is attributable to genetics. Also, students with obese friends tend to gain weight by eating high calorie and excess fat foods in accordance with their friends and surrounding, which makes them as obese individuals in future. Pregnancy is one of the factors in which all females gain weight easily due to increased insulin resistance which increases their craving for more sweet products.

VI. CONCLUSION

The study concludes based on the 3933 responses that, about 47% of people are under obesity risk group out of which 24.217% are on behavioural risks, 15.85% on environmental risks and 7.57% are prone to social risks. Increased stress level, refraining from rest with no enough sleep and parental gene or innate nature contributes to the risk of obesity among the population is in agreement with the literature discussed in this study. Stress leads to irregularity in diet, lack of exercise and addiction, each being considered as an independent factor as a cause of obesity. Students with overweight/obese parents or relatives tend to gain weight quickly, which contributes to the number of calories people eat and burn up. The impact of inadequate sleep and improper eating time leads to the secretion of the signal hormone ghrelin, which increases appetite and leptin, which indicates that the body is satiated. Adequate sensitization of students early in their courses would help them to make healthy life choices, which will also empower them to act as facilitators in influencing the community to adopt healthy lifestyles [10].

VII. SUMMARY BOX

“What is already known on this subject?”

Obesity among aged people has been attempted by many authors, and the causative factors are restricted to very few and also among youth are very rare.

“What does this study add?”

Determining the obesity risk among the health status of the students is not widely studied in many countries. Hence to examine the obesity risk among college students a new and candid approach to calculate Obesity Risk Index ORI is evolved in this study comprising of 28 influential causative factors grouped under three major criteria's (Environmental, behavioural and social).

VIII. ACKNOWLEDGEMENT:

I render my sincere to thanks to my friends from University of Northern Philippines for their healthy discussion in the accomplishment of this work. Grateful thanks to my brother Jesvaan for his support. Above all, I thank our Almighty for his grace and mercy in making this a successful one.

REFERENCES

- [1] Gudegowda, K.S., Vengatesan, S., and Sobagiah, R.T. (2018) Prevalence of overweight and obesity among medical college students, Bengaluru. *Int. J. Community Med. Public Heal.*, 5 (5), 1881.
- [2] Organization, W.H. (2003) Obesity and overweight facts: how do we define obesity and global strategy on physical activity. *World Health Organisation WHO*, 2013.
- [3] Anja Schienkiewitz., Gert B. M. Mensink., Ronny Kuhnert., C.L. (2017) Journal of Health Monitoring | 2017/2 | Overweight and obesity among adults. *J. Heal. Monit.*, 20–27.
- [4] Deotale, M.K., Ranganathan, U., and Akarte, S. V. (2015) Prevalence of overweight and obesity among medical students and their knowledge, attitude and practices about obesity. *Int. J. Sci. Reports*, 1 (1), 74.
- [5] Bhuiyan, M.U., Zaman, S., and Ahmed, T. (2013) Risk factors associated with overweight and obesity among urban school children and adolescents in Bangladesh: A case-control study. *BMC Pediatr.*, 13 (1).
- [6] Devaux, M., and Sassi, F. (2015) The Labour Market Impacts of Obesity, Smoking, Alcohol Use and Related Chronic Diseases. *OECD Heal. Work. Pap.*, (86), 0–50.
- [7] Aleman-Mateo, H., Rush, E., Esparza-Romero, J., Ferriolli, E., Ramirez-Zea, M., Bour, A., Yuchingtat, G., Ndour, R., Mokhtar, N., Valencia, M.E., and Schoeller, D.A. (2010) Prediction of fat-free mass by bioelectrical impedance analysis in older adults from developing countries: A cross-validation study using the deuterium dilution method. *J. Nutr. Heal. Aging*, 14 (6), 418–426.
- [8] Wilborn, C., Beckham, J., Campbell, B., Harvey, T., Galbreath, M., La Bounty, P., Nassar, E., Wismann, J., and Kreider, R. (2005) Obesity: Prevalence, Theories, Medical Consequences, Management, and Research Directions. *J. Int. Soc. Sports Nutr.*, 2 (2), 4–31.
- [9] M., J., Karthik S., P., R., K., Bibiana C., I., N., K., J., S., and M., V. (2017) A study on the knowledge, attitude and practices (KAP) regarding obesity among engineering college students. *Int. J. Adv. Med.*, 4 (6), 1681.
- [10] Ramaiah, R. (2015) Prevalence of obesity and awareness of its risk factors among medical students of a rural teaching hospital of south India: a cross-sectional study. *Int. J. Med. Sci. Public Heal.*, 4 (10), 1373.