Asian Social Science; Vol. 9, No. 16; 2013
ISSN 1911-2017 E-ISSN 1911-2025
Published by Canadian Center of Science and Education

Physical Activity, Aerobic Fitness and Body Composition among Students in Malaysia and Libya

Mohd Radzani Abdul Razak[1], Ibrahim Elsalhin Maizi[1] & Tajul Arifin Muhamad[1]

[1] Faculty of Education, Universiti Kebangsaan Malaysia, Selangor, Malaysia

Correspondence: Mohd Radzani Abdul Razak, Faculty of Education, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia. Tel: 60-3-8921-6254. E-mail: jingga@ukm.my

Received: August 16, 2013 Accepted: October 14, 2013 Online Published: November 28, 2013

doi:10.5539/ass.v9n16p168 URL: http://dx.doi.org/10.5539/ass.v9n16p168

Abstract

The purpose of this study is to compare the physical activity (PA), exercise time and Body Composition, Body Mass Index (BMI), % Body fat (%BF) and aerobic fitness (VO_{2max}) among students in the Faculty of Education UKM Malaysia and Faculty of Education Sabha University Libya (SUL). Respondents drawn from both faculties of education of the two institutions were of average age between 18-25 years. Four-site skinfold thicknesses and Queen's College Step Test (QCT) were used to determine the percentage body fat (%BF) and aerobic fitness (VO_{2max}) respectively. Physical activity pattern and health status were also assessed by means of the seven days activity of self-reported questionnaire. The study showed a significant difference in terms of moderate (8.59 hrs/wk, 7.48 hrs/wk; t=-3.3, p=.001) and vigorous (4.3 hrs/wk, 6.3 hrs/wk; (t= -7.7, p= .000) time spent in exercising. This also similar with scores for BMI (SUL: m = 22.2; UKM: m = 24.4) and %BF (SUL: m = 13.6%; UKM: m = 16.3%) among students of both SUL (Libya) and UKM (Malaysia). However, analyses revealed that there was no significant difference in VO_{2max} between student-teachers of SUL and UKM (t= -.99, p = .324). This study concludes that participants score an above average of 44 ml.kg □ ¹ .min ⁻¹ that are considered as being in good fitness and good health. Although SUL students scored lower BMI and less %BF than participants from UKM who reported engaging more time in vigorous physical activity, SUL participants spent significant time in moderate exercises. Lifestyle among student-teachers of UKM Malaysia and SUL Libya did not differ in terms of aerobic fitness but showed significant influence of moderate exercises towards BMI and %BF as for Libyan participants spent more time in moderate activities like walking and gardening.

Keywords: physical activity (PA), exercise, health, BMI, % Body Fat, aerobic fitness (VO_{2max})

1. Introduction

From the physiologist view point, physical fitness is said to be ability of the body to adopt and recover from strenuous exercise and it is a known fact that every individual has a different level of physical fitness which changes with time and situation in which an individual finds oneself and the interaction between the daily activities and the fitness of an individual. Furthermore, experts simply describe physical fitness as the ability of human beings to engage in various forms of physical activities, without being unduly tired and for the body to maintain qualities that remain important to the individual's health and well-being. Generally, the public's perception of physical fitness as defined by the World Health Organization is the ability to undertake muscular work satisfactorily.

The physiology of the human body functions well when it is in active state mentally and physically; and being in active state avoid the body being infected or make it suffer from any kind of illness. The body should be able to perform activities that will not be detrimental and to able to prevent diseases like high blood pressure, cancer, diabetes, osteoporosis and heart failure (Omar-Fauzee et al., 2010). Cardio-respiratory fitness and body composition are closely linked and associated with the risk of the emergence of cardiovascular diseases. There is a significant relationship between these factors and have been the focus of researchers in the field of sports and health sciences in recent time (Jaswant et al., 2010).

Hence, obesity is found to be the closely associated with incidences of cardiovascular disease. Statistics have also shown that obese individuals stand a greater risk (2 ½ times) to die as a result of cardiovascular disease than the individual with an average or below average body weight (Fox & Browers, 1989). Considered as part of the cardio-respiratory or the oxygen transport system, maximal aerobic (VO_{2max}) capacity is taken as the only single

measure of the functional capacity of the system (Koley, 2007) or as a proxy of health.

The remaining part of this paper will be as follows: Literature review discusses the previous works done by other researchers and their findings, the methodology of how the research was conducted and the step-by-step procedure of conducting the research was also discussed. Results and analysis of the work presented in this paper was highlighted and finally the conclusion of the analysis was given.

2. Literature Review

Daily physical activity is considered to be important for a healthy lifestyle and is associated with decreased risk of obesity, a source that causes heart disease (Powell, 1988; Shaw et al., 2006). It has been observed in recent years, that tremendous decline in physical activities among college students has taken a toll (ACHA, 2006, 2008; Sacheck & Kuder, 2010). However, M. Dencker et al. (2006) studied daily physical activity related to the body fat level of children between 8 to 11 years. With the use of accelerometers to study the daily physical activity and DXA to check the body fat percentage, because no such data exist and they concluded that, low physical activity is a contributing factor in childhood obesity.

In addition, Peter et al (2010) described the trends of physical fitness related to BMI and body fat among university students between 1996 and 2008. They showed a significant decline in the average fitness levels measured as an estimation of VO_{2max} for male and female students. There is a significant indirect correlation between the students' VO_{2max} levels and % body fat, $r = -0.489$; $p < 0.001$ for males. The results support recent findings that physical fitness among college students is declining and body fatness is increasing.

Hayes et al. (2002) compared the physical activities of a number of ethnic groups resident in the United Kingdom (UK). Bangladeshi men were found to be physically less active than their European counterparts. Whereas 52% of European men did not meet the current guideline for participants (Indian, Pakistani and Bangladesh, men were 71%, 88% and 87% respectively) in physical activities. In recent studies, the indicator is that nearly half of the U.S. college student population does not participate in moderate or vigorous physical activities (Douglas et al., 1997). Components such as cardio-vascular endurance, strength, flexibility and body composition forms the complex nature of physical fitness. In addition to these components, other factors such as environment, climatic factors, heredity, living standard, nutrition, hygienic conditions, etc, also contribute to physical fitness.

Jose et al. (2008) conducted a research to check whether a relationship exists between health-related fitness, taken as an indicator of regular physical activity, and educational and income levels of adult Spanish women. The samples of 1709 were selected according to population size, age and level of physical activity according to a previous epidemiological survey. It was classified into high, medium and low level groups for education and income. All groups were checked for morphological and physical health-related fitness. The lowest values for health-related fitness were found in the lowest educational and income groups ($P<0.001$). The higher the level of education and income, the higher the values for all fitness variables ($P<0.001$) except for the anterior trunk flexibility.

On the other hand, individuals who engage in regular physical activity to develop cardio respiratory endurance, musculoskeletal fitness and optimal body fat levels, place themselves at lower risk of silent killer diseases of our time, which comprises of heart diseases of our time, cancer, diabetes, osteoporosis and other chronic disorders (Bouchard & Rankinen 2001). While few studies on physical activity and fitness have been conducted in Malaysia (Hazizi et al., 2012; Lim Khong, 2010; Mohd Sofian, 2007), the story is different for Libya.

There have not been studies conducted in Libyan to address adolescents' participation in physical fitness activities or influence on health related fitness. However, there are considerable socio-economic, political and cultural differences between South East Asian and African countries that may influence the patterns of physical activity. It is not clear whether the same determinants of physical activity for adults in most Africa countries would be relevant, given these differences. The purpose of study is to investigate and compare the physical activities and health-related fitness (BMI, %Body fat and Aerobic fitness) between students in the Faculty of Education in UKM, Malaysia and SU, Libya.

3. Methodology

This investigation is a cross-sectional study with a total of 242 students who are studying in the Faculty of Education in UKM Malaysia and Faculty of Education in Sabha University Libya (SUL). A stratified sampling method was adopted for the study assessing undergraduate male and healthy student-teachers of age between 18 to 25 years old from the same the same school of both countries. The participants altogether comprised of 122 Libyan and 120 Malaysian students of various program within Faculty of Education.

3.1 Criteria Measured

3.1.1 Physical Activity and Exercises

Self-reported questionnaires (Dietary Guidelines for Americans 2005) were collected and the physical activity exercise measurements that assess many uncertainties about the various types and the intensities of exercises were analyzed. An intensity index was used to classify the activities as light, moderate, and vigorous and all based on self-reported leisure-time activities in lifestyle questionnaire (PALQ). The five items comprising this subscale of the instrument asked subjects to recall and report their physical activity participation over one week period of time. This seven day recall included five response options ranging from zero hour to more than five hour per week. The question 4 assessed strenuous level example, jogging, swimming, and Badminton whereas question 5 assessed competitive level example, football, Basketball, Volleyball and tennis. Calculation of physical activity exercise levels in questionnaire; (a) Total moderate exercise time = walking time + cycling time + moderate activity time (b) Strenuous exercise time = time in strenuous exercise question. (c) Competitive exercise time = time in competitive question (d) Vigorous exercise time = strenuous exercise time + competitive exercise time. And (e) Total exercise time = total moderate exercise time + vigorous exercise time.

3.1.2 Aerobic Fitness (VO_{2max})

Aerobic fitness refers to endurance or the ability to sustain work for prolonged periods; it is one of the most important factors in physical fitness. The study adopted Queen's college test (QCT) which is also known as the McArdle step test (Gregory B. Dwyer et al 2005) method to measure cardiovascular endurance. The method requires that the individual step up and down on a standardized step height of 16.25 in (41.25cm) for 3 minutes. The men step at a rate (cadence) of 24 per minute. This cadence should be closely monitored and set with the use of an electronic metronome. A 24 per minute cadence means that the complete cycle of step up with one leg, step up with the other, step down with the first leg, and finally step down with the last leg is performed 24 times in one minute (up one leg, up the other leg, down the first leg, down the other leg). It would be difficult to test two men simultaneously. After exhausting the 3 minutes, the client stops and palpates the pulse taken (preferably at the radial site) while standing within the first 5 seconds. A 15 second pulse count is then taken. Multiply this pulse count by 4 to determine HR in beats per minute (bpm). The recovery HR should occur between 5 and 20 seconds of immediate recovery from the end of step test. The subject's VO2max in mL.kg-1.min-1 is determined from the recovery HR by the following formulas: For Men: VO2max (mL.kg-1.min-1) = 111.33 – (0.42. . HR) (Gregory B. Dwyer et al 2005).

3.2 Anthropometrics Measurement

Anthropometry is the measurements of the human body such as skinfold assessment for estimations of body fat, while other techniques such as BMI are estimations of body build particularly body fatness. In this study 2 dimensions of anthropometry are used to assess the human body as follows:

1) Percentage of body fat; was determined by skin-fold thickness, recorded at four sites of the body i.e. biceps, triceps, sub-scapular and supra-iliac and the total corresponding value of skin-fold at four sites were referred to with the help of the converting chart prepared by Durnin and Rah-man (1967).

2) Body Mass Index; Respondent provides information on his weight (in kg) and height (in cm) into empty boxes. These two values are used for the later computation of BMI (body mass index) according to the formula: BMI= weight (kg) / (height "m"2). The recommended values of BMI, categorized as "normal weight" are in the range BMI 18.5 – 25. As a result of elaboration, usually average values of BM are presented, but even more important is the distribution of values according to categories in the table above (i.e. what percentage of subject is in category "normal weight" etc.) (Wilmore & Costill 2004).

3.3 Data Analysis

Descriptive statistics on activity levels by ethnic were calculated to describe the characteristics of the groups of respondents. Analysis was largely by correlation and regression to see the relationships and association between variables whereas T-tests were used to compare group means on key variables. All the statistical analyses were carried out using the SPSS v.19.0 statistical package.

4. Results

Table 1. Mean and standard deviations for age, BMI, %body fat, VO2max and physical activity exercise time among students of education in (UKM) Malaysia and (SU) Libya.

	Libyan (N=122)		Malaysian (N=120)	
Variables	Mean	SD	Mean	SD
Age, yrs	22.1	1.8	22.1	1.4
Height (cm)	175.6	6.8	169.3	6.2
Weight (kg)	68.6	12.2	70.1	17.2
BMI(kg/m □ ²)	22.2	3.5	24.4	5.2
%Body fat	13.6	4.5	16.3	5.7
VO2max.(ml.kg □ ¹ .min ¯¹)	44.8	4.2	45.4	5.1
Moderate exercise time (hpw)	8.6	2.8	7.5	2.4
Strenuous exercise time (hpw)	2.0	.79	3.2	1.2
Competitive exercise time (hpw)	2.5	.92	3.1	1.2
Vigorous exercise time (hpw)	4.5	1.4	6.3	2.1
Total exercise time (hpw)	13.11	3.4	13.8	4.0

Table 1 describes the characteristics of the study population. The stature and weight among subjects were 175.6 ± 6.8 cm and 68.6 ± 12.2 kg; respectively. Body mass index was 22.2 ± 3.5 kg / m² for subject and mean and standard deviation of % body fat was 13.6 ± 4.5. In addition to that VO2max was 44.82 ± 4.24 millilitres per kilogram body weight per minute. The mean and standard deviations in Libyan were as follows: in moderate exercise 8.6 ±2.8; in strenuous exercise 2.0 ± .79; in competitive exercise 2.5 ± .92; in vigorous exercise 4.5 ± 1.4 and in total exercise 13.1 ± 3.4 hrs/ week.

Table 2. Independent-sample t-test for physical activity exercise among students of education faculty in (UKM) Malaysia and (SU) Libya

Physical activity time (hrs/per week)	Libyan		Malaysian				
	Mean	SD	Mean	SD	T	DF	P
Moderate exercise time (h/w)	8.59	2.79	7.48	2.93	3.29	240	.001
Strenuous exercise time(h/w)	2.04	.79	3.21	1.16	-9.18	240	.000
Competitive exercise time (h/w)	2.48	.92	3.07	1.19	-4.26	240	.000
Vigorous exercise time(h/w)	4.52	1.43	6.28	2.07	-7.65	240	.000
Total exercise time (h/w)	13.11	3.42	13.76	3.98	-1.35	233.6	.179

The mean age of subjects was 22.08 with standard deviation 1.39 the stature and weight among Malaysian subject was 169.3 ± 6.2 and 70.1 ± 17.2 kg respectively. Body mass index was 24.4 ±5.2 kg /m² for Malaysian subject and mean and standard deviation of % body fat was 16.3 ± 5.7 for Malaysians respectively. In addition to that, VO_{2max} for Malaysians was 45.4 ± 5.1 millilitres per kilogram body weight per minute. The mean and standard deviations in Malaysia were as follows: in moderate exercise 7.5 ± 2.4; in strenuous exercise 3.2 ± 1.2; in competitive exercise 3.1 ± .1.2; in vigorous exercise 6.3 ± 2.7 and in total exercise 13.8 ± 4.0 hrs/ week.

Table 3. Independent-sample t-test for body mass index, %body fat and aerobic fitness among students of education in (UKM) Malaysia and (SU) Libya

Variables	Libyan (N=122)		Malaysian (N=120)		T	DF	P
	Mean	SD	Mean	SD			
BMI (kg/m □ ²)	22.2	3.5	24.4	5.2	-3.8	240	.000
% BF	13.6	4.5	16.3	5.7	3.3	240	.001
VO_{2max} (ml.kg □ ¹ .min ⁻¹)	44.8	4.2	45.4	5.1	-.99	231.0	.324

Table 3 shows the difference in body mass index and %body fat among students of education in (UKM) Malaysia and (SU) Libya in which subjects were enrolled was analyzed by independent t test. Findings from this analysis revealed that there was a statistically significant difference in body mass index among students of education in (UKM) Malaysia and (SU) Libya, t= -3.77, p = .000 and %body fat t= 3.3, p= .001 (see Table 3). Therefore, Table 3 shows no statistically significant difference in aerobic fitness between students of education in (UKM) Malaysia and (SU) Libya, t= (-.99), p = .324 (see Table 3).

5. Discussion

There is a significant difference found in the present study for Malaysian participants compared to the Libyan counterparts. The mean average time in moderate exercise were 7.5 hr/w with vigorous exercise time of 6.3 hr/w for Malaysian participants and 8.6 hr/w with vigorous exercise time of 4.5 hr/w for Libyan participants. In total exercise time of 13.8 hr/w for Malaysian and 13.1 hr/w for Libyan participants as shown in Table 2. The Malaysian participants reported engaging in physical activities are almost as many times as Libyan participants, except in moderate exercise.

One interpretation that remains is that, Libyan participants tend to expend more time in activities that relate to walking and grades, as well as the effort in the care of the farms. Farming is the region's predominant agricultural activities that have a role in generating income for self-sufficiency in terms of access to agricultural products. The second interpretation is that, Malaysian participants have a lot of stadiums and arenas equipped with sporting facilities. Therefore, these results indicate the interest of the state and sports officials on educational activities and thus achieved their desired goals and developed for it.

It is evident that there is ethnic difference in the physical activities of individual participants (Suminski, Petosa, Utter & Zhang, 2002). Hayes, White, Unwin, Bhopal, Fischbacher, Harland, and Alberi (2002) compared the physical activities of a number of ethnic groups resident in the United Kingdom (UK). Bangladeshi men were found to be physically less active than their European counterparts. Whereas 52% of European men did not meet the current guideline for participants (Indian, Pakistani and Bangladesh, men were 71%, 88% and 87% respectively) in physical activities. Rune H et al. (2002) reported that among men of the two ethnic groups differed in leisure time physical activity (χ''= 11.462, p= 0.009). Sami women were less active than Norse women in leisure time (χ''= 21.568, p< 0.001). Both Sami men and women were significantly more active during work than Norse persons (χ'' = 93.819, p< 0.001 for men and χ'' = 59.323, p< 0.001 for women). In the conclusion, Sami men and women were more physically active at work and had a higher total physical activity score than Norse men and women.

The difference in body mass index between students of education in (SU) Libya and (UKM) Malaysia in which subjects were enrolled was analyzed by independent t test. Findings from this analysis revealed that there was a statistically significant difference in body mass index between students of education in (SU) Libya and (UKM) Malaysia, t= -3.77, p = .000 (see table 3). This study reported that BMI as a whole for both Malaysia and Libya was 24.38 kg/m² and 22.22 kg/m² respectively, Clearly Malaysian has higher value than Libya. Lim et al (2000) have confirmed from their findings that racial differences for BMI in present study but they reported that the most notable findings were the remarkably low BMI prevailing in all ethnic groups' population. This was in contrast with present study for Malaysian and Libyan groups whereby the researchers found racial differences in BMI. There was a significant difference between Malaysian and Libyan participants in body mass index.

The difference in %body fat between in (SU) Libya and (UKM) Malaysia in which subjects were enrolled was analyzed by independent t test. Findings from this analysis revealed that there was a statistically significant difference in %body fat between students of education in (SU) Libya and (UKM) Malaysia, t= -3.29, p = .001 (Table 3). A significant difference was found in terms of present body fat in Malaysian and Libyan participants. One interpretation is probably that the increase in body weight which we are measuring in BMI, related to both

increase in muscle volume and body fat and most likely due to strong relationship between BMI and %BF.

Corroborating their findings, Deurenberg-Yap (2000) reported that ethnic groups differ due to differences in energy balance in physical body structure. Consequently, in the present study the correlation between Malaysian and Libyan was found to be 0.79 and 0.88 respectively as reported by Pearson correlation method. They concluded that the relationship between present body fat and BMI was different among different ethnic groups. Several studies have also suggested that the relationship between BMI and %BF (i.e. the BMI–%BF relationship) varies with age, gender and ethnicity (Deurenberg & Deurenberg-Yap, 2002). Asian individuals, including Chinese, Malays and Japanese, have more body fat than Caucasians at the same BMI values (Kohl, 2001).

Therefore, Deurenberg-Yap et al. (2002) suggested that the differences in body build between Asians and Caucasians, including differences in relative leg-to-trunk length, slenderness and muscularity, as some of the reasons for this difference in the BMI–%BF relationship between ethnic groups. The differences in the BMI–%BF relationship is found to exist between two Chinese populations living in different countries (Deurenberg-Yap et al., 2002). This may indicate environmental influences on body physique.

The difference in aerobic fitness between students of education in (SU) Libya and (UKM) Malaysia in which subjects were enrolled was analyzed by independent t test. Findings from this analysis revealed that there was no statistically significant difference in aerobic fitness between students of education in (SU) Libya and (UKM) Malaysia, t= (-.99), p = .324 (see Table 3). The comparison of aerobic fitness between Malaysian and Libyan participants suggested that there was no significant difference between subjects. In contrast with these findings, Jaswant et al (2010) reported that major influence of body weight on VO_{2max} is explained by fat-free mass and fat mass does not have any effect on VO_{2max}. Thus, fatness and $_{VO2\ max}$ should be considered independent factors. In the present study, the researchers found an influence of BMI on VO_{2max} in Malaysian participants but not for Libyan participants.

Therefore, the researchers found inverse significant correlation in VO_{2max} with fat mass r= .82, p=.000 in Malaysian participants and r= .89, p= .000 in Libyan participants. In earlier report, Boulay, Ama, and Bouchard (1988) concluded that differences between ethnic groups in terms of aerobic power were small, and when other factors are taken into account, there was a little evidence for genuine ethnic differences in maximum aerobic power. A similar conclusion was reached by Sallis and his associated Sallis Patterson, Morris, Nader, & Buono, 1989). Similarly in present study for participants, Malaysian participants did not have a significant difference in estimated VO_{2max} than Libyan participants.

T-test revealed that no significant differences between Malaysian and Libyan groups in estimated VO2max, but Malaysian had extend to be higher than Libyan. Estimated VO_{2max} was depended on age, mass and physical activity, complicated problem rose because of unequal groups thus an interpretations for VO_{2max} extend to be difference between groups was that Libyan were taller and fat and engaged less in total time exercise than Malaysian participants. Apparently, lifestyle between Malaysian and Libyan did not influence on aerobic fitness. Thus more study in this area need to be done to confirm it.

6. Conclusions

Students of both country spent adequate time in PA meeting the ACSM's requirement for health dosage. Participants scored above average of 44 ml.kg □ ¹ .min ⁻¹ in which was considered as being in good fitness and good health. Although USL students scored lower BMI and less %BF, participants from UKM reported engaging more time in vigorous physical exercise time than Libyan participants who expend more time in moderate activities like walking and gardening. Extensive time spent in moderate exercise averaging approximately 9 hours per week may explain the reason why the Libyan had lower BMI and %BF. The Malaysian participants reported engaging in physical exercises almost as many times as their Libyan participants spent in moderate exercise. Clearly Malaysian was higher than Libyan in reporting for BMI and %body fat. Complicated problem raised because of unequal groups thus an interpretation for VO_{2max} extend to be difference between groups. Libyan students were taller and engaged less in total time exercise than Malaysian participants. Apparently, lifestyle between Malaysian and Libyan did not influence on aerobic fitness but influence on BMI and %Body Fat. Thus more study in this area need to be done to confirm it.

References

American College Health Association. (2008). *National College Health Assessment Reference Group Executive Summary Fall*. Retrieved June 12, 2010, from http://www.acha-ncha.org/docs/ACHA-NCHA_Reference_Group_ExecutiveSummary_Fall2008.pdf

American College Health Association. American College Health. (2006). *Association-National College Health*

Assessment (ACHA-NCHA) Spring 2005 Reference Group Data Report (Abridged). *J. Am. Coll. Health, 55*, 5-16. http://dx.doi.org/10.3200/JACH.55.1.5-16

American College of Sports Medicine. (2010). *ACSM'S guidelines for exercise testing and prescription* (8th ed.). Philadelphia, PA: Lippincott Williams & Wilkins.

Bouchard, C., & Rankinen, T. (2001). Individual differences in response to regular physical activity. *Medicine & Science in Sports and Exercise, 33*(6), S446-3. http://dx.doi.org/10.1097/00005768-200106001-00013

Boulay, M. R., Ama, P. F., & Bouchard, C. (1988). Racial variation in work capacities and powers. *Canadian Journal of Sport Science, 13*(2), 127-135.

Chiu, L. K. (2010, July). Psychological Determinants of leisure time physical activity participation among public university students in Malaysia. *AJTLHE, 2*(2), 33-45

Dencker et al. (2006). Daily physical activity related to body fat in children aged 8-11 years. *J Pediatr, 149*, 38-42. http://dx.doi.org/10.1016/j.jpeds.2006.02.002

Deurenberg, P., & Deurenberg-Yap, M. (2002). Validation of skinfold thickness and hand-held impedance measurements for estimation of body fat percentage among Singaporean Chinese, Malay and Indian subjects. *Asia Pacific J Clin Nutr, 11*(1), 1-7. http://dx.doi.org/10.1046/j.1440-6047.2002.00258.x

Deurenberg-Yap, M., Schmidt, G., Staveren, W. A., & Deurenberg, P. (2000). The paradox of low body mass index and high body fat percent among Chinese, Malays and Indians in Singapore. *International Journal of Obesity, 24*, 1011-1017. http://dx.doi.org/10.1038/sj.ijo.0801353

Dietary Guidelines for Americans. (2005). U.S. *Department of Health and Human Services U.S. Department of Agriculture* Retrieved from http://www.healthierus.gov/dietaryguidelines

Douglas, K. A., Collin, J. L., Warren, C., Kann, L., Gold, R., Clayton, S., … Kolbe, L. J. (1997). Results from the 1995 national health risk behavior survey. *J. Am. Coll. Health, 46*, 55-66. http://dx.doi.org/10.1080/07448489709595589

Durnin, J. V. G. A., & Rahman, M. M. (1967). The assessment of the amount of fat in the human body from measurements of skinfold thickness. *British Journal of Nutrition, 21*, 681-689. http://dx.doi.org/10.1079/BJN19670070

Dwyer, G. B., & Davis, S. E. (2005). *American College of Sports Medicine*.

Fox, L. E., Bowers, W. R., & Foss, L. M. (1989). *Physiological Basis of Physical Education and Athletics* (4th ed.). WM. C. Brown Publishers Dubuene, Lowa.

Hayes, L., White, M., Unwin, N., Bhopal, R., Fischbacher, C., Harland, J., & Alberti, K.G. (2002). Patterns of physical activity and relationship with risk markers for cardiovascular disease and diabetes in Indian, Pakistani, Bangladesi and Europens adults in UK population. *Journal of Public Health Medicine, 24*(3), 170-178. http://dx.doi.org/10.1093/pubmed/24.3.170

Hazizi, A. S., Mohd Hamdi, B., Leong, Y. M., & Izumi, T. (2012). Assessment of Physical Activity among Undergraduate Students in a Local University using a Pedometer. *Health and the environment Journal, 3*(1).

Hermansen, R., Njølstad, I., & Fønnebø, V. (2002). Physical activity according to ethnic origin in finnmark county, Norway. *The Finmark study. Original research, 61.*

Kohl, H. W. (2001). Physical activity and cardiovascular disease; evidence for a dose response. *Medicing & Science in Sports and Exercise, 33*(6), S472-83. http://dx.doi.org/10.1097/00005768-200106001-00017

Koley, S. (2007). Association of cardio respiratory fitness, body composition and blood pressure in collegiate population of Amritsar, Punjab, India. *The Internet Journal of Biological Anthropology.*

Lim, T. O., Ding, L. M., Zaki, M., Suleiman, A. B., Fatimah, S., Siti, S., Tahir, A., & Maimunah, A. H. (2000). Distribution of body weight, height and body mass index in a national sample of Malaysian adults. *Med J Mal, 55*(1), 108-128.

Omar-Fauzee et al. (2010). Sport Science Students' Fitness level at University Malaysia Sabah. *European Journal of Social Sciences, 12*.

Powell, K. E. (1988). *Habitual exercise and public health: An epidemiological view. In Exercise Adherence: Its Impact on Public Health.* In R. K. Dishman (Ed.), *Nutrients, 2* (pp. 15-40). Human Kinetics: Champaign, IL, USA.

Pribis, P., Burtnack, C. A., McKenzie, S. O., & Thayer, J. (2010). Trends in Body Fat, Body Mass Index and Physical Fitness among Male and Female College Students. *Nutrients, 2*, 1075-1085. http://dx.doi.org/10.3390/nu2101075

Saavedra, J. M., Torres, S., Caro, B., Escalante, Y., Cruz, E. D. l., Durán, M. J., & Rodríguez, F. A. (2008). *Relationship between health-related fitness and educational and income levels in Spanish women*. AFIDES Research Group, Facultad de Ciencias Del Deporte, Universidad de Extremadura. Spain.

Sacheck, J. M., Kuder, J. F., & Economos, C. D. (2010). Physical fitness, adiposity, and metabolic risk factors in young college students. *Med. Sci. Sports Exerc. 42*, 1039-1044.

Sallis, J. F., Patterson, T. L., Morris, J. A., Nader, P. R., & Buono, M. J. (1989). Familial aggregation of aerobic power: the influence of age, physical activity and body mass index. *Research Quarterly in Exercise and sport, 60*(4), 318-324. http://dx.doi.org/10.1080/02701367.1989.10607458

Shaw, K., Gennat, H., O'Rourke, P., & Del Mar, C. (2006). Exercise for overweight or obesity. *Cochrane Database Syst. Rev., 4.* http://dx.doi.org/10.1002/14651858.CD003817.pub3

Sofian, M. (2007). Attiudes toward physical activity among college students. *Pakistan journal of psychological research, 22*(1-2), 43-54.

Suminski, R. R., Petosa, R., Utter, A. C., & Zhang, J. J. (2002). Physical activity among ethnically diverse college students. *Journal of American college Health, 51*(2), 75-80. http://dx.doi.org/10.1080/07448480209596333

Thakur, J. S., Yadav, R. C., & Singh, V. K. (2010). Influence of Body Composition on the Dimensions of VO2 Max. *VSRD-TNTJ, I*(2), 72-77.

Wilmore, J. H., & Costill, D. L. (2004). *Physiology of Sport and Exercise.* Champaign, Illinois: Human Kinetics.