Exercise and nutrition

Exercise and proper nutrition are general concepts of health care needs required by the body for normal functioning. The following paper illustrates the interdependent relationship between proper nutrition and adequate exercise in order to achieve balance directed towards optimum body function. Recently, scientific interests on primary heath care have focused on the increasing scholarly literatures revealing the promising impact of the combined effects of proper nutrition and adequate exercise in treating various disorders of the body. b.

Overview of the ProblemProper nutrition and exercise are already established social and health facts comprising the model of healthy lifestyle. Fundamental theories of basic needs (e. g. Maslow's Hierarchy of Needs, Nightingale's Environmental Theory, etc.

) categorize these two components as physiological needs required by the body to function efficiently and effectively. However, according to Brown, Miller and Eason (2006), most literatures on proper nutrition and exercise fail to emphasize the limitations or applicability of these conditions derived from their fundamental physiology within the body (p. 288). Contrary to the generally established norms, nutritional intake is not all the time beneficial to the human body similar to physical activities.

Driskell and Wolinsky (2005) emphasize the limitations of nutrition and exercise that, if crossed, may lead to damaging effects in various systems of the body (p. 169). In an essence, knowing what to eat or knowing what activities suit best is not enough to achieve the two components of healthy lifestyle. In order to prevent the consequences of nutritional imbalances and unsuccessful exercise programs, one must understand the physiology and fundamental relationships occurring between nutrition and exercise, and systemic physiology (Wilmore, Costill and Kenney, 2008 p.

325-326). The following sections of the study cover the (a) two components of optimum health needs – nutrition and exercise- and (b) the physiologic interactions between these components and the bodily systems. II. Review of Literaturea. Nutrition and ExerciseProper nutrition and exercise are two generic components of optimum health according to the fundamental theories on human beings' fundamental needs. In fact, McArdle, Katch and Katch (2007) state that proper nutrition and exercise share a natural relationship.

Adequate nutritional intake serves as the primary foundation of physical performance, while adequate exercise acts as the channel activity used by the body to release the stored energy consumed from food intake and various physiologic reactions in the body (p. 3). Based on the diet-exercise relationship study of Layman, Evans and Baum et al. (2005), two categorized forms of diets, specifically (a) protein-based (PRO) and (b) carbohydrate-based (CHO), were performed with supervised exercise regimen among 48 women (less than 46 years old, body mass index (BMI)= 33 kg/m2) on a 4-month weight loss program. Results revealed significant reductions in lipid profiles in all groups (CHO= decrease in Low Density Lipoprotein (LDL) or bad cholesterol; CHO= decrease in triacylglycerol with marked higher concentrations of High-Density Cholesterol (HDL) or good cholesterol) brought by the combined effects of diet and exercise. Nutrition and exercise move through cyclical relationship dependent to each other in order to facilitate the body's optimum physical wellness.

As explained by Taylor and John (2007), adequate nutrition allows the entry of body required vitamins and minerals to compensate the developmental needs of the body systems, while exercise or physical activity aids in the metabolic processes breaking absorbed nutrients and distribute throughout the body (p. 74). Added by Lang and Hansrud (2004) of the American Medical Association (AMA), dietary intake " must be equivalent in the total calories (energy) and percentage of fat and carbohydrate utilized during the exercise activity" (p. 164). Nutritional intake and exercise largely depend on the developmental needs imposed by several innate factors, such as aging, environment, physical health, and others.

Battinelli (2007) views these components as potential contributors to the triadic relationship existing between (1) nutrition, (2) activity or exercise and (3) body physique (p. 9). McArdle, Katch and Katch (2007) support the triadic relationship addressing that the combinations of planned exercise and proper diet are the key elements for achieving physiologic balance unattainable through diet or exercise alone (p. 871).

Based on the hierarchy of needs established by Maslow, exercise and nutrition must be met in order to achieve the next level of needs (Lang and Hansrud, 2004 p. 164). Theoretically, fulfilling the basic physiologic needs comprising of nutrition and exercise is the first step towards optimum health.

b. Elements Affecting the Impact Nutrition and ExerciseProper nutrition and adequate exercise comprise the generic idea of compositions healthy lifestyle.

According to Battinelli (2007), the cyclical, triadic relationships of the following three elements are crucial to the attainment of optimum health: first, nutritional diets introduce food biochemical contents in the body; secondly, exercise burns calories and fats, while stimulating body metabolism to facilitate absorption of nutrients; lastly, nutrients are distributed throughout the body through transports (e. g. red blood cell (RBC) carriers, lymph pathways, exocrine hormones, etc). In order to achieve the optimum level of health, Coulston and Boushey (2008) emphasize the value of physiologic balance (p. 318). Bodily balance achieved through combined effects of proper nutrition and adequate exercise has been supported by various scholarly studies.

Balanced nutrition and adequate exercise markedly show evident body enhancements and optimization of system functioning. The interdependent relationship between nutrition and exercise was explained in the bone development study of Ezquerra, Mesana and Fernandez-Alvira et al. (2008). Based on the study, food intake provides the required nutritional components for adequate metabolic functions in the bone (e. g. erythropoietin synthesis, hemoglobin production, etc.

). Meanwhile, exercise stimulates osteogenic responses affecting calcification, bone mass development and bone supplementation (Ezquerra, Mesana and Fernandez-Alvira et al., 2008). In another controlled study conducted by Kemmler, Lauber and Weineck et al. (2004), sample population consisting of 50 compliant early postmenopausal osteopenic women for exercise group (EG-EPOW) had undergone an exercise program for over 26 months (Bi-weekly group and home training sessions) with calcium and cholecalciferol supplementation, and balanced food intake. Meanwhile, another 33 EPOW women had been placed as a nonstraining control group (CG-EPOW) to serve as the baseline data.

Results revealed promising results among EG-EPOW samples manifested by development in their isometric strength (trunk extensors: EG +36. 5% vs. CG +1. 7%; trunk flexors: EG +39.

3% vs. CG –0. 4%), Bone-Mineral density (BMD) (lumbar spine (L1 to L4): EG +0. 7% vs.

CG –2. 3%), total hip (EG –0. 3% vs. CG –1. 7%), serum levels (total cholesterol: EG –5. 0% vs.

CG +4. 1%) and triglycerides (EG –14. 2% vs. CG +23. 2%) (Kemmler, Lauber and Weineck et al. (2004).

The study showed dramatic improvements in the bone structures of EG-EPOW samples as well as their lipid-blood compositions. Meanwhile, the study of Pedersen, Bruunsgaard and Jensen et al. (1999) from Copenhagen Muscle Research Centre and Department of Infectious Diseases (CMPC-DID) explored the possible impacts of unbalanced exercise activities and nutritional intake. Based on the study, strenuous exercise activities with inadequate nutritional intake led to immunologic impairments (e. g.

lymphopenia, neutrophilia, alterations of natural antibodies, high-circulating anti-inflammatory cytokines, etc.

). As explained by the study of Gleeson, Nieman and Pedersen (2004), imbalance between exercise and nutritional intake predispose exercise-induced immune depression due to inadequate intake of iron, zinc, vitamins A, E, B6 and B12 as well as other specific micronutrients combined with strenuous and prolonged exercise. Meanwhile, the study of Timmons, Tarnopolsky and Bar-or (2004) contend that the effects of exercise-nutrition may vary based on non-modifiable elements influencing bodily responses on such combination. Immune responses of combined dietary consumption and exercise to children and adult men showed varying differences. Based on the study of Timmons, Tarnopolsky and Bar-or (2004), samples consisting of twelve boys (9.

8 +/- 0. 1 years old) and ten adult men (22. 1 +/- 0. 5 years old) had their 60 min cycling exercise while drinking their 6% carbohydrate-based flavored water. Results markedly showed varying increase between two age groups samples wherein boys has smaller increases in total leukocytes (28%), natural killer (NK) cells (78%) and NK T-cells (42%), while other immunologic factors (i. e.

tumor necrosis factor (TNF)-alpha and neutrophils) remained unchanged. In the group of adult men, results showed marked increases in leukocytes (38%), NK cells (236%), NK T-cells (128%) and TNF-alpha (189%). In another study showing the effects of nutrition-exercise regimen, Leon and Sanchez (2001) reviewed the effects of aerobic exercise with dietary dosage analysis on blood lipids and body weight conditions. According to Leon and Sanchez (2001), there had been 51 studies indicating consistent results of marked high-density lipoprotein-cholesterol (HDL-C) reductions involving decline in total cholesterol, LDL-C and triglycerides in response to the intensity of exercise performed and dietary interventions taken. By implication, the results of the studies above suggest possible variations of nutrition-exercise effect influenced by external and internal components, such as age, intensity of exercise, and nutritional intake.

c. Physiology of Nutrition and ExerciseThe physiological impact of proper nutrition and exercise in the body involves distinct relationships and physiological processes aimed at maintaining internal bodily balances. McArdle, Katch and Katch (2007) support the idea pointing on the need for well-planned diet program combined with vigorous-structured exercise in order to achieve well-balanced physical stature evidenced by (a) attaining the ideal BMI of 18 to 25 for individuals weighing the average 125 to 168 lbs (Coulston and Boushey, 2008 p. 317), (b) satisfying the generally acknowledged RDI recommended daily calorie consumption of 2, 000 Kcal (National Academy of Sciences (NAS), 2004), and (c) attaining the average 1, 600 to 3, 200 Kcal energy expenditures for females and 2, 900 to 10, 5000 Kcal among males (Coulston and Boushey, 2008 p.

318). The above study indicates the crucial balance of food intake and energy expenditures released during exercise. Theoretically, physiological balance can be attained by adhering to these conditions. Meanwhile, the following studies address the different processes and systemic interactions caused by exercise and nutrition administered to the body. In the study of

Jeukendrup (2004), dietary intake combined with exercise patterns comprised various internal mechanisms occurring to main appropriate phases of nutritional absorption, distribution and elimination.

Jeukendrup (2004) used the illustration of carbohydrate consumption vs. exercise and performance based on oxygen consumption. As stated by Jeukendrup (2004), oxidation efficiency rate amounting to 20% – 50% showed significant inverse relationship with carbohydrate delivery and absorption. Explained by Coulston and Boushey, (2008), the process of nutritional distribution is facilitated through hemo-transporters present in RBCs (hemoglobin), cellular organelles, receptor sites and hormonal channels (p.

318). Wilmore, Costill and Kenney (2008) add that the most processes of bodily transports require oxygen (e. g. hemoglobin, etc.), adenosine triphosphate (ATP) derived from burned calories, and other essential elements (e.

g. iron, zinc, selenium, vitamin D, B12, etc) (p. 327). Based on the study of Helge, Watt and Richter et al.

(2004), increase in fat oxidation could be best facilitated through adequate activity patterns or exercise, since higher oxygenation and consumption showed marked increase during exercise (Jeukendrup 2004). In order to demonstrate the correlations between physiologic transports and high rates of oxygenation, Helge, Watt and Richter et al. (2004) utilized 12 male unstrained samples categorizing them into two groups: (a) Group consuming fat-rich diet (n= 7; 62% fat, 21% carbohydrate) and (b) Group consuming carbohydrate-rich diet (n= 6; 20% fat, 65% carbohydrate). Theoretically, the burning of calories achieved through exercise initially targets available carbohydrates absorbed by the body prior to glycogen-deposited carbohydrates found in fats (Coulston and Boushey, 2008 p. 318).

Results of the study revealed significant decrease of high LDL lipoprotein-triacylglycerol (TG) among the group consuming fat-based diet compared to the other group (132 ± 26 vs. 16 ± 21 ? mol min? 1). Meanwhile, lipid oxidation showed marked increase (55-65%) among fat-rich diet group. Analyzing these results, the study revealed the physiologic order of carbohydrate distribution via the available transports produced through variations in oxygenation and lipid oxidation brought by exercise (Helge, Watt and Richter et al., 2004).

Rogol, Clark and Roemmich (2000) from University of Virginia Health Sciences utilized these correlations associating with growth and development analysis. According to them, proper somatic growth and maturation are dramatically influenced by the existing bodily stability between nutritional distribution, absorption and elimination. Rogol, Clark and Roemmich (2000) viewed " nutritional status and heavy exercise training are 2 of the major influences on the linear growth of children…" Consistent and appropriate phases of growth and development are significant manifestations of well-balanced nutritional intake and caloric expenditure brought by exercise leading to optimum body functioning. Tipton and Wolfe (2001) further explained the correlations of these components by studying exercise, nutritional metabolism and muscular growth – three essential components of physical development. From the two group samples of Helge, Watt and Richter et al. (2004), marked protein breakdown had been observed among high carbohydrate-diet group.

Tipton and Wolfe (2001) explained that food taken during for the last 24 to 48 hours are immediately subjected to absorption through carbohydrate simplifications or conversions to glucose. During this time, absorbed carbohydrates must be burned through exercise to decrease glycogen storing, and deposition of excess carbohydrate and fats into adipose tissues, while absorbed protein amino acids remain as the last target of physiologic metabolism. According to Tipton and Wolfe (2001), " interaction of postexercise metabolic processes and increased protein amino acid availability maximizes the stimulation of muscle protein synthesis and results in even greater muscle anabolism than when dietary amino acids are not present." As supported by the study of Hargreaves and Cameron-Smith (2002), high availability of dietary amino acids combined with exercise activities increases the skeletal muscles' mRNA levels producing cumulative effects of protein buildup. In addition, dietary manipulations and exercise activities enhance gene expressions of skeletal muscles allowing enhanced growth and development (Hargreaves and Cameron-Smith, 2002).

Indeed, nutritional intake and caloric metabolism largely contribute to the balance of the body leading to growth and development, which is facilitated through efficient utilization of dietary components and maintenance of protein anabolic build-up. d. Nutrition and Exercise: Chronic IllnessesImproper nutritional intake and inadequate exercise activities have always been associated with various kinds of chronic and acute cardiovascular, metabolic and musculoskeletal illnesses. According to

Roberts and Barnard (2005), chronic illnesses, such as diabetes mellitus, metabolic syndrome, cardiovascular disorders, associated with nutrition and exercise are now becoming the leading killers in United States. Meanwhile, recent studies have uncovered other bodily disruptions associated with faulty nutrition and exercise. Gleeson, Nieman and Pedersen (2004) point out that excessive intake of micro and macronutrients, as well as lipid-based substances may predispose immunologic depression due to the hormonal response of stress hormones (e.

g. cortisol, etc.) inducing parasympathetic immunologic response. Nutrition and exercise patterns had been associated with the risk components of chronic illnesses brought by distinct changes in the cellular profile and bodily chemistry of various systems in the body (Nicklas, Ambrosius and Messier et al.

, 2004). The elderly age group (> 50) is considered as the largest demographic experiencing improper diet, malnutrition and inadequate exercise activities (Brownie, 2006). As explained by the review study of Brownie (2006), physical contributes to the increasing nutritional need of the body as well as the adequacy of physical activities required by the body to slow down the gradually declining physiological processes (e. g. metabolic rate, digestive activity, electrolyte regulation, immunology, etc.

) induced by aging. In the another study documented by Nicklas, Ambrosius and Messier et al. (2004), the effects of nutrition-exercise on low-grade inflammation and chronic diseases (e. g. osteoarthritis, obesity, diabetes mellitus, etc.) had been evaluated through four 18-month treatment, namely

(a) healthy lifestyle control, (b) diet-induced weight loss, (c) exercise (combination of weight training and walking for an hour thrice weekly) and (d) diet plus exercise.

Samples (n= 316; > 60 years old; BMI: > 28) had been randomly assigned according to the four sets of programs. Results of the study reveal significant reductions in C-reactive protein, interleukin and soluble tumor necrotic factors among patients under diet-induced weight loss (Nicklas, Ambrosius and Messier et al., 2004). Explained by the literary review of Brownie (2006), imbalances in nutritional status and activity requisites of the body result to chronic decline of most bodily functions associated with the maintenance of physiologic homeostasis. Latter discussed studies had shown distinct relationships of body physiology and balance in nutrition-exercise needs. Combined nutrition and exercise regimen had also shown great importance in the study of Roberts, Vaziri and Barnard (2002) in preventing a chronic cardiovascular condition – coronary artery disease.

The study explored the relationships between the effects of diet and exercise on blood pressure (BP), insulin, oxidative stress (OS) and nitric oxide availability (NOA). The study comprised 11 men placed under low-fat, high-fiber diet together with exercise program of 45 to 60 minutes for 3 weeks. Results revealed dramatic metabolic improvement in BP (pre-intervention: 137/81 vs. post-intervention: 119/73), insulin (22. 9±3.

9 vs. 12. 3±1. 8), LDL (113.

2±6. 1 vs. 87. 5±6.

0), triglycerides (223±52 vs. 131±20) and total cholesterol (4. 95±0. 42 vs.

4. 39±0. 35). Combined nutrition and exercise regimen following appropriate standards of caloric consumption, nutritional intake and caloric expenses strongly suggest promising impact in the prevention of chronic illnesses and promotion of the body's physical health and well-being. Based on the study of Patrick, Calfas and Norman (2006), primary care interventions with follow-up visits largely depend on the motivating forces present in the external environment.

The study consisted adolescents aged 11 to 15 years old (n= 878) undergoing primary care follow-up based on computer-assisted diet and exercise assessment for one year time frame. Combining proper nutrition and adequate exercise patterns provide consistent beneficial results in preventing chronic illnesses and promotion of health status. Primary care interventions have always included these two components in planning and providing care to patients requiring nutrition-activity associated physiological homeostasis. III. SynthesisIn synthesis of this literature review study, the effects of proper nutrition and adequate exercise have provided consistent results showing the beneficial nature of such regimen in prevention of chronic illnesses and promotion of health.

Meanwhile, the study emphasizes the need for maintaining a well-balanced relationship between nutrition and exercise in order to avoid untoward bodily reactions and responses that may predispose chronic illnesses. In the essence, proper nutrition and exercise must always conform to the standard physiological needs of the body in order to prevent systemic alterations, such as lipid deposition due to high nutritional intake and lowered activity or immunologic reactions due to strenuous exercise with lowered dietary consumption. In relation to the problem statement imposed to this study, the relationship between nutrition and exercise leading to optimum health must always be in balanced interactions. Furthermore, such relationships must consider other external contributors affecting the developmental and physiologic needs of the body, such as aging, environment, support systems, etc. At the end of the review, the following gaps have been evaluated and recommended for future studies on he subject of nutrition and exercise:· Determine the quantitative exercise limitations in terms of duration, frequency and type according to the different developmental stages from adolescent to elderly adults· Obtain a qualitative analysis in the relationship of sedentary lifestyle and improper nutritional in relation to chronic illnessesIV. ReferencesBattinelli, T.

(2007). Physique, Fitness, and Performance. New York, London: CRC Press. Brown, S. P.

, Miller, W. C., & Eason, J. M. (2006). Exercise Physiology: Basis of Human Movement in Health and Disease.

New York, U. S. A: Lippincott Williams & Wilkins. Brownie, S. (2006, April).

Why are elderly individuals at risk of nutritional deficiency?. International Journal of Nursing Practice, 12, 110-118. Coulston, A. M., & Boushey, C. J.

(2008). Nutrition in the Prevention and Treatment of Disease. New York, London: Academic Press. Driskell, J.

, & Wolinsky, I. (2005). Sports Nutrition: Vitamins and Trace Elements. New York, London: CRC Press. Ezquerra, J.

, Mesana, M., & Fernandez-Alvira et al., (2008, September). Independent and combined effect of nutrition and exercise on bone mass development.

. Journal of Bone & Mineral Metabolism, 26, 416-424. Gleeson, M., Nieman, D. C.

, & Pedersen, B. K. (2004, January). Exercise, nutrition and immune function.

Journal of Sports Sciences, 22, 115 – 125 . Hargreaves, M., & Cameron-Smith, D. (2002, September). Exercise, diet, and skeletal muscle gene expression. Medicine & Science in Sports & Exercise, 34, 1505-1508.

Helge, H. W., Watt, P. W., & Richter et al.

, E. A. (2004, August). Fat utilization during exercise: adaptation to a fat-rich diet increases utilization of plasma fatty acids and very low density lipoprotein-triacylglycerol in humans. The Journal of Physiology, 537, 1009 – 1020. Jeukendrup, A.

(2004, January). Carbohydrate intake during exercise and performance. Journal of Nutrition, 20, 669 – 677. Kemmler, W.

, Lauber, D., & Weineck et al., J. (2004, May). Benefits of 2 Years of Intense Exercise on Bone Density, Physical Fitness, and Blood Lipids in Early Postmenopausal Osteopenic Women linical trial. Archives of Internal Medicine, 164, 1084-1091.

Lang, R. S., & Hensrud, D. D. (2004).

Clinical Preventive Medicine. New York, London: AMA Bookstore. Layman, D. K.

, Evans, E., & Baum et al., J. I.

(2005, August). Dietary Protein and Exercise Have Additive Effects on Body Composition during Weight Loss in Adult Women. The Journal of Nutrition, 135, 1903-1910. Leon, A. S.

, & Sanchez, O. A. (2001, June). Response of blood lipids to exercise training alone or combined with dietary intervention. Medicine & Science in Sports & Exercise, 33, S502-S515.

McArdle, W. D., Katch, F. I., & Katch, V. L.

(2007). Exercise Physiology: Energy, Nutrition, and Human Performance. New York, U. S. A: Lippincott Williams & Wilkins.

National Academy of Sciences, (2004, January). Dietary Reference Intakes (DRIs): Recommended Intakes for Individuals, Vitamins. National Academy of Sciences, Nicklas, B. J., Ambrosius, W.

, & Messier et al., S. P. (2004, January).

Diet-induced weight loss, exercise, and chronic inflammation in older, obese adults: a randomized controlled clinical trial. American Journal of Clinical Nutrition, 79, 544-551 . Patrick, K., Calfas, K.

J., & Norman et al., G. J. (2006, February). Randomized Controlled Trial of a Primary Care and Home-Based Intervention for Physical Activity and Nutrition Behaviors .

Archives of Pediatric and Adolescent Medicine, 160, 128-136. Pedersen, B., Bruunsgaard, H., & Jensen et al., M. (1999, June).

Exercise and immune function: effect of ageing and nutrition. Proceedings of the Nutrition Society , 58, 733-742. Roberts, C. K., & Barnard, R.

J. (2005, June). Effects of exercise and diet on chronic disease . Journal of Applied Physiology, 98, 3-30. Roberts, C. K.

, Vaziri, N. D., & Barnard, J. (2002, January). Effect of Diet and Exercise Intervention on Blood Pressure, Insulin, Oxidative Stress, and Nitric Oxide Availability . Circulation, 106, 2530-2532.

Rogol, A. D., Clark, P. A.

, & Roemmich, J. N. (2000, August). Growth and pubertal development in children and adolescents: effects of diet and physical activity. The American Journal of Clinical Nutrition, 72, 521S-528S. Taylor, A.

W., & Johnson, M. J. (2007). Physiology of Exercise and Healthy Aging.

New York, U. S. A: Human Kinetics. Timmons, B.

W., Tarnopolsky, M. A., & Bar-or, O.

(2004, August). Immune Responses to Strenuous Exercise and Carbohydrate Intake in Boys and Men. Pediatric Research, 56, 227-234. Tipton, K. D., & Wolfe, R.

R. (2001, March). Exercise, protein metabolism, and muscle growth. Internal Journal of Sport Nutrition and Exercise Metabolism, 11, 109-132. Wilmore, J. H.

, Costill, D. L., & Kenney, W. L. (2008).

Physiology of Sport and Exercise. New York, London: Human Kinetics.