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Physical Activity, Dietary Intake and Nutritional Status of Young Adult Student Athletes and Gamers in a Philippine University

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Abstract

Obesity continues to be a leading cause of global mortality cases. It has been linked with low physical activity and sedentary lifestyle since 2008 with a prevalence of insufficient physical activity in adults. This study aimed to investigate the relationship of physical activity and dietary intake to the nutritional status of young adult student athletes and gamers belonging to the University of the Philippines Los Baños (UPLB). A total of 79 student athletes and 37 gamers were gathered as respondents. Anthropometric measurements such as height and weight were measured for their BMI interpretation using WHO classification. Further data were obtained through a survey form which contained a personal background section and two standardized questionnaires to assess physical activity namely the Sedentary Behavior Questionnaire (SBQ) and International Physical Activity Questionnaire-Short form (IPAQ-SF). Three-nonconsecutive food recalls were conducted to assess their usual dietary intake. Results showed that the assessment of athletes' nutritional status were significant wherein they generally had a normal BMI interpretation while gamers do not. Moreover, in the dietary assessment, there was only a significant difference between the energy intake of athletes and gamers wherein athletes had higher mean intake of energy than gamers. As for the nine sedentary behaviors, there was only a significant difference with playing video games between athletes and gamers. SBQ results showed that gamers spend longer hours in playing video games than athletes. For relationship of physical activity and dietary intake with nutritional status, results from the Spearman's correlation revealed that there was a very weak negative linear relationship between physical activity and nutritional status of an individual wherein nutritional status is dependent on the nature of physical activity while there was no significant relationship found with dietary intake. More regulated frequency and intensive physical activity would lead to maintain or achieve a normal nutrition status.

Keywords: *Athlete; Dietary Intake; Gamer; Physical Activity; Young Adult*

Introduction

In the fast evolution of modern society, developing countries continue to strive for advancements in various fields for their stability and progress while also combating their current struggles. The Philippines, belonging to one of the many developing countries of the world, faces numerous difficulties wherein health is one of its major concerns. In the area of health concerns, nutritional problems come out on top as one of the leading contributors to poor health and lifestyle practices. There must be an increasing need for addressing nutrition problems since various factors contribute to an individual's nutritional status that affect their overall health condition. Improving the country's nutrition situation has continuously been the goal for undertaking nutrition research, and implementation of policies and projects [1].

According to the World Health Organization [2], around the world, 31% of adults who are at least 18 years of age were found to be insufficiently active in 2010 with men at 20% while women at 27%. Moreover, the World Health Organization [2] stated that the lack of physical activity has been identified as the fourth leading risk factor of global mortality contributing six percent of deaths globally. Physical inactivity was also linked with the main cause for approximately 21 to 25% of breast and colon cancers, 27% of diabetes and 30% of ischemic heart disease burden [2]. Moreover, in western populations, it has been documented that physical inactivity was associated as a risk factor for cardiovascular diseases while a two-fold increase in risk of cardiovascular diseases was linked with living a sedentary lifestyle. The prevalence of a sedentary lifestyle had further increased especially among the young adult individuals due to the increasing rates of urbanization and other major changes in human behavior. Prevalence of adult sedentary behavior such as increased hours spent on sitting in front of their television playing video games had been linked to increased physical inactivity since physical activity generally decreases as television watching increases. In developed countries, like the United States of America, 53% of adult Americans play video games while 21% play every day or almost every day in a week. This had been linked to chronic diseases and obesity since low physical activity had been thought to be both a contributory cause and consequence of obesity [3,4]. With this, there is a substantial need to take corrective actions especially on the aspect of nutrition.

Adulthood is comprised of individuals with ages ranging from 18 to 65 years old and is considered as a relatively quiet life stage as compared to other life stages in a nutritional perspective. Through the completion of growth towards the end of the adolescent years, adult physiology becomes stable only until senescence sets in wherein degenerative processes associated with aging begin to affect organ functions. Aside from this, adulthood also represents most of the adverse consequences of poor nutrition and acquisition and development of unhealthy lifestyle behaviors from earlier life stages that begin to manifest as major disease starts [5].

Adulthood is further divided into three phases namely; early adulthood, midlife and old age. Early adulthood entails the individuals to embark the transition into becoming independent such as leaving their homes, completing their school education, applying for employment and starting a career. In addition, they will start entering and forming relationships wherein they may soon choose their future partners. Those classified as young adults are individuals from ages 18 to 30 years old [6]. Under young adulthood, this life stage is also considered as the period for emerging adulthood which is an overlooked but important age for establishing long-term health behavior patterns. There are several factors that differentiate emerging adulthood from the other life stages since it includes the development of one's self identity and shifting of interpersonal influences. Furthermore, this period involves the exploration of new ideologies and behaviors that help express and mold their individuality which serves as an indicator of lasting health behavior changes and period for establishing interventions on long-term health behavior patterns [7]. Based from the challenges during adulthood, those in their adult years must begin focusing on achieving and maintaining a state of well-being that leads them to achieve positive health or wellness and beneficial lifestyle choices since they have mostly reached full maturity and growth in terms of body composition [8]. Thus, the priority of a young adults is to establish lifestyle patterns that promote their personal health and to attain a state of well-being and fitness for a lifetime.

In view of the aforementioned composition of young adult individuals, more work on researches regarding the nutrition of young adults particularly athletes and gamers are needed especially in the Philippines since there are increasing risks of developing physical inactivity and sedentary living that results to cardiovascular diseases and pre-mortality. Facing this enormous struggle, everybody should raise their desire to educate themselves and initiate more actions on providing a healthy foundation for the young people; since the early incorporation of active physical fitness and proper dietary intakes could be greatly beneficial to their overall health and nutrition.

The study investigated the relationship of physical activity and dietary intake to the nutritional status of young adult student athletes and gamers of the University of the Philippines Los Baños. It is specifically aimed to assess the nutritional status and dietary intake of student athletes and gamers in the collegiate level; compared the two groups in terms of Body Mass Index (BMI), physical activity and dietary intake; and correlated the physical activity and dietary intake with nutritional status.

Methodology

Location of the study

The study was conducted in the University of the Philippines Los Baños, Laguna (UPLB) during the second semester of the academic year 2018 - 2019. The respondents of the study came from enrolled college students who are athletes and gamers. Moreover, the respondents comprised of young adults aged between 18 to 25 years old. The site was selected because of the proximity and accessibility to the community and due to the availability of the respondents needed for the survey. Additionally, this was chosen since the study aimed to find the difference between the physical activity and dietary intake of student athletes and gamers and its relationship to their nutritional status.

Population and sampling procedure

The population of the study consisted of male and female undergraduate students which were comprised of student athletes and gamers who were categorized in the young adult age group between 18 to 25 years old at the time of the interview and were under one of the following weight categories such as underweight, normal, overweight, obese class I or obese class II. Furthermore, those who were free from chronic diseases were included in the sampling.

The chosen student athletes were included in the official roster of team ball sports such as: basketball, volleyball and football wherein both male and female teams were considered. The chosen gamers, on the other hand, were male and female members from the university organization, UP Alliance of Gamers. Among the varsity sports at the university, these three sports were chosen since they were classified in the same sports category which is team sports and ball games. Moreover, the three sports have similar levels of vigorous physical activity. The members from the UP Alliance of Gamers were chosen since it is the only established gaming organization in the university and the medium used in gaming involves mobile, video and computer games. The respondents' anthropometric measures such as height and weight, and dietary intake were also considered.

Stratified random sampling was used wherein the undergraduate student population was divided into two groups namely, student athletes with a total of 112 athletes and student gamers which consisted of 53 gamers. The 112 athletes sub-consisted of 17 male basketball athletes, 17 female basketball athletes, 21 male football athletes, 17 female football athletes, 25 male volleyball athletes and 15 female volleyball athletes. The gamers, on the other hand, only consisted of three female members and had 50 male members. Of the 112 athletes and 53 gamers, 79 athletes and 37 gamers were randomly selected. The sample size was obtained using a margin of error of 5% and a level of confidence of 95% and was calculated using Cochran's formula, where n_0 is the sample size, e^2 is the margin of error, Z^2 is the abscissa of the normal curve that cuts off an area at the tails, p is the degree of variability and q is equal to 1 - p. From the target sampling, 116 respondents participated in the study. On the occurrence that one of the respondents declined to participate due to the period of data collection in the semester, another random selection from the list was conducted to meet the margin of error. Reasons for declining to be part of the study included busy or conflicting schedules of the respondent due to personal, mental health issues and other academic matters.

Data collection procedure

Preparation

Prior to the conduct of the study, request letters for securing the respondents were verified and signed by the faculty-in charge. The roster of student athletes was obtained through the assistance of the Department of Human Kinetics and only those who were within the age range of young adults were included specifically those from 18 to 30 years old. Additionally, athletes who were considered were those enrolled during the second semester and had received proper training from the school varsity teams. Moreover, athletes belonging to either one of the competitive team ball sports such as basketball, volleyball or football were chosen as participants of the study due to the similar intensity of physical activity. As for the student gamers, the students considered are members of the student gaming organization, UP Alliance of Gamers and the head of the organization granted permission to conduct the survey among their members. Initial meetings with the respondents were scheduled through contacting them via text and online messenger. For student athletes, coaches of the respective teams were also contacted during training sessions to inform and request assistance in the data collection of the study. Some respondents from each sport team and from the gaming organization, who had already been interviewed, volunteered to help contact the other respondents. At the initial meeting, each participant was given a printed consent form and properly explained to them and emphasized that their participation in the study is completely voluntary. Additional queries regarding the study were also answered. They were also informed that their responses shall remain confidential. Moreover, the scheduling of the next meetings for anthropometric assessment and 3 non-consecutive food recalls were set. The printed questionnaire on physical activity was also accomplished after the participant agreed to be part of the study.

Preparation for gathering the anthropometric measurements of the respondents were also done before the conduct of the study. Requisition forms were submitted to the office and were reserved to be used for the duration of three weeks. Letter addressed to the Institute Director was made and submitted to the office in order to use the nutrition clinic room in the institute to facilitate ease and coordinated data gathering. The nutrition clinic was chosen because of its availability, accessibility and proper ambiance for initial interviews and safe storage for the anthropometric equipment.

Selection of questionnaires

Two questionnaires to measure physical activity was used for the study namely the Sedentary Behavior Questionnaire (SBQ) and the International Physical Activity Questionnaire - Short Form (IPAQ-SF). These two questionnaires were chosen to categorize the level of physical activity of the gamers from their athlete counterparts. Moreover, these questionnaires were both chosen since they were applicable to be self-administered and were internationally accepted and considered as standardized questionnaire so pre-testing was not needed. The Sedentary Behavior Questionnaire (SBQ) was adapted from a measure used in children who had some evidence of reliability and validity. This questionnaire was chosen to seek any differences in specific sedentary behaviors between the athletes and gamers since this test assessed the amount of time spent doing 9 different behaviors such as watching television, playing computer or video games, sitting while listening to music, sitting and talking on the phone, doing paperwork or office work, sitting and reading, playing a musical instrument, doing arts and crafts, sitting and driving/riding a car, bus, or train [9]. The SBQ had good reliability and acceptable validity to assess sedentary behaviors in the study on Turkish population [10]. The International Physical Activity Questionnaire - Short Form (IPAQ-SF) was chosen to estimate the intensity of physical activity of the respondents since it assessed the level of physical activities like walking, moderate activity, and vigorous activity and estimated sitting time from the previous seven days which were part of individuals'

daily life that were considered to estimate physical activity in MET-min per week and time spent sitting. Moreover, this measure had been recommended as a cost-effective method to assess physical activity and based from the test - rest reliability, it had indicated good stability and high reliability ($\alpha < .80$) [11].

Anthropometry

Weight and height of the respondents was measured in the Nutrition Clinic at the Institute of Human Nutrition and Food in UPLB. The WHO BMI classification was used for assessing their nutritional status and BMI. For height, a stadiometer was used and measurement was recorded in the nearest 0.1 centimeters while for the weight, a SECA digital weighing scale was used and measurement was recorded in the nearest 0.1 kilograms. Standard measurement protocols and usage of standard equipment were followed [12]. Briefly, footwear and headwear (if any) were removed before measuring height and respondent was asked to stand straight facing the measurer, arms placed at their sides, with feet flat on the floor and the heels of their feet firmly against the wall. Moreover, the respondents were asked to look straight ahead at eye level. In measuring weight, the respondents were instructed to remove wristwatches or bracelets, eyeglasses, footwear and headwear and to empty their pockets to obtain an accurate reading.

Dietary assessment

Three-nonconsecutive food recalls were used to estimate the average food intake of athletes and gamers over a long period of time to account for their usual food intake. This method was chosen since it is a quantitative tool which has been recommended internationally in assessing food consumption patterns. A 24-hour food recall contain detailed description of all food and beverages consumed with the cooking methods and brand names [12].

Data analysis

A one-on-one interview with the respondents was conducted to find correlation between their physical activity and dietary intake for the comparison between student athletes and gamers. Three (3) nonconsecutive 24-hour food recall were also performed and evaluated for adequacy using Menu Eval Plus [13], a software from the Food and Nutrition Research Institute of the Department of Science and Technology, which was accessible online.

The mean intake for three days was calculated and encoded in an excel sheet. The Philippine Dietary Recommended Intake (PDRI) [14] served as a reference in evaluating the adequacy of the dietary intakes of the macro- and micronutrients except for carbohydrates and fat where the Acceptable Macronutrient Distribution Range (AMDR) from the Institute of Medicine [15] was used.

Statistical analyses

Descriptive statistics was used to describe the physical activity and dietary intake of the respondents. The excel file of compiled raw data was used for cross tabulation and correlation of the different factors. Moreover, the analysis of the data was consulted with a statistician and with the aid of Statistical Package for Social Sciences (SPSS v.25) to provide more reliable analysis and interpretations of the data.

Statistical methods such as Exploratory Analysis, T-test for Two Sample Population Mean, Wilcoxon-signed Rank Test and Correlation analysis were used. Exploratory analysis was used to perform initial investigations on the data on nutritional status and dietary intake of student athletes and gamers to be able to discover patterns, to spot anomalies, to test hypothesis and to check assumptions with the help

of summary statistics and graphical representations [16]. T-test for Two Sample Population Mean was used to determine if two population means are equal wherein these involved the athlete student group and gamer student group. This was to test if the former's BMI, nutritional status and dietary intake is superior to the latter group [17]. Wilcoxon-signed Rank Test was used for comparison of two related samples or repeated measurements on a single sample to assess whether their population mean ranks differ [18]. Correlation analysis was also used to study the strength of a relationship between numerically measured continuous variables such as height, weight, BMI, physical activity and dietary intake with nutritional status. These helped established possible connections between the variables [19]. The Spearman's Rank Order Correlation was used to measure the strength of association between the ordinal and interval variables.

Results and Discussion

Respondents' profile

The personal characteristics of the respondents such as sex, classification, weekly allowance and BMI were summarized in table 1 while other profiles of the respondents which included age, units enrolled, money allotted for food and anthropometric measurements are summarized in table 2.

Parameter	Overall n = 116		Overall n = 79		Overall n = 37	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Sex						
Female	30	25.86	27	34.18	3	8.11
Male	86	74.14	52	65.82	34	91.89
Classification Freshman	25	21.55	25	31.65	0	0
Sophomore	6	5.17	2	2.53	4	10.81
Junior	31	26.72	16	20.25	15	40.54
Senior	54	46.55	36	45.57	18	48.65
Weekly Allowance (PHP)						
< 1000	9	7.76	8	10.13	1	2.70
1001 - 1500	46	39.65	26	32.92	20	54.05
1501 - 2000	36	31.03	28	35.44	8	21.62
2001 - 2500	19	16.38	15	18.99	4	10.81
2501 - 3000	6	5.17	2	2.53	4	10.81
Body Mass Index (BMI) Underweight	11	9.48	5	6.33	6	16.22
Normal	73	62.93	56	70.89	17	45.95
Overweight	26	22.41	15	18.99	11	29.73
Obese Class I	4	3.45	2	2.53	2	5.41
Obese Class II	2	1.72	1	1.27	1	2.70

Table 1: *Personal characteristics of respondents.*

	Overall (n = 79)		
	(Mean ± SD)	Minimum	Maximum
Age	20.33 ± 1.34	18	25
Units Enrolled	16.02 ± 4.55	1	24
Money Allotted for Food (Php)	1163.79 ± 422.01	200	2000
Height (cm)	166.26 ± 7.67	146.5	181.6
Weight (kg)	64.48 ± 12.72	38.1	108
Body Mass Index	23.25 ± 3.86	16.41	36.09

	Athletes (n = 79)			Gamers (n = 37)		
	(Mean ± SD)	Minimum	Maximum	(Mean ± SD)	Minimum	Maximum
Age	20.18 ± 1.30	18	25	20.65 ± 1.38	18	25
Units Enrolled	16.52 ± 4.25	1	22	14.95 ± 5.03	3	24
Money Allotted for Food (Php)	1155.32 ± 417.34	200	2000	1181.89 ± 437.09	500	2000
Height (cm)	166.22 ± 8.34	146.5	181.6	166.35 ± 6.08	153.3	180.5
Weight (kg)	63.37 ± 12.09	38.1	108	66.84 ± 13.85	41	100
Body Mass Index	22.85 ± 3.40	16.41	36.1	24.10 ± 4.65	16.9	35.6

Table 2: *Descriptive profile of the respondents.*

Overall

In total, there were 116 respondents wherein 30 were females (25.86%) and 86 were males (74.14%). The respondents' ages ranged from 18 to 25 years old with a mean of 20.33 ± 1.34. Most of the respondents were seniors (46.55%), followed by juniors (26.72%), freshmen (21.55%) and sophomores (5.17%). For the second semester of the academic year 2018 - 2019, the respondents' units enrolled ranged from 1 unit to 22 units with a mean of 16.02 ± 4.55 units.

As for their socio-economic status, majority of the respondents had a weekly allowance ranging from Php 1001 to 1500 (39.65%), followed by Php 1501 to 2000 range (31.03%), Php 2001 to 2500 range (16.38%), then the less than Php 1000 (7.76%), which was then followed by Php 2501 to 3000 range (5.17%) and lastly by Php 1001 to 1500 range (0.86%). From their weekly allowance, the mean budget allotted for food of the respondents was Php 1163.79 ± 422.01 and ranged from Php 200 to 2000.

With the WHO BMI cut-off points used for determining their nutritional status, 62.93% of the respondents were classified as normal, while 22.41% were overweight, 9.48% of the respondents were underweight, 3.45% were classified under Obese Class I and the rest of the 1.72% of the respondents were Obese Class II. The mean height of the respondents was 166.26 ± 7.67 cm while their mean weight was 64.48 ± 12.72 kg. As for their BMI, the respondents had a mean BMI of 23.25 ± 3.86 kg/m2 which encompassed interpretations from normal to overweight.

Athletes

Further composition of the respondents was categorized as athletes and gamers. For the athletes, there were 79 respondents wherein 52 were males (66.82%) and 27 were females (34.18%). The athletes' ages ranged from 18 to 25 years with a mean age of 20.18 ± 1.30

years old. Majority of the athletes were seniors (45.57%), followed by freshmen (31.65%), then juniors (20.25%) and the rest were sophomores (2.53%). For the semester, the athletes had enrolled mean units of 16.52 ± 4.25 and the units enrolled ranged from 1 to 22 units.

Among the athletes, 35.44% of them have a weekly allowance ranging from Php 1501 to 2000, while 32.92% of the athlete respondents have a weekly allowance ranging from Php 1001 to 1500, followed by 18.99% of the athletes who have Php 2001 to 2500 for their weekly allowance. Additionally, 10.13% of the athletes have less than Php 1000 as their weekly allowance, while the remaining 2.53% have their weekly allowance between Php 2501 to 3000. As for the athlete's budget allotted for food, it ranged from Php 200 - 2000 and the mean money spent for food is Php 1155.32 ± 417.34.

In terms of height, the athletes had a mean height of 166.22 ± 8.34 cm which ranged from 146.5 cm to 181.6 cm. The athletes' mean weight, on the other hand, was 63.37 ± 12.09 kg and ranged from 38.1 kg to 108 kg. The athletes' mean BMI was 22.85 ± 3.40 kg/m^2 wherein the athlete respondents BMI ranges were from 16.41 to 36.09 kg/m^2. Moreover, most of the athletes (70.89%) had a normal nutritional status, while a few were overweight (18.99%), underweight (6.33%), or belonged to the obese class I category (2.53%) and obese class II category (1.27%).

Gamers

The gamers, on the other hand, were comprised of 37 respondents in which 34 were male (91.89%) and 3 were female (8.11%). The gamers' ages ranged from 18 to 25 years old and had a mean age of 20.65 ± 1.38 years. Most of the gamers were seniors (48.65%) and juniors (40.54%), while the rest of the gamers were sophomores (10.81%). There were no freshmen among the gamer respondents. For the semester, the gamers had enrolled mean units of 14.95 ± 5.03 wherein the units enrolled ranged from 3 to 24 units.

For the weekly allowance of the gamers, 54.05% had a weekly allowance range from Php 1001 to 1500, while 21.62% had Php 1501 to 2000. Moreover, 10.81% of the gamers had Php 2001 to 2500 while the other 10.81% had Php 2501 to 3000 and the remaining 2.70% had a weekly allowance less than Php 1000. As for their budget allotted for food, the gamers had a mean money allotted for food at Php 1181.89 ± 437.09 wherein their budget ranged from Php 500 to 2000.

As for the height of the gamers, the mean height was 166.35 ± 6.08 cm wherein the ranges were from 153.3 to 180.5 cm. The mean weight of the gamers, on the other hand, were 66.84 ± 13.85 kg wherein the ranges were from 41 to 100 kg. For the gamers, mean BMI was 24.10 ± 4.65 kg/m^2 and ranged from 16.85 to 35.59 kg/m^2. In line with this, gamers were classified on the following nutritional status categories wherein 45.95% were normal, 29.73% were overweight, 16.22% were underweight, 5.41% were under obese class I and 2.70% were classified as obese class II.

Nutritional status of athletes and gamers

Table 3 shows the analysis of nutritional status of gamers and athlete respondents through the Wilcoxon Signed-Rank test to check whether the groups have a normal BMI interpretation based on the WHO BMI cut-off points. The Wilcoxon Signed-Rank test showed that the nutritional status of athletes was statistically significant implying that they generally have a normal nutritional status while the nutritional status of gamers generally did not have a normal nutritional status for their BMI interpretations. Athletes have a higher percentage of respondents with normal nutritional status than their gamer counterparts. Moreover, the results show that gamers had relatively more respondents who were classified outside the range of normal nutritional status such as the underweight, overweight, obese class I and

obese class II categories. Furthermore, comparing the mean BMI of both groups, gamers have a higher mean which indicated that the BMI of gamers was more spread out of the normal range than that of the athletes. Related findings found that video game players reported higher BMI than non-gamers [20].

Nutritional Status	p value	Interpretation
Athletes	0.0059	Significant
Gamers	0.0550	Not Significant

Table 3: *Analysis of nutritional status of athletes and gamers using the Wilcoxon Signed-Rank test.*

Dietary intake of athletes and gamers

Mean dietary intakes

Table 4 summarizes the mean dietary intake of both athletes and gamers which were obtained from their three non-consecutive food recalls. The results showed that athletes have higher mean intakes of macronutrients specifically energy, protein and fat while gamers were shown to have consumed more carbohydrates than the athletes. The mean intake for energy of athletes was higher at about 109.96 ± 26.15g while the gamers consumed 92.64 ± 30.85g. Along with the protein intake wherein athletes had more intake than the gamers which was about 165.69 ± 65.29g, while gamers had 149.44 ± 69.01g. For the fat intake, athletes had a higher mean intake of 34.75 ± 10.26g than gamers who had a mean intake of 30.43 ± 12.17g. However, for the carbohydrate intake, gamers had a higher mean intake which was 54.97 ± 13.35g while athletes had a mean carbohydrate intake of 50.91 ± 11.51g. Related studies on gamers' food intake influencing carbohydrate intake revealed that average daily soft drink consumption was significantly higher between the gamers and non-gamers [21]. Soft drinks, being widely available in the market, contain sugar and include carbonated sugar-sweetened soft drinks as fruit juices, fruit drinks, cordials, sports drinks, energy drinks and iced teas.

	Athletes (n = 79)	Gamers (n = 37)
	Intake	Intake
	(Mean ± SD)	(Mean ± SD)
Macronutrients Energy (kcal)	109.96 ± 26.15	92.64 ± 30.85
Carbohydrates (g)	50.91 ± 11.51	54.97 ± 13.35
Protein (g)	165.69 ± 65.29	149.44 ± 69.01
Fat (g)	34.75 ± 10.26	30.43 ± 12.17
Micronutrients Calcium (mg)	140.84 ± 98.00	158.45 ± 171.68
Iron (mg)	128.07 ± 87.39	158.35 ± 211.89
Vitamin A (µgRE)	124.21 ± 145.53	152.18 ± 351.60
Thiamin (mg)	146.08 ± 217.68	128.89 ± 172.96
Riboflavin (mg)	143.33 ± 135.11	159.69 ± 226.49
Niacin (mgNE)	314.63 ± 153.95	420.08 ± 579.11
Vitamin C (mg)	113.00 ± 117.55	140.97 ± 141.70

Table 4: *Dietary intake of athletes and gamers.*

As for the micronutrient intake, results indicated that gamers have higher mean intake of most micronutrients except for thiamin since athletes had consumed a greater mean thiamin intake of 146.08 ± 217 mg while gamers consumed 128.89 ± 172.96 mg.

Adequacy of macro- and micronutrient intakes

Table 5 illustrates the adequacy levels for both macro and micro-nutrient intakes were evaluated using EAR except for carbohydrates and fats wherein AMDR was used. Both age and sex of the respondents were accounted for in the evaluation. Results showed that athletes generally consume within or above adequacy in their food intake, which means that they received enough or exceeded the recommended nutrients that the adult body needs. However, there were some nutrients which were more below adequacy for athletes but were within or above food adequacy for the gamers. These nutrients are carbohydrates, iron and Vitamin C. Carbohydrate intake could again be influenced by the increased and frequent soft drink consumption of gamers as stated previously in Cemelli and Colleagues' Study [21]. In their study, a factor that could lead to decreased micronutrient intake in athletes was due to the regular, intense training that may increase an athlete's requirements for vitamins and minerals above recommended levels because of decreased gastrointestinal absorption or increased excretions of sweat, urine, or feces or the increased need for tissue maintenance and repair [22]. Despite gamers having high intake of micronutrients as seen in previous discussion, data on adequacy levels of micronutrients appeared that most gamers consumed mostly below the adequacy of food intake. This suggested that food consumed were not micronutrient-rich as compared to the athletes. Furthermore, Campbell and Geik [22] stated that sedentary individuals may not notice the effects of marginal micronutrient deficiencies. However, for athletes, inadequate micronutrient intakes may adversely affect performance due to impaired exercise capacity.

At the macronutrient level, energy mean intake in kcal (67.57%) of gamers were below adequacy while athletes were at 40.51%. Moreover, athletes had higher energy intake that were above adequacy (59.59%) than gamers (32.43%). These results showed that athletes generally consumed more adequate levels of energy than gamers and meet the above recommended requirements for energy intake. As for other macronutrients, adequacy of carbohydrate intake was higher in gamers (27.03%) as compared with athletes (11.39%) at above levels. However, at below and within adequacy levels of carbohydrate intake, (30.38% and 58.23%) athletes had a higher percentage compared to their gamer counterparts (24.32% and 48.65%) respectively. The data showed that adequacy of carbohydrate intake is generally higher in gamers since most individuals who consumed within and below adequacy in terms of percentage were from the athlete groups. Protein intake in terms of above adequacy levels; there were athletes (77.22%) than gamers (56.76%). Nonetheless, in terms of below and within adequacy levels of protein intake, gamers (16.22% and 27.03%) outnumbered the athletes (5.06% and 16.22%). This showed that the majority of individuals who consumed below and within adequacy of protein intake are from the gamer group. As for fat mean intake in above and within levels of adequacy, athletes (48.10% and 36.71%) were higher than the gamers (32.43% and 32.43%). Gamers (35.14%) had higher values for below adequacy of fat intake than athletes (15.19%). Generally, respondents who are athletes consumed fat within and above the recommended levels while most gamers do not meet the recommended levels.

At the micronutrient level, seven nutrients were evaluated namely: calcium, iron, Vitamin A, thiamin, riboflavin, niacin, and Vitamin C. For above levels of adequacy of calcium intake, athletes were relatively higher than gamers. However, both levels below and within adequacy were higher with gamers than athletes. It showed that the gamer group was mostly composed of those who consumed both below and within adequacy levels while the athlete group was mostly comprised of individuals who consumed above adequacy levels of calcium. In iron, athletes (44.30% and 31.65%) were higher than gamers (43.24% and 24.32%) in terms of above and below adequacy levels while gamers (32.43%) were higher in terms of within levels of iron adequacy. With the given dietary data for adequacy of iron, more gamers' intake was within levels than athletes wherein both of their above and below levels of adequacy were slightly greater than gamers.

As for Vitamin A, both below and within levels of adequacy were higher in gamers (48.65% and 24.32%) than in athletes (48.10% and 21.52%) while above levels of adequacy were higher with athletes (30.38%) than gamers (27.03%). Thiamin, on the other hand, athletes had (34.18% and 25.32%) who had higher above and within levels than gamers (29.73% and 13.51%) while for below adequacy levels, gamers (56.76%) had a higher value than athletes (40.51%). This showed that gamers generally did not meet or surpass the adequacy levels of thiamin than athletes. Riboflavin adequacy levels were higher with athletes (45.57% and 29.11%) at the above and within levels than gamers (40.54% and 18.92%) while the latter group (40.54%) were higher at the below levels of adequacy than athletes (23.52%). It was observed that the adequacy of thiamin for gamers were equal for above and below levels of adequacy. Niacin levels of adequacy were higher at above levels for athletes (97.47%) as compared to gamers (94.39%) and athletes (2.53%) were lower at below levels of adequacy than gamers (5.41%). There were no athletes and gamers who had intake within adequacy levels. Adequacy levels of niacin showed that there were more gamers who consume thiamin below the recommended levels while the athletes are the opposite. Vitamin C adequacy which are above and within levels were higher in gamers (35.14% and 27.30%) than athletes (31.65% and 12.66%) while below adequacy were greater in athletes (55.70%) than gamers (37.84%).

Among the dietary intake between athletes and gamers, there was only a significant difference on their energy intake as seen in table 5 wherein related studies showed that all athletes, independent of age, need to consume adequate dietary energy for energy expenditure, maintenance of body weight and health, and optimal training effects. Energy requirements for athletes were determined by host factors such as body composition, exercise, intensity and duration wherein athletes have higher energy requirements than age-matched sedentary individuals. Failure to consume recommended levels of energy may lead to impaired quality of athletic performance [22]. Moreover, in most cases if energy intake is sufficient, the micronutrient requirements of athletes are similar to healthy, fairly active individuals [23].

	Overall (n = 116)	
	t	**p**
Nutrients		
Macronutrients		
Energy (kcal)	2.9536	0.0045
Carbohydrates (g)	-1.5899	0.1169
Protein (g)	1.2025	0.2334
Fat (g)	1.8718	0.066
Micronutrients		
Calcium (mg)	-0.5813	0.5638
Iron (mg)	-0.8366	0.4076
Vitamin A (µgRE)	-0.4655	0.644
Thiamin (mg)	0.458	0.6481
Riboflavin (mg)	-0.4068	0.6859
Niacin (mgNE)	-1.0898	0.2826
Vitamin C (mg)	-1.0443	0.3005

Table 5: *Two sample t-test on dietary intake between athletes and gamers.*

Physical activity of athletes and gamers

The physical activity of athletes and gamers were assessed through the IPAQ-SF as seen in figure 1 and 2 respectively wherein results showed that there were more athletes (89.87%) who had high intensity of physical activity than gamers (54.05%). However, gamers had a higher percentage of respondents who had low physical activity with 10.81% than athletes with 3.8%.

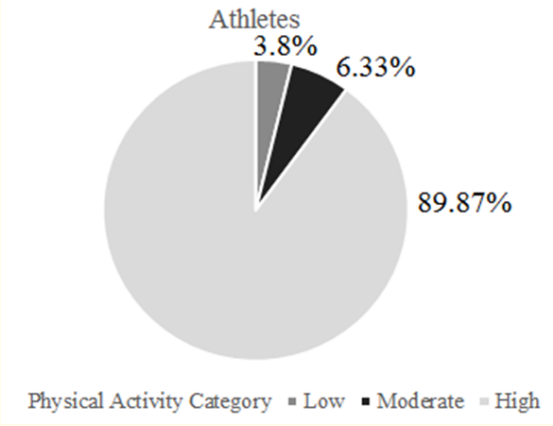

Figure 1: *Distribution of athletes by physical activity category.*

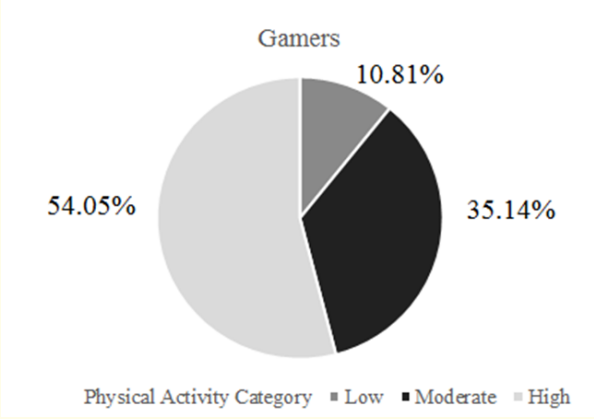

Figure 2: *Distribution of gamers by physical activity category.*

Moreover, the categorical scores from the IPAQ-SF scoring shown in table 6 revealed that 58.23% of athletes have reported to engage in high level of physical activity for at least more than three days than gamers since 81.08% of them have reported that they do not perform high level of physical activity for at least more than three days. Furthermore, 88.61% of athletes have reported to perform at least 3000 MET minutes per week for a span of at least more than seven days while only 48.65% were reported from the gamers. With the results of the categorical scores, it showed that athletes spend more time on high intensity activities than the gamers. This may be due to athletes maintain a training regimen and to sustain athletic performance require them to continuously involve in sport training activities which are related to health benefits brought by consistent physical activity. Routine physical activity showed to improve body composition which contributes to better physical performance [24].

	Athletes (n = 79)		Gamers (n = 37)	
IPAQ-SF Categorical Score Criteria	**Frequency**	**Percent**	**Frequency**	**Percent**
High Activity Criteria ≥3 Days Vigorous				
No	33	41.77	30	81.08
Yes ≥7 Days Any	46	58.23	7	18.92
No	9	11.39	19	51.35
Yes	70	88.61	18	48.65
Moderate Activity Criteria ≥3 Days Vigorous Intensity (≥20 min/d)				
No	33	41.77	30	81.08
Yes ≥5 Days	46	58.23	7	18.92
No	12	15.19	5	13.51
Yes ≥5 Days Any Intensity (≥600 MET-min/wk)	67	84.81	32	86.49
No	3	3.80	4	10.81
Yes	76	96.20	33	89.19

Table 6: *Distribution of athletes and gamers according to IPAQ-SF categorical score criteria.*

Table 7 summarizes the comparison between athletes and gamers in terms of the different intensities of physical activity from the scoring of IPAQ-SF forms. Activities were classified as vigorous, moderate, walking and sitting and were measured in mean days, time spent in minutes and time spent in minutes per day, total days spent, and in MET minutes per week. Results showed that athletes had generally spent more days and time in minutes on vigorous and moderate activities than their gamer counterparts. The mean days spent,

and mean time spent in minutes by athletes on vigorous activity were 2.84 ± 1.56 and 142.09 ± 69.24 while gamers only spent 1.38 ± 1.60 days and 46.86 ± 61.90 minutes respectively. On moderate activities, athletes had spent mean days of 2.22 ± 1.84 and mean time in minutes of 78.73 ± 72.83 while gamers had spent mean days of 1.54 ± 2.12 and mean time in minutes of 56.76 ± 113.56. Furthermore, athletes had spent more mean days on walking (6.28 ± 1.49) than their gamer counterparts (6.16 ± 2.06). However, gamers were recorded to have spent more mean time in minutes on walking (95.27 ± 80.73) and sitting (434.59 ± 223.34) than athletes (79.94 ± 55.34, 322.03 ± 198.17). In terms of time spent on minutes per day for each activity, athletes had spent more minutes per day on vigorous (135.63 ± 62.26) and moderate (75.70 ± 62.71) activity while gamers had spent more minutes per day on walking (87.16 ± 62.74).

	Athletes (n = 79) Mean ± SD	**Gamers (n = 37) Mean ± SD**
Days Spent on Vigorous Activity	2.84 ± 1.56	1.38 ± 1.60
Time Spent on Vigorous Activity (min)	142.09 ± 69.24	46.86 ± 61.90
Days Spent on Moderate Activity	2.22 ± 1.84	1.54 ± 2.12
Time Spent on Moderate Activity (min)	78.73 ± 72.83	56.76 ± 113.56
Days Spent on Walking	6.28 ± 1.49	6.16 ± 2.06
Time Spent on Walking (min)	79.94 ± 55.34	95.27 ± 80.73
Time Spent on Sitting (min)	322.03 ± 198.17	434.59 ± 223.34
Time Spent on Vigorous Activity (min/day)	135.63 ± 62.26	45.24 ± 57.31
Time Spent on Moderate (min/day)	75.70 ± 62.71	43.78 ± 66.60
Time Spent on Walking (min/day)	77.66 ± 46.69	87.16 ± 62.74
Total Days of Activity	11.33 ± 3.38	9.08 ± 3.88
MET minutes per week Vigorous Activity	3504.81 ± 2119.63	1063.78 ± 1698.74
Moderate Activity	878.73 ± 913.59	708.11 ± 1339.61
Walking Activity	1666.50 ± 1073.00	1930.50 ± 1484.38
Total Activity	6050.04 ± 3011.66	3702.39 ± 3106.80

Table 7: *Comparison of different intensities of physical activity between athletes and gamers.*

Overall, athletes still had performed more MET minutes per week of vigorous (3504.81 ± 2119.63) and moderate (878.73 ± 913.59) activities than gamers (1063 ± 1698.74, 708.11 ± 1339.61) and had more total days of activity with a value of 11.33 ± 3.38 as compared to gamers with 9.08 ± 3.88. Moreover, walking activity was slightly higher in gamers 1930.50 ± 1484.38 MET minutes per week than athletes who spent 1666.50 ± 1073.00. Despite having spent a lower amount of walking activity, athletes still had spent a higher total activity per week in MET minutes with a mean of 6050.04 ± 3011.66 than gamers who had a mean of 3702.39 ± 3106.80. A direct relationship was observed with the number of days spent on vigorous and moderate activities and MET minutes per week for total activity since as number of days allotted for activities increased, MET minutes per week for total activity increased. Moreover, if the time spent on walking and sitting was higher than the time spent for vigorous and moderate activity, it yielded lower total days of activity and lower total activity in MET minutes per week. It can be inferred that the intensity of physical activity performed more often and the nature of the physical activ-

ity such as vigorous and moderate contributed more to the MET minutes per week of total activity. Furthermore, it revealed that walking and sitting contributed smaller METs than vigorous and moderate activity that affected the total activity. As stated by the Physical Activity Guidelines Committee [25], sitting requires less than 1.5 METs or fewer and is considered a sedentary activity while walking is considered a light activity which uses 1.6 to 3.0 METs. Moderate activity, on the other hand, uses 3.0 to less than 6.0 METs while vigorous activity uses 6.0 or greater METs. Based on the result of this study, there were relatively more days and minutes spent for vigorous- and moderate-intensive activities than walking and sitting. As more time was spent on intensive activities such as moderate and vigorous activities, a higher total activity was achieved while those who had spent more light and sedentary activities had a lower yield of total activity.

Sedentary behaviors between athletes and gamers

Among the sedentary behaviors between athletes and gamers, there was a significant difference in playing computer or video games as seen in table 8. It can be inferred that gamers spent majority of their time in a day by playing computer or video games as compared to athletes. Related studies manifested that due to the increased prevalence of electronic games played; such as computer and video games, an inverse relationship between time spent on playing video games and daily physical activity was reported. Usage on playing video games could be influenced by the impact of this medium being relatively new [26]. Video games provide a reward aspect wherein gamers are encouraged to keep on playing until they achieve the reward [21]. It was also reported that sitting time in gamers showed that the average amount of time spent on the computer was more than 10 hours per week for gamers wherein the sitting duration poses a health risk associated with cardiovascular diseases and mortality [21].

	Overall (n = 116)	
Sedentary Behaviors during Weekdays	**t**	**p**
Watching television	0.1948	0.8461
Playing computer or video games	-5.0360	< 0.0001
Sitting listening to music on the radio, tapes, or CDs	-0.6556	0.5147
Sitting and talking on the phone	1.2287	0.2229
Doing paperwork or computer work	0.1962	0.8450
Sitting reading a book or magazine	-0.9378	0.3517
Playing a musical instrument	-0.4282	0.6698
Doing artwork or crafts	-1.6172	0.1118
Sitting and driving in a car, bus, or train	0.7898	0.4318
Sedentary Behaviors during Weekends	**t**	**p**
Watching television	1.2694	0.2083
Playing computer or video games	-5.3600	<0.0001
Sitting listening to music on the radio, tapes, or CDs	-1.0514	0.2970
Sitting and talking on the phone	1.2200	0.2265
Doing paperwork or computer work	-0.2371	0.8133
Sitting reading a book or magazine	-1.7583	0.0837
Playing a musical instrument	0.2082	0.8356
Doing artwork or crafts	-1.8228	0.0754
Sitting and driving in a car, bus, or train	1.5163	0.1344

Table 8: *Two sample t-test on sedentary behaviors between athletes and gamers.*

Relationship of physical activity and dietary intake with the nutritional status of athletes and gamers

Between physical activity and sedentary behaviors during weekdays and weekends, there was a very weak negative linear relationship between physical activity and nutritional status of an individual. This means that if physical activity is increased, nutritional status shall also increase to the normal as seen in table 9. Spearman correlation was used to determine the strength of association and found that the only significance was with the physical activity on nutritional status. Despite dietary intake playing a role in nutritional status, the amount and intensity of physical activity should also be considered since it expends energy consumed from food and beverages and provides other health benefits. Regular physical activity which may include endurance-, muscle-, bone- and flexibility strengthening shall further improve BMI status along with the accompaniment of healthy diet [2]. Moreover, previous research has reported that gamers have a higher BMI than non-gamers. Higher BMI in gamers was due to increased soft drink intake and time spent on gaming displaces the time that could have been used for eating meals and physical activity. Moreover, more recent observational studies indicated that there was a direct association between video games and overweight and obesity. A recent study found that for every hour spent on playing video games daily resulted to a nearly two-fold increased risk of obesity [21,26]. On consumption of soft drinks, they had been identified as one of the dietary contributors to overweight and obesity wherein it was reported that each can of soft drink consumed per day increases the risk of being obese [27,28].

Factors vs Nutritional Status	Coefficient	p value
Physical activity	0.1916	0.0394
Sedentary Behaviors during Weekdays	0.0253	0.7877
Sedentary Behaviors during Weekends	-0.0415	0.6586
Nutrients Macronutrients Energy (kcal)	0.0118	0.8995
Carbohydrates (g)	0.0114	0.9029
Protein (g)	0.0684	0.4656
Fat (g)	0.0290	0.7571
Micronutrients Calcium (mg)	-0.1156	0.2165
Iron (mg)	0.0656	0.4840
Vitamin A (µgRE)	-0.1211	0.1952
Thiamin (mg)	-0.0827	0.3777
Riboflavin (mg)	-0.1253	0.1803
Niacin (mgNE)	0.1607	0.0849
Vitamin C (mg)	0.0838	0.3711

Table 9: *Spearman correlation of physical activity, sedentary behaviors and dietary intake with nutritional status of athletes and gamers.*

Summary and Conclusion

With the rising concern of obesity-linked mortality, the study found the relationship of nutritional status on athletes and gamers in relation to dietary intake and physical activity of the respondents from UPLB. The prevalence of low physical activity and sedentary behaviors had been identified as risk factors of obesity. Data was collected through anthropometric assessment of height and weight using a stadiometer and SECA digital weighing scale, respectively. Physical activity and sedentary behavior were measured through internationally standardized questionnaires such as the IPAQ-SF and SBQ. Dietary intake was gathered through three non-consecutive food recalls

and was evaluated using Menu Eval Plus, PDRI and AMDR values. Statistical analysis with the aid of a statistician was used such as Exploratory analysis, T-test for Two Sample Population Mean, Wilcoxon-signed Rank Test and Spearman's Rank Order Correlation analysis.

Results from the study showed that gamers from the UP Alliance of Gamers generally have a higher BMI as compared to athletes belonging to similar intensity and competitive team sports of the university namely basketball, volleyball and football wherein gamers were more prone to developing obesity. In terms of dietary intake, there was only a significant difference between the energy intake of athletes as compared to the gamers. This may be due to the increased energy needs of the body of athletes for tissue repair and maintenance to perform in moderate to vigorous activities. There were nutrients wherein the intake of athletes was greater than gamers and vice versa. However, they did not show any significant relationship on nutritional status. Moreover, there was a very weak negative linear relationship between physical activity and the nutritional status of the respondents. Thus, increase in physical activity can result to better BMI or nutritional status of an individual since those who had more time spent on sedentary behaviors were shown to have lower activity throughout the week as compared to the athletes who spent more time on moderate and vigorous activities throughout the week. Results also showed that among the different sedentary behaviors, there was a significant difference with playing video games between athletes and gamers. Time that was spent for gaming and sitting had displaced the time for meal eating and involvement in light to moderate or moderate to vigorous physical activity. In developing a better nutritional status, factors such as dietary intake in the macro and micronutrients were considered. The intensity, duration and frequency of physical activity must also be included to reduce sedentary behavior, risks of obesity and development of chronic diseases. There is the importance of not only meeting the recommended levels of nutrient intake but also achieving consistent and proper physical activity in an individual's lifestyle because it is needed for adults whether an athlete or gamer to achieve long term health goals and benefits.

Recommendations

For future research studies to be conducted on the nutritional status of athletes and gamers in relation to dietary intake and physical activity, it is advisable to have a longer period for conducting studies of similar in nature and use of other standard techniques that account for other nutritional biomarkers such as waist to hip ratio, abdominal fat, lean body mass, and body fat. Furthermore, use of complex anthropometric equipment such as body fat analyzers and applicable anthropometric equations for body density, whenever and if ever there is availability. For dietary intake, a semi-quantitative Food Frequency Questionnaire (FFQ) can be used as an alternative to food recalls to better account for specific food intake such as amount of fluids, soft-drink consumption, energy-dense foods, specific vitamin intake and more. Data on dietary intake may be further supplemented through longer food recall or use of food records to minimize the burden on the researcher. Other researchers may pursue this study in a similar fashion on other life stages such as children and adolescents. They may also focus their study on a more defined population of gamers and athletes such as considering the different types of gaming like active forms and specified traditional forms of gaming as sub-classifications of the gamer group. More varied sports and other forms of recreation may have been considered for different intensities of physical activity such as aerobics, muscle- strengthening and bone-strengthening activities and dancing. Questions specific on gaming and sports may also be included. Other sedentary behavior questionnaires or other forms of tests could be used to further assess sedentary behaviors. Lastly, interested researchers could form a team of their own with a sports nutritionist to widen the scope of the study and to perform more activities with needed expertise and skills.

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