

Association of Weight Status and Energy & Macronutrient Intake with the Academic Performance of Female Student of RLAK Govt College of Home Economics Karachi

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ABSTRACT

Nutritional Nutritional depletion is a serious international problem that can lead to long-term deficits in growth, immune function, cognitive and motor development, behavior, and academic performance. The purpose of this study was to explore the association between weight status and Energy & Macronutrient Intake and academic performance of young female college students (18-24 years). A questionnaire consisting of items regarding subjects' general information, food intake, and academic records was used as a data collection tool. Information about food intake was collected by quantitative food frequency questionnaire and was used to assess food and nutrient intake. Underweight students were more likely to have poor academic performance but the difference was not significant. There was a significant positive association between protein and energy intake and the academic performance of the students ($p=.037$ & 0.005 respectively). The proportion of students having below average performance was lower in the group that had adequate protein and energy intake.

Keywords: Energy, Academic performance, Home economics

1. INTRODUCTION

Since inception, nutrition plays an important role in determining anyone's physical and mental potential (Bhutta, Guerrant, & Nelson, 2017; Koletzko et al., 2017). Nutritional status at any age can affect a person's academic performance through its effect on health and mental performance and is an important factor that determines their mental potential to gain knowledge and develop skills (Florence, Asbridge, & Veugelers, 2008; Owen & Corfe, 2017).

All the dietary components play their role in cognitive functions (Stevenson & Prescott, 2014). Proteins are basis of neurotransmitters, earlier identified as chemical messengers that carry information from brain cells to other brain cells. A lack of protein, also known as Protein Energy Malnutrition, leads to poor school performance by children and causes young children to be lethargic, withdrawn, and passive, all of which affect social and emotional development.

Carbohydrates are commonly found in grains, fruits, and vegetables. Carbohydrates are broken down into glucose (sugar) which is where the brain gets its energy. Fluctuating levels of carbohydrates may cause dizziness and mental confusion, both of which can affect cognitive performance. Eating a carbohydrate-heavy meal can cause one to feel more calm and relaxed because of a brain chemical called serotonin and its effect on mood. Serotonin is created within the brain through the absorption and conversion of tryptophan. Tryptophan is absorbed within the blood and this absorption is enhanced with carbohydrates (Markus, 2007). Fat makes up more than 60% of the brain and acts as a messenger in partial control of aspects such as mood. Omega-3 fatty acids are very important to the optimum performance of the brain and are found to influence cognition of adolescents (Bondi et al., 2014). Important foods to consume to ensure an Omega-3 fatty acid diet are certain fish and nuts. Antioxidant vitamin intake delays cognitive decline.

It is not essential to take supplements to get all the nutrients required for optimal functioning of brain and Healthful nutritional habits help students in achieving optimal learning. People exposed to poor diets either due to poverty or due to ignorance are less likely to attain their full cognitive potential. Children from families that report experiences of food insufficiency and hunger are more likely to show academic problems (Florence et al., 2008; Ni Mhurchu et al., 2010; Shilts, Lamp, Horowitz, & Townsend, 2009). In Pakistan, the role played by the quality of peoples' diet and nutritional status in the nations' human resource development and progress is rarely

appreciated. Availability of evidence about positive relationship between diet and academic performance of students could provide advocacy for making nutrition a priority at family, community and public level.

Objectives of the study:

To find out the association of weight status and energy & macronutrient intake with the academic performance of BS student of RLAK Government College of Home Economics Karachi.

2. METHODOLOGY

The population of this study comprised of BS students of Ra'ana Liaquat Ali Khan, Govt. College of Home Economics, Stadium Road, Karachi, Pakistan. Students were selected through simple random sampling through college enrolment numbers. Sample size was calculated on the basis of previous reports (Sirang et al., 2013) about rates (27%) of underweight. The purposive sampling design was used, and sample size composed of 150 BS students of the RLAK, Govt. College of Home Economics, Karachi.

The data was collected through personal visits to various classes of College of Home Economics. A questionnaire was used as a data collection tool which consisted of items regarding their general information, frequency of food intake and academic records. Students were explained how to fill the questionnaires and the data collectors got the questionnaires filled by the students during college hours. Nutritional status was determined on the basis of anthropometric measurement, and dietary data collected through food frequency questionnaire. Heights and weights were measured using standard protocols, BMI was calculated and weight status was reported using both the International (World Health Organisation, 2017) and Indian-Asian criteria (Misra, 2015). BMI < 18.5 was considered underweight, 18.5 to 22.99 as Normal, 23 to 24.99 as Overweight-Asian and 25 or above as "Overweight-International, Asian-Obese".

General questionnaire contained questions about relevant personal and social characteristics, health status and academic performance. Photocopies of evidence of academic performance were also collected to verify related answers. Overall academic performance was estimated by finding out average of numerical grades in three preceding exams.

The data was entered in SPSS, Version 20 (Statistical Packages for the Social Sciences). After the entry of data by the collectors, it was checked and cleaned. The data was analyzed in the SPSS 17 version. (Statistical Packages for the Social Sciences)

1. The descriptive statistics was used to describe the general characteristics of the sample.
2. Non parametric analysis was used to explore associations between categorical variables, e.g. categories of academic performance and categories of nutritional status
3. Parametric analysis was done to explore differences in, and association between scale level variables, e.g. blood hemoglobin, BMI, percentage of total marks obtained etc.

The level $P < 0.05$ was considered as the cutoff value for indicating statistical significance.

3. RESULTS

The dependent variable in the study was Data was collected from a total of 150 female college students aged 19 to 25. Mean age was 20, years, and majority of the subjects were less than 21 years old. Most of the students belonged to middle-income families and no of persons per room was 1.13 (0.4 to 2.6). No significant differences were noted in general characteristics in the three groups made according to academic performance (Table 1). Table 1 indicates the general characteristics of respondents i.e. age, height, weight status, BMI, and waist circumference. respectively. Majority (48.7%) were normal weight, 26.0% underweight and 25.4% overweight, including those who would be categories as obese (12.7%) according to Asian criteria.

Association of academic performance with nutrition:

Figure 2 shows the association between the BMI status with the academic performance of BS students, The proportion of below average academic performance was highest among underweight students however this study showed no significant or consistent association of BMI status with academic performance.

Mean intake of energy and macro nutrients was significantly ($P < 0.01$) lower among those students who had below average academic performance as compared to two other groups (Table 3). No significant differences were observed in relation to proportion of calories from various macronutrients however percentage of calories from carbohydrates was slightly higher and that of protein slightly lower among those students who had below average academic performance.

The proportion of students having below average performance was significantly higher in the group that had inadequate protein intake (81.00%), as compared to those who had an adequate protein intake (51%, $P = .037$). Similarly the proportion of students having below average performance was significantly higher in the group

that had inadequate energy intake (71.00%) as compared to those who had an adequate energy intake (44.30%, P=0.005) (Table 4)

Table 1. Characteristics of the sample

Characteristics	Academic Performance Groups								Sign.
	Below Average		Average		Above Average		Total		P Value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Education status (Mean BS year)	2	1	2	1	2	1	2	1	.962
Age (years)	20	1	20	1	20	1	20	1	.789
Number of rooms in the house	5	1	5	2	5	1	5	2	.653
Person per room	1.17	.40	1.09	.43	1.06	.44	1.13	.41	.387

Table 2. Health related characteristics of the respondents

Characteristics	Age groups									
	19 year old (n=26)		20 year old (n=65)		21 year old (n=37)		>21 year old (n=22)		Total (n=150)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Height in inches	62.96	2.73	62.36	2.38	62.73	2.11	62.70	2.04	62.60	2.32
Weight in Kg*	50.12	10.01	51.81	10.19	53.59	10.90	56.41	11.40	52.63	10.59
BMI*	19.67	3.27	20.56	3.84	21.04	4.33	22.19	3.58	20.76	3.87
Waist Circumference (cms) **	67.85	5.92	71.83	7.03	74.11	10.61	74.45	8.28	72.06	8.30

*Difference statistically significant (P<0.05) between 19 and >21 years old

** Difference statistically significant (P<0.05) between 19 and all other groups

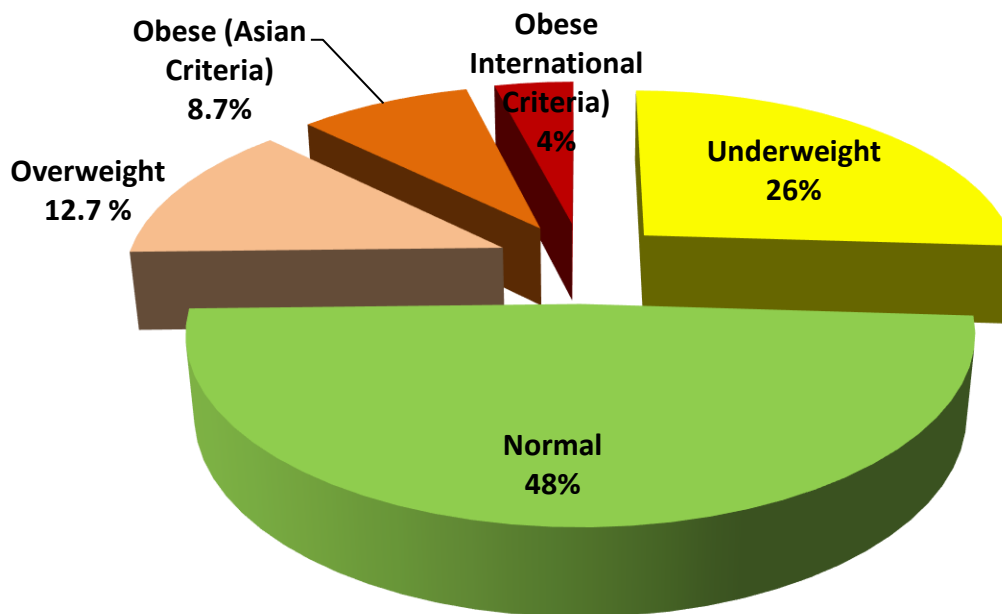


Figure 1. Weight status of the subjects.

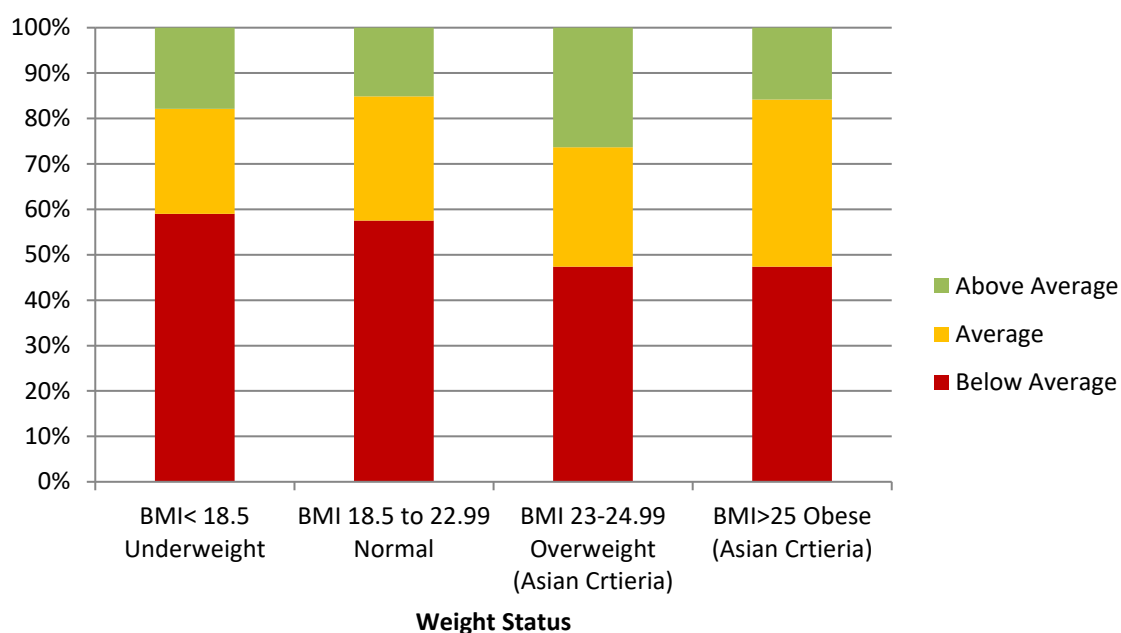


Figure 2. Weight status of the subjects according to academic performance

Table 3. Energy and macronutrient intake of the subjects

Energy/ Nutrient	Academic Performance Groups						Total		Sign. P Value*
	Below Average		Average		Above Average				
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Protein (gm)	53.53	29.85	71.29	39.25	66.12	32.38	60.57	33.83	.040
Fat (gm)	92.68	57.21	122.58	67.41	108.04	51.89	103.51	60.34	.014
CHO (gm)	217.57	98.46	277.62	132.44	273.34	101.73	243.65	112.39	.001
Energy (kcal)	1880.73	966.69	2449.57	1208.8	2285.84	932.18	2106.43	1057.7	.003
Protein (%Kcal)	11.37	1.88	11.57	2.14	11.42	1.95	11.43	1.95	.661
Fat (%Kcal)	42.49	7.13	43.95	5.77	41.69	6.93	42.75	6.75	.561
CHO (%Kcal)	48.19	8.02	46.49	6.66	48.87	7.99	47.85	7.67	.691

* Level of significance for difference between below average and other two groups.

Table 4. Academic performance according to adequacy of energy and protein intake

Adequacy* of Energy and Protein intake		ACADEMIC PERFORMANCE						P value
		Low		Average		High		
		n	Row %	n	Row %	n	Row %	
Protein	Inadequate	17	81.00%	2	9.50%	2	9.50%	0.037
	Adequate	66	51.20%	39	30.20%	24	18.60%	
Calories	Inadequate	44	71.00%	10	16.10%	8	12.90%	0.005
	Adequate	39	44.30%	31	35.20%	18	20.50%	

*At least 75% requirement

4. DISCUSSION

The study Academic performance of the students is one of the indicators of quality of human resource in any country. It is influenced by many factors including nutrition however importance of nutrition is not duly recognized. In this study we explored a positive relationship between adequacy of protein and energy intake

and academic performance of young college girls. Similar associations have been reported in many studies done in other countries among children and adolescents (Edwards, Mauch, & Winkelman, 2011; Florence et al., 2008; Kamath, Venkatappa, & Sparshadeep, 2017; Saha et al., 2010; Shilts et al., 2009).

As the three groups of students were similar in terms of height and number of persons per room it is unlikely that availability of material resources could have been major factor in the differences in academic performance. It is likely that priorities of families in relation to nutrition and/or education could have been different and there may be synergetic effect of both. Nevertheless importance of giving priority to nutrition among low achievers and potential for improving academic performance through better nutrition is highlighted by these results.

Unlike observations of a few researchers in studies done among children (Li, Dai, Jackson, & Zhang, 2008; Rashmi et al., 2015) and in line with observations by Baxter (Baxter, Guinn, Tebbs, & Royer, 2013) in this study height or weight status did not have a significance association with academic performance.

The differences seem to be less pronounced in quality than in the quantity of food intake. However absence of corresponding significant differences in weight status indicate that difference in food intake are either relatively recent, or are not reflected in anthropometric measures due to differences in physical activity or metabolism. Still a trend of higher percentage of low-achieved among underweight students was seen. This was a very small study limited in rigor and scope, and identification of significant differences in spite of these limitations evidence the role of nutrition in influencing cognitive function and academic performance. As there are no reports of this kind of research in Pakistan these observations highlight the need for further research and interventions in this area. Presence of evidences that nutrition interventions are effective in enhancing cognitive function and academic performance provide further support for instantaneous actions (Kamath et al., 2017; Ni Mhurchu et al., 2010; Shilts et al., 2009).

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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REFERENCES

- Baxter, S. D., Guinn, C. H., Tebbs, J. M., & Royer, J. A. (2013). There is no relationship between academic achievement and body mass index among fourth-grade, predominantly African-American children. *Journal of the Academy of Nutrition and Dietetics*, *113*(4), 551-557. Available at: <https://doi.org/10.1016/j.jand.2013.01.004>.
- Bhutta, Z. A., Guerrant, R. L., & Nelson, C. A. (2017). Neurodevelopment, nutrition, and inflammation: The evolving global child health landscape. *Pediatrics*, *139*(Suppl 1), S12. Available at: <https://doi.org/10.1542/peds.2016-2828d>.
- Bondi, C. O., Taha, A. Y., Tock, J. L., Totah, N. K., Cheon, Y., Torres, G. E., . . . Moghaddam, B. (2014). Adolescent behavior and dopamine availability are uniquely sensitive to dietary omega-3 fatty acid deficiency. *Biological Psychiatry*, *75*(1), 38-46. Available at: <https://doi.org/10.1016/j.biopsych.2013.06.007>.
- Edwards, J. U., Mauch, L., & Winkelman, M. R. (2011). Relationship of nutrition and physical activity behaviors and fitness measures to academic performance for sixth graders in a midwest city school district. *Journal of School Health*, *81*(2), 65-73. Available at: <https://doi.org/10.1111/j.1746-1561.2010.00562.x>.
- Florence, M. D., Asbridge, M., & Veugelers, P. J. (2008). Diet quality and academic performance. *Journal of School Health*, *78*(4), 209-215. Available at: <https://doi.org/10.1111/j.1746-1561.2008.00288.x>.
- Kamath, S. M., Venkatappa, K. G., & Sparshadeep, E. M. (2017). Impact of nutritional status on cognition in institutionalized orphans: A pilot study. *Journal of Clinical and Diagnostic Research*, *11*(3), CC01-CC04.
- Koletzko, B., Brands, B., Grote, V., Kirchberg, F. F., Prell, C., Rzehak, P., . . . Weber, M. (2017). Long-term health impact of early nutrition: the power of programming. *Annals of Nutrition and Metabolism*, *70*(3), 161-169.
- Li, Y., Dai, Q., Jackson, J. C., & Zhang, J. (2008). Overweight is associated with decreased cognitive functioning among school-age children and adolescents. *Obesity*, *16*(8), 1809-1815. Available at: <https://doi.org/10.1038/oby.2008.296>.
- Markus, C. (2007). Effects of carbohydrates on brain tryptophan availability and stress performance. *Biological Psychology*, *76*(1-2), 83-90. Available at: <https://doi.org/10.1016/j.biopsycho.2007.06.003>.
- Misra, A. (2015). Ethnic-specific criteria for classification of body mass index: A perspective for Asian Indians and American diabetes association position statement. *Diabetes Technology & Therapeutics*, *17*(9), 667-671. Available at: <https://doi.org/10.1089/dia.2015.0007>.

- Ni Mhurchu, C., Turley, M., Gorton, D., Jiang, Y., Michie, J., Maddison, R., & Hattie, J. (2010). Effects of a free school breakfast programme on school attendance, achievement, psychosocial function, and nutrition: a stepped wedge cluster randomised trial. *BMC Public Health*, *10*(1), 1-6. Available at: <https://doi.org/10.1186/1471-2458-10-738>.
- Owen, L., & Corfe, B. (2017). The role of diet and nutrition on mental health and wellbeing. *Proceedings of the Nutrition Society*, *76*(4), 425-426. Available at: <https://doi.org/10.1017/s0029665117001057>.
- Rashmi, M., Shweta, B., Fathima, F. N., Agrawal, T., Shah, M., & Sequeira, R. (2015). Prevalence of malnutrition and relationship with scholastic performance among primary and secondary school children in two select private schools in Bangalore Rural District (India). *Indian Journal of Community Medicine*, *40*(2), 97-102. Available at: <https://doi.org/10.4103/0970-0218.153871>.
- Saha, K. K., Tofail, F., Frongillo, E., Rasmussen, K., Arifeen, S., Persson, L.-Å., . . . Hamadani, J. (2010). Household food security is associated with early childhood language development: results from a longitudinal study in rural Bangladesh. *Child: Care, Health and Development*, *36*(3), 309-316. Available at: <https://doi.org/10.1111/j.1365-2214.2009.01049.x>.
- Shilts, M. K., Lamp, C., Horowitz, M., & Townsend, M. S. (2009). Pilot study: Eatfit impacts sixth graders' academic performance on achievement of mathematics and English education standards. *Journal of Nutrition Education and Behavior*, *41*(2), 127-131. Available at: <https://doi.org/10.1016/j.jneb.2008.05.007>.
- Sirang, Z., Bashir, H. H., Jalil, B., Khan, S. H., Hussain, S. A., Baig, A., . . . Kadir, M. M. (2013). Weight patterns and perceptions among female university students of Karachi: A cross sectional study. *BMC Public Health*, *13*(1), 1-8. Available at: <https://doi.org/10.1186/1471-2458-13-230>.
- Stevenson, R. J., & Prescott, J. (2014). Human diet and cognition. *Wiley Interdisciplinary Reviews: Cognitive science*, *5*(4), 463-475. Available at: <https://doi.org/10.1002/wcs.1290>.
- World Health Organisation. (2017). BMI classification. WHO [On-line]. Retrieved from: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html.