Original Research

Relationship of Video Gaming Lifestyle with Dietary Habits and Physical Activity Level of Filipino University Students Aged 18-24 Years Old

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Abstract

With the rise of video gaming trends within the Philippines, the risk of malnutrition related to escalated sedentary behavior and poor dietary habits may also occur. This research aims to describe the association between the video gaming lifestyle, dietary habits, and physical activity level (PAL) of university students aged 18-24. The study follows a descriptive study design and uses Spearman's rank correlation coefficient to determine the relationships of the variables. After correlation tests, gaming addiction level was found to have a weak direct relationship with the frequency of consumption among all food groups (ρ = 0.138±0.047). Weak positive correlation was also discovered with excessive gaming and meal skipping (ρ = 0.184), self-reported loss of appetite (ρ = 0.070), and tendency to eat their meals in front of their gaming devices (ρ = 0.160). Furthermore, PAL is found to have a weak positive correlation with gaming addiction level (ρ = 0.074). Among the sample, excessive video game use was found to be related to all variables, whereas higher chances of becoming pathologic gamers may also imply a tendency in the participant's increased consumption of caloric-dense foods, poor dietary habits and moderate to high PAL.

Keywords— *dietary habits, nutrition, physical activity, video gaming*

1 Introduction

Video games, otherwise known as electronic or computer games, are any games that can be played on a personal computer, video gaming console, or mobile device by pushing buttons on a controller or screen [1]. These games became extremely popular worldwide and locally, mainly due to the limited human interactions imposed within restricted physical contact and lockdowns. In 2021, it was estimated that there are over 3.24 billion gamers globally, with Asia being the top continent with the most gamers of about 1.48 billion in total [2]. A study in Germany [3] identified that most video game enthusiasts are young adults who are either work apprentices or students – particularly university students who testified to spending a couple of hours gaming after their classes and training. These may indicate that video gaming is beneficial for young adults because it primarily serves as a good distraction and stress reliever [4] while at the same time potentially contributing to the enhancement of their learning processes due to its positive impact on the development of their cognitive skills [5]. Other than that, video gaming also served as source of income for professional eSports players and online game streamers [6] through their earnings from live streaming views, follower gifts and refundable tokens, partnerships on social media platforms, and from competition rewards and benefits.

In the Philippines, a news report from 2020 stated that around 52.8 million people spend at least two to three hours every day on online games [7], and it is expected to become higher as opportunities in video gaming within the country are being continuously opened. A study conducted in Unibersidad de Manila [8] stated that video game engagement among young adults was mainly driven by its perceived benefits in improving the students' strategic thinking, analytical skills, and technology knowledge. Similarly, Filipino streamers and professional eSports players also earn from video gaming [9].

Despite the number of advantages that video gaming has, its excessive use can still negatively impact health, physical activity level, and social relationships [10]. The World Health Organization included the gaming disorder in the 2018 WHO draft of the 11th Revisions of the International Classification of Diseases (ICD-11) [11]; hence, it is recognized that uncontrollable gaming can increase the risk of health complications, not limited to psychological distress, eye problems, and increased body mass index due to sedentary lifestyle and impaired eating behaviors [1, 3, 12, 13]. The levels of depression, academic standing, and mental health status have associations too with excessive use of video gaming. In contrast, longer game durations result in higher risk of stress, anxiety and/or depression [5, 10, 14]. Among university students, poor mental health status due to stress was found to be related to increased consumption of saturated fat and sugar [15]; hence video gaming-induced stress may also cause negative impacts on diet. Furthermore, gamers also tend to have a low intake of fruits and vegetables, with subsequent increases in sweetened beverage consumption and dependence on take-outs, delivery, or processed foods [3, 16].

This study aims to determine the relationship between video gaming lifestyle, dietary habits, and the physical activity level of university students aged 18-24. To do that, the researcher (1) identified the video gaming lifestyle of university students using the game addiction scale (GAS), (2) assessed the dietary habits and food intake of the university students, and finally (3) determined the physical activity level of the university students using the international physical activity questionnaire (IPAQ). It followed the conceptual framework below (Figure 1) which presents that the video gaming lifestyle measured through the gaming addiction scores can affect both the physical activity level and the dietary habits (i.e., food intake, food preferences, meal time pattern) of a university student.

Conducting this study in the Philippines is important because video gaming is a current emerging trend among young adults. With its growing popularity, the risk to malnutrition may also occur. Determining the association of the gaming behaviors among the sample, and their dietary habits and physical activity can help develop interventions for the nutritional problems dealt with by the university students who engage in video gaming. The study will also serve as an added contribution

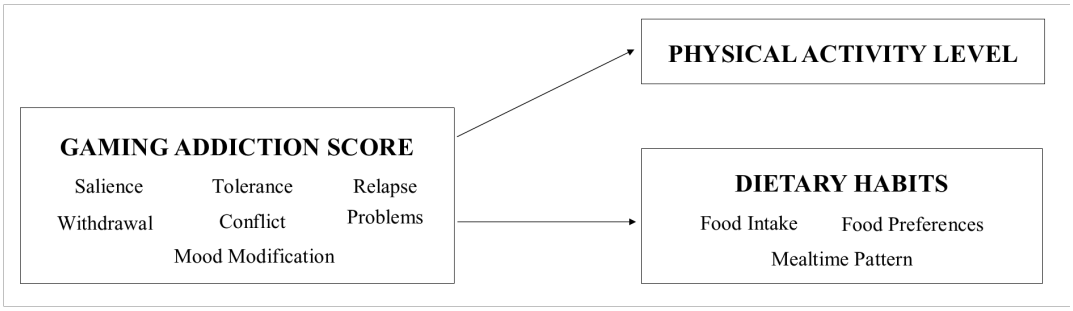

Figure 1.
Conceptual Framework on the Association of Video Gaming Lifestyle with Dietary Habits and Physical Activity Level. Reproduced from Alpe [17], published by the University of the Philippines Los Baños

to knowledge about video gaming and nutrition and starting point for other researchers to discover further the relationship of excessive video gaming to nutritional status and other subjects from a similar field. In human ecology, this paper contributes to improving human well-being among university students who may have an addictive behavior towards video gaming. This research determines the relationship between the university students' gaming behavior and its implications to their nutrition, which may assist in making proper approaches to improve their diet and overall health. The study differs from other research regarding video gaming because it focuses on its association with diet and physical activity level, compared to the usual subjects revolving around the academic standing and mental health.

2 Methodology

2.1 Research Design

This study followed a cross-sectional descriptive study design conducted through an online survey divided into six parts: (1) Informed Consent Form and Data Privacy Agreement, (2) the Respondent's Profile, (3) Video Gaming Lifestyle using the Game Addiction Scale (GAS), (4) food intake measured using the DEGS-FFQ, (5) dietary habits, and (6) physical activity level using the International Physical Activity Questionnaire. A purposive sampling technique was used to determine the participants of the study. To qualify, the respondent must possess the following criteria: (1) a student at tertiary level education, (2) currently 18-24 years old during the conduct of the study, and (3) plays video games either through their mobile phone or personal computers. Using descriptive statistics, the data gathered were presented in frequency and percentages, and correlations were tested using Spearman's rank correlation coefficient.

2.2 Study Locale

The study was conducted in the Philippines, a Southeast Asian country with one of the fastest growth in video gaming popularity during the pandemic. It had around 52.8 million gamers in the year 2020, and the Philippines was also ranked as the 6th country in the world during 2021, with the highest number of posts about topics relating to gaming in the social media X, then called Twitter [7].

2.3 Data Collection Methods

2.3.1 Sampling Technique

The purposive sampling technique was employed in this study with inclusion criteria of (1) a student enrolled in a university or local college as evidenced by their school IDs or forms of registrations,

(2) must be 18-24 years old during the conduct of the study, and they must be (3) an enthusiast of video games, offline or online, on their phone and/or a personal computer. Participants were recruited by circulating a post on social media and coordinating online with public video gamers group. No specific figure for the total number of participants was set to acquire as many responses as possible since the study locale was vast and any eligible respondents from different parts of the Philippines were free to participate.

2.3.2 Data Gathering Procedure

The study was administered via Google Forms. The data collection period was from August to September 2022. The link for the forms were pasted in the online post for participant invitations. Leniency was given in terms of location and date of answering the survey among the participants, meaning they may accomplish it at any place or time. The questionnaire was made to be accessed with mobile devices and desktop computers, whichever the participant may own. Inquiries or concerns from the participants regarding the questionnaire or parts of it were addressed by the researcher through email. The questionnaire was open for 24 hours daily during the entirety of the data collection period, but responses for concerns and inquiries were only attended from 8 am to 8 pm daily.

2.3.3 Research Tools

The study was administered using Google Forms. The questionnaire was divided into six (6) sections. The first section was the Informed Consent Form containing the electronic consent form and the Data Privacy Agreement. The second section was the Demographic Profile Section which collects the personal data of the respondents including name, age, sex at birth, university attending, degree program currently taking, and student classification – part-time (i.e., takes less than the regular unit credits) or full-time (i.e., takes the regular unit credits). The third section was the Game Addiction Scale (GAS) which is used to identify the video gaming lifestyle of the respondents. The GAS has seven questions, each corresponds to a pathological gaming criterion: salience, tolerance, mood modification, withdrawal, relapse, conflict, and problems. Results for this section classify the respondents as pathological gamers or non-pathological gamers. GAS was developed by Lemmens, Valkenberg, and Peter [18]. The same authors determined the reliability and validity of the scale through population cross-validation, where strong correlations with video gaming and significant moderate psychosocial variables were found. However, video game usage was not considered a valid indicator of pathological behavior using GAS because it minimally correlates with the other scale variables. Due to that, this study did not focus on the duration of video game usage but rather on determining the pathological tendencies of the participants in game addiction.

The fourth section of the questionnaire was the food intake assessment form adopted from the German Health Examination Survey for Adults – Food Frequency Questionnaire (DEGS1-FFQ). The validation of the DEGS1-FFQ was conducted from 2008 to 2009 through cross-sectional comparisons of food consumption data from the FFQ and from the two 24-hour food recalls among selected sample of participants aged 18 to 80 years old. Correlations between the FFQ and the 24-hour food recalls were statistically significant and ranking management for the food groups was determined to be reasonably valid in assessing food consumption. In this study, the DEGS1-FFQ was modified into a qualitative food frequency questionnaire, which includes the foods that Filipinos commonly eat according to the 2013 Philippines National Nutrition Survey [19], but the food groups and ranking management based on the DEGS1-FFQ were still retained. This was done to ensure that the foods in the questionnaire suited the Filipino young adult respondents. After the food intake, questions classifying the meal behaviors, mealtime, and food preferences were covered in the fifth section of the survey to further the investigation of the dietary habits of the university students.

The sixth section contains the physical activity level measured using the International Physical

Activity Questionnaire (IPAQ). IPAQ is an international questionnaire developed to measure physical activity [20]. The IPAQ short form is administered in different international studies as it was already validated to have reasonable measurement properties for population-level monitoring of physical activity among 18-65 years old adults through test-retest repeatability. However, this tool is only suitable for individuals with normal health.

To ensure the reliability of the adapted questionnaires, pre-testing was performed among ten (10) university students before the actual data gathering. Participants for the pre-testing were chosen through volunteerism, and Cronbach's alpha was computed to measure the reliability of each tool. For the gaming addiction scale, Cronbach alpha was determined to be good (α =0.829), while the food frequency questionnaire was noted as acceptable (α = 0.768). This indicates that the responses from each modified questionnaire correlate with each other. For the IPAQ, Cronbach alpha was deemed poor (α = 0.520), meaning the responses were more independent.

2.4 Data Analysis

The results of the study were primarily reported as frequencies and percentages. Data at nominal and ordinal levels of measurement utilized the median measure of central tendency. Those at the ratio level adapted the mean and standard deviation. Relationships among the variables were analyzed using Spearman's rank correlation coefficient, as interpreted below (Table 1).

Table 1. Interpretation of Spearman's Rank Correlation Coefficient

Correlation Coefficient		Interpretation
Positive	Negative	
+1	-1	Perfect
+0.9	-0.9	Strong
+0.8	-0.8	Strong
+0.7	-0.7	Strong
+0.6	-0.6	Moderate
+0.5	-0.5	Moderate
+0.4	-0.4	Moderate
+0.3	-0.3	Weak
+0.2	-0.2	Weak
+0.1	-0.1	Weak
0	0	Zero

Source: Statistics Without Math for Psychology, p. 176 [21]

Due to the descriptive study design of the research, non-parametric tests were the most suitable statistical test to use in determining the relationship among variables. With that, Spearman's rank correlation coefficient was utilized because it can calculate qualitative observations for data at nominal and ordinal level of measurements [21]. GAS, DEGS1-FFQ, and IPAQ all describe their results at nominal and ordinal level, making Spearman's rank correlation coefficient superior in calculating the correlation among these variables.

Age and gender were also subjected to correlation analysis to describe the profile of the university students. For age, normality was tested using the Shapiro-Wilk Normality Test while Wilcoxon signed rank test with continuity correction was used for gender. Shapiro-wilk normality test was used because this test mainly determines whether the data at ratio level comes from a normal distribution. In this study, age was at ratio level described using mean and standard deviation. Furthermore, Shapiro-Wilk Normality test is also the most suitable normality test to be used if data will be described using correlation analysis. Wilcoxon signed rank test with continuity correction

was used for gender because this statistical test best describes the presence of significant difference between non-parametric data, such as the gender which was a nominal data. This was also used because the researcher only aims to see if differences between the male and female respondents are present to create a general assumption about whether gender plays a role in the tendency of each sample to engage in excessive gaming.

GAS was interpreted using the seven (7) pathological gaming criteria: salience, tolerance, mood modification, withdrawal, relapse, conflict, and problems [18]. Each criterion was measured using a 5-point Likert scale – never, rarely, sometimes, often, and always. If more than or equal to three (3) of the criteria were reported, "pathologic gamer" was used as classification and "non-pathologic gamer" if otherwise.

Food intake was described based on the frequency of their consumption of food items during the past four weeks. These food items were divided into ten food groups: (1) dark leafy vegetables, (2) deep yellow vegetables, (3) fruits, (4) milk and dairy, (5) rice and products, (6) meat and other protein, (7) processed meat, poultry, and fish, (8) sugar and confectionary, (9) mixed foods, and (10) non-alcoholic beverages; and each intake were described as either never, seldom, 1-3 times per month, 1-2 times per week, 3-4 times per week, once daily, and 2-3 times daily. The central tendency of intake was analyzed using the median measurement for each food group.

Dietary habits were based on the participant's responses for meal behavior, meal time, and food preferences. Meal behavior includes the tendency of university students to skip meals, to consume food in front of the gaming device, in-between snacks consumption, and the self-reported loss of appetite during gaming. Meal time is the stated time of meal consumption during breakfast, lunch, and dinner, presented using frequency and percentage for each period. Lastly, food preferences were described through the likes and dislikes of the five basic tastes – sweet, salty, sour, bitter, and umami.

Physical activity level followed the scoring protocol provided by the International Physical Activity Questionnaire (IPAQ). There are two types of IPAQ: the short form (SF) containing the summarized questions and mode of PAL measurement, and long form (LF) which has detailed questions for measuring the PAL derived from physical activities, transportation, leisure, and walking [20]. In this study, the short form was utilized. It was interpreted using the three categorical scores and the continuous scoring using the MET-minutes per week of the respondents. The categorical criteria for physical activity level were as follows (Table 2).

The interpretations for each tool followed the nominal scale such as the GAS, most of the questions in the dietary habits section (i.e., answerable yes or no), and ordinal scale like the FFQ, IPAQ-short form, and food preferences.

2.5 Ethical Considerations

Ethical considerations utilized for this study include voluntary participation, informed consent, minimal potential to harm, and confidentiality. Voluntary participation was observed such that the participants were allowed to revoke their participation anytime during the course of the study. Informed consent forms were also presented in the first section of the survey form, in which the participants had to agree and input their printed name in place of their signature. Aside from that, ID numbers were given to each participant during the data analysis to maintain confidentiality and anonymity with the participants. Minimal potential to harm was kept such that questions that can trigger psychological, social, physical, or legal harm were kept to a minimum and in relation to this, the respondents were informed of the risk of answering GAS in the study information section, before they can proceed on answering the form for their discretion whether to participate still or not.

Table 2. Categorical Criteria for the International Physical Activity Questionnaires

Category	Criteria
Low	Does not meet the criteria for categories two (moderate) or three (high).
Moderate	Three (3) or more days of vigorous-intensity activity of at least 20 minutes per day; or
	Five (5) or more days of moderate-intensity activity and/or walking of at least 30 minutes per day; or
	Five (5) or more days of any combination of walking, moderate-intensity or vigorous intensity activities, achieving a minimum of at least 600 MET-minutes/week.
High	Vigorous-intensity activity on at least three (3) days achieving a minimum total physical activity of at least 1500 MET-minutes/week; or
	Seven (7) or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total physical activity of at least 3000 MET-minutes/week.

Source: International Physical Activity Questionnaire [20]

3 Results

A total of one hundred seventy-one (171) university students participated in this study. One hundred thirty (130) or 76.02% were identified as "pathologic" gamers while forty-one (41) or 23.98% were identified as "non-pathologic" gamers. The results of the survey are as follows:

3.1 Profile of the Respondents

The age and sex at birth of the respondents were checked to see the difference between female and male gamers (Table 3). The majority (41.52%) of the respondents were 21-year old, followed by 22-year-old (21.05%) with a mean age of 20.84±1.15 years old. Distribution for age was tested using the Shapiro-Wilk Normality Test, and results were in a normal distribution (p-value = 0.8575 > α).

Table 3. Age and Gender of the Respondents

Socio-Demographic Characteristics	Frequency (n)	Percentage (%)	Mean±SD
Age			
18 years old	5	2.92	20.84±1.15
19 years old	18	10.53	
20 years old	32	18.71	
21 years old	71	41.52	
22 years old	36	21.05	
23 years old	7	4.09	
24 years old	2	1.17	
Total	171	100	
Sex at Birth			
Male	95	55.56	
Female	76	44.44	
Total	171	100	

Male and female gender were equally distributed at 55.56% and 44.44%, respectively. Wilcoxon Signed Rank Test was used to compute the mean difference between the two and zero difference between observation pairs was found (p-value = 0.1101 > α). Therefore, male and female respondents have the same tendency to become pathologically addicted.

3.2 Video Gaming Lifestyle

Assessment of the video gaming lifestyle classified the respondents' gaming addiction level as pathologic or non-pathologic. Out of 171 respondents, 76.02% identified as pathologic gamers, while the remaining 23.98% were non-pathologic gamers.

3.2.1 Gaming Addiction Level and Types of Games Played

In this section, the respondents were allowed to answer multiple types of games played. Table 4 presents that out of four hundred eighteen (418) responses, one hundred thirty-four (134) university students reported that they engage in First Person Shooter (FPS) games (32.06%), followed by the Multiplayer Online Battle Arena (MOBA) with 30.14% (n=126) of the sample playing it. Role-playing game (RPG) comes next at 19.86% (n=83), and then the Massively Multiplayer Online Role-Playing Games (MMORPG) comprise 10.05% (n=42) of the total number of university students. The least played game was the Real-Time Strategy (RTS) at 4.55% (n=19).

Table 4. Type of Games Played by the University Students

Type of Games	Frequency (n)	Percentage (%)
First Person Shooter (FPS) games	134	32.06
Multiplayer Online Battle Arena (MOBA)	126	30.14
Role-Playing Games (RPG)	83	19.86
Massively Multiplayer Online Role-Playing Game (MMORPG)	42	10.05
Real Time Strategy (RTS) games	19	4.55
Others*	8	2.45
Total	418	100.00

**Sum of all items which acquired less than 5 responses*

3.2.2 Perceived Benefits of Video Gaming

Similar to the previous section, multiple answers were allowed for the respondents' motivation to play video games. Table 5 shows that out of five hundred six (506) responses, 32.81% (n=166) of them stated that they play games because it serves as a distraction and stress reliever. Another perceived motive towards video gaming was its benefits in the enhancement of cognitive skills, followed by the video gaming serving as a medium for wider social connections (16.28%), improvement of technology skills (16.28%), and improvement of communication skills (11.89%). The least answered motive for playing was video gaming as an added income source at 3.88%.

3.2.3 Video Gaming Duration and Frequency

Determining the usual length of time the university students dedicate to gaming is also analyzed to determine their video gaming lifestyle (Table 6). The longest gaming duration reported by pathologic gamers was "greater than or equal to 5 hours each day" (20.47%), followed by "two hours daily" described by thirty-two (32) or 24.62% pathologic gamers. Among the non-pathologic gamers, "two hours daily" was the most answered gaming duration, followed by "three hours daily". The mean gaming duration of the non-pathologic gamers was more than or less than 2 hours (2.95±0.68 hours). The mean duration of gaming among pathologic gamers was more or less 3 hours (3.35±1.32 hours).

Table 5. Perceived Benefits of Gaming that Motivates the University Students

Motivation to play games	Frequency (n)	Percentage (%)
Serves as a good distraction and stress reliever	166	32.30
Enhances my cognitive skills (e.g., logic, visual perception, attention)	98	18.60
Widens my social connections	82	16.28
Improves my technology knowledge	78	16.28
Improves my communication skills	57	11.89
Serves as my source of income (e.g., streaming, e-sports tournaments, NFT games)	22	3.88
Others*	3	0.76
Total	506	100.00

**Sum of all items which acquired less than 5 responses*

Table 6. Video Gaming Duration Per Hour of the University Students

Duration of Gaming	Frequency (n=171)	Percentage (%)	Mean±SD
Pathologic gamers			
1 hour	10	7.69	3.35±1.32 hours
2 hours	32	24.62	
3 hours	26	20.00	
4 hours	27	20.77	
Greater than or equal to 5 hours	35	26.92	
Total	130	100.00	
Non-Pathologic gamers			
1 hour	4	9.76	2.95±0.68 hours
2 hours	13	31.71	
3 hours	11	26.83	
4 hours	7	17.07	
Greater than or equal to 5 hours	6	14.63	
Total	41	100.00	

For the number of times that the respondent played their game in a day (Table 7), the results show that pathologic and non-pathologic gamers open their game “twice a day” (33.08%).

Table 7. Video Gaming Frequency Per Day of the University Students

Rate of Gaming	Frequency (n=171)	Percentage (%)
Pathologic gamers		
Once Daily	34	26.15
Twice Daily	43	33.08
Thrice Daily	22	16.92
Greater than or equal to 4 times daily	31	23.85
Total	130	100.00
Non-Pathologic gamers		
Once Daily	9	21.95
Twice Daily	19	46.34
Thrice Daily	2	4.88
Greater than or equal to 4 times daily	11	26.83
Total	41	100.00

In summary, most university students (76.02%) were classified as pathologic gamers who are playing for about three (3) hours (3.35± 1.32 hours) twice daily. Non-pathologic gamers (23.98%) reported playing for more than or less than two (2) hours (2.95± 0.68 hours) twice daily, as well. Pathologic gamers are those who are more likely to express excessive, compulsive and addictive video gaming as measured by the pathological gambling criteria, while non-pathologic gamers are those who do not exhibit problematic use of video games.

3.3 Dietary Habits

3.3.1 Frequency of Consumption of Different Food Groups

Food intake was expressed in terms of the frequency of consumption of different food items from each food group. The most frequently eaten foods were recognized as those that were consumed at a “two to three times daily” frequency (Figure 2).

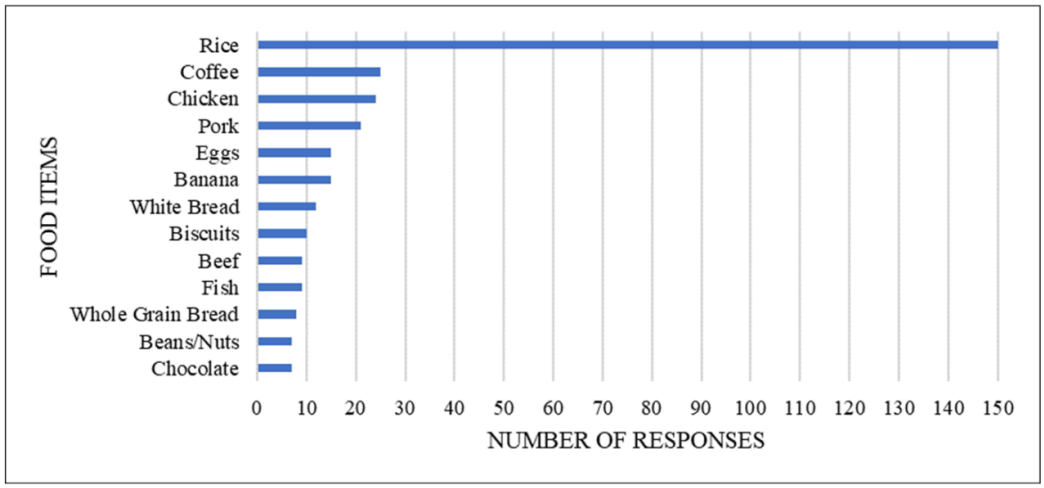

Figure 2.
Most Frequently Eaten Food Items of the University Students. Reproduced from Alpe [17], published by the University of the Philippines Los Baños

The university students reported that their foods eaten more than once daily are mostly comprised of carbohydrate-dense foods like rice, white bread, and whole grain bread; protein-rich foods like chicken, pork, eggs, fish, beef, and beans/nuts; sweetened food and beverage like coffee and chocolate; and other food items like banana, and biscuits. The respondents also drink sweetened fruit juice and chocolate, consume salty snacks, and eat pastries and candies daily.

3.3.2 Meal Time

The usual meal times of the respondents revealed that breakfast has the highest tendency to be skipped among pathologic and non-pathologic gamers (Table 8). Fifty (50) or 38.46% and eighteen (18) or 43.90% of them reported that they do not eat breakfast, respectively. For lunch, 57 (43.85%) of the pathologic gamers have their meal at 12 noon to 1 in the afternoon while 12 (29.27%) of non-pathologic gamers eat at 1 to 2 in the afternoon. Dinner time at 7 to 8 in the evening is the same for pathologic and non-pathologic gamers with 51 (39.23%) responses and 14 (34.15%) responses, respectively.

Table 8. Usual Meal Times of the University Students

Usual Meal Time	Pathologic		Non-Pathologic		Total	
	n	%	n	%	n	%
Breakfast						
6 am or earlier	2	1.54	2	4.88	4	2.34
6-7 am	6	4.62	0	0.00	6	3.51
7-8 am	14	10.77	6	14.63	20	11.70
8-9 am	16	12.31	8	19.51	24	14.04
9-10 am	42	32.31	7	17.07	49	28.66
Skips breakfast	50	38.46	18	43.90	68	39.77
Total	130	100.00	41	100.00	171	100.00
Lunch						
11 am-12 nn	22	16.92	11	26.83	33	19.30
12 nn-1 pm	57	43.85	10	24.39	67	39.02
1 pm-2 pm	26	20.00	12	29.27	38	22.22
Later than 2 pm	22	16.92	7	17.07	29	16.96
Skips lunch	3	2.31	1	2.44	4	2.34
Total	130	100.00	41	100.00	171	100.00
Dinner						
6 pm or earlier	8	6.15	2	4.88	10	5.85
6-7 pm	27	20.77	9	21.95	36	21.05
7-8 pm	51	39.23	14	34.15	65	38.01
8-9 pm	26	20.00	8	19.51	34	19.88
Later than 9 pm	14	10.77	6	14.63	20	11.70
Skips dinner	4	3.08	2	4.88	6	3.51
Total	130	100.00	41	100.00	171	100.00

3.3.3 Meal Behaviors

Meal skipping, consumption of in-between snacks, self-reported loss of appetite during gaming, and tendency to eat in front of the gaming device were the meal behaviors included in the study (Table 9).

Among pathologic gamers, meal skipping was observable (56.92%), and half of the non-pathologic gamers (53.66%) also exhibited the same behavior. In-between snacks are eaten by both types of gamers with 109 (83.85%) yes responses from pathologic gamers and 35 (85.37%) from non-pathologic gamers. Furthermore, self-reported loss of appetite during gaming is not felt by both types of gamers with 68 (52.31%) of no responses from pathologic gamers, while 30 (73.17%) are reported by non-pathologic. Eating in front of their gaming devices is observed among pathologic (53.85%) while half non-pathologic gamers (65.85%) do otherwise.

Table 9. Meal Behaviors Exhibited by the University Students

Meal Behaviors	Pathologic				Non-Pathologic			
	Yes		*No*		*Yes*		*No*	
	n	%	n	%	n	%	N	%
Meal Skipping	74	56.92	56	43.08	19	46.34	22	53.66
In-between snacks consumption	109	83.85	21	16.15	35	85.37	6	14.63
Self-reported loss of appetite during gaming	62	47.69	68	52.31	11	26.83	30	73.17
Eating in front of gaming device	70	53.85	60	46.15	14	34.15	27	65.85

3.3.4 Food Preferences

The food preferences of the university students showed that 112 (32.18%) pathologic gamers reported that they like sweet foods. This is followed by salty foods with 105 (30.17%) responses. The non-pathologic gamers have the same food likes with 35 (32.11%) reporting to like sweet foods, and 29 (26.61%) for salty foods.

For food dislikes, university students expressed that they dislike bitter foods. One hundred fifteen (115) or 61.83% of pathologic gamers reported this as food dislike, and 37 (64.91%) for non-pathologic gamers.

To summarize, the dietary habits of university students include frequent consumption of mixed foods, sugar and confectionary, meat, non-alcoholic beverages, and carbohydrate-dense foods. University students were also found to exhibit meal skipping, eat meals at a later time, consume sweetened or salty snacks, and dislike bitter foods.

3.4 Physical Activity Level

The university students' physical activity level (Table 10) is a combination of the computation of the MET-minutes/week of their activities and the type of physical activities performed by the university students. The results showed that 36 (27.69%) were classified as having a high PAL, 35 (26.69%) had moderate PAL, while 59 (45.38%) had a low PAL among the pathologic gamers. Non-pathologic gamers have 9 (21.95%), 10 (24.39%), and 22 (53.66%) high, moderate, and low PAL, respectively.

Table 10. Physical Activity Levels of the University Students

Physical Activity Level	Pathologic		Non-Pathologic	
	n	%	n	%
Low Physical Activity Level	59	45.38	22	53.66
Moderate Physical Activity Level	35	26.92	10	24.39
High Physical Activity Level	36	27.69	9	21.95
Total	130	100.00	41	100.00

3.5 Relationship of Video Gaming Addiction Level with Dietary Habits and PAL

Utilizing Spearman's correlation coefficient, association of video gaming with dietary habits and physical activity level was found (Table 11). Among all the food groups, only fruits and protein-rich foods acquired a weak negative relationship, indicating a decrease in consumption as the level of video gaming addiction increases. All other food groups acquired a weak positive relationship.

All meal behaviors resulted in a weak positive relationship, implying higher chances of exhibiting these habits with increasing gaming, while meal times have almost no relationship to the latter variable. Physical activity level acquired a weak positive relationship, indicating a rise in levels of physical activity despite the increasing tendency of the student to become a pathological gamer.

Table 11. Association of Video Gaming with Dietary Habits and PAL Described using the Spearman's Correlation Coefficient

Variable Tested		Spearman's correlation coefficient	Interpretation*
Gaming Addiction Level	**Food intake**		
	Dark leafy vegetable	0.150	Weak positive relationship
	Deep yellow vegetable	0.082	Weak positive relationship
	Fruits	-0.054	Weak negative relationship
	Milk and dairy	0.115	Weak positive relationship
	Rice and products	0.117	Weak positive relationship
	Meat and other protein	-0.066	Weak negative relationship
	Processed meat, poultry, and fish	0.081	Weak positive relationship
	Sugar and confectionary	0.089	Weak positive relationship
	Mixed foods	0.057	Weak positive relationship
	Non-alcoholic beverages	0.124	Weak positive relationship
	Meal Behaviors		
	Meal Skipping	0.177	Weak positive relationship
	Self-reported loss of appetite	0.170	Weak positive relationship
	Meal place convenience	0.218	Weak positive relationship
	Food preferences	0.068	Weak positive relationship
	Meal Time		
	Breakfast	0.029	Zero relationship
	Lunch	0.065	Weak positive relationship
	Dinner	0.039	Zero relationship
	Physical Activity		
	Physical Activity Level	0.098	Weak positive relationship

4 Discussion

The profile of the respondents may have an incurring influence on the participation of university students in video gaming. In terms of age, the mean and standard deviation of the responses revealed that the age of the participants was normally distributed at 20.84±1.15 years old. This mean age concurred with the other studies stating age has an inverse relationship with gaming [22, 23], possibly due to younger students' higher substantial competitiveness. Students aged 18-20 are mostly inclined to achieve more and be better than their peers, causing them to engage in video games, which would justify their skill comparisons [23]. Regarding gender, male respondents have a slightly higher population than female gamers because, generally, more male students engage in video gaming due to the genre of most games, which aligns with their natural interests. However, the test for population difference stated that the female and male respondents do not have significant differences in video game usage. This is contrary to the assumption of this study and to the results of the research authored by Wittek et al. [24], which found a positive correlation between male gender and video game use. Meanwhile, in the study of Camarata [23], female university students have reported also engaging in gaming at the same rate as male because of the rewarding effect of video gaming every time that they reach a new level and because of the desire for females to improve their spatial skills through gaming.

The university students were determined as either pathologic or non-pathologic gamers. Pathologic gamers are those who have acquired more than or equal to three (3) pathologic gaming criteria

[18]. Each criterion corresponds to a psychosocial aspect that may have been neglected due to excessive video game use. Most of the respondents for this study were revealed to be pathologic gamers, meaning that they demonstrate addictive gaming behavior. This behavior may be why there is an increased gaming use in the Philippines during the pandemic [7]. The study also revealed that games played by the respondents were mostly MOBA and FPS games. In the Philippines, online competitive games are more engaged by young adults, than any other type of games and because of the competitive nature of MOBA games like League of Legends (LOL), Defense of the Ancients 2 (DOTA2), and Mobile Legends (ML), Filipino video gamers become an enthusiast of these games [7]. FPS games such as Valorant and PlayerUnknown's Battleground (PUBG) also have growing popularity among university students, similar because of their competitive nature and due to the immersive experience that it brings to the gamers through its first-person setting. Aside from being commonly engaged, FPS is also more popularly viewed than other game genre when live streamed online [25]. The respondents reported that the most common reason they engaged in gaming is that it is a good distraction and stress reliever. Games serving as an escape from stress are the most commonly reported reason to explain the addictive gaming behavior of video game users [8]. Moderate gaming can be associated with relaxation and stress reduction, potentially assisting in a healthy mind development [5]. Aside from that, the participants also reported that video gaming enhances their cognitive skills such as logic, visual perception and attention. In this sense, video games were seen as an influential factor in mental growth, a medium for developing spatial skills, and a contributor to improving students' strategic and analytical thinking skills [8, 10, 23].

Since the university students perceive video gaming as beneficial, the mean duration of gaming among pathologic gamers was more or less 3 hours The mean duration of gaming among pathologic gamers was more or less 3 hours (3.35±1.32 hours) per day. Puolitaival et al. [26] stated that excessive gamers spend around three hours of gaming each day at most. When expressed to an amount in a week, the duration is close to the playtime value that Rudolf, et al. [3] also acquired which is about 24.4 ± 15.9 hours per week. Both non-pathologic and pathologic gamers revealed that they play their games two times daily. Twice a day is the most common frequency of gaming according to other studies [27], indicating that gamers may tend to engage in gaming a similar number of times daily but differ in the duration of their video game use.

In the food intake section, the results of the study presented that the most consumed foods of the university students are those that are caloric-dense and fewer that are nutrient-dense. Video gamers are typically observed to exhibit low consumption of fruits and vegetables and high consumption of sweetened foods and drinks [16, 26, 28]. This may be connected to the video gamers' long screen time, which inhibits them from preparing their own food and solely lie on readily available ones [3]. The video game induced stress that the students experience after gaming might also alter their food intake [5, 14], causing them to consume higher amounts of fat and sweets and lower intake of fruits and vegetables [15]. Tendency to skip meals, consume their food later, and eat their meals in front of their gaming device. High amount of screen time and the addictive impulse to gaming may be the reason for the following habits. For an instance, a gamer may skip their meal or eat at a later time to prevent disruption from their video games because video gamers typically allot more time in gaming rather than meal consumption [29]. Similarly, they may also eat in front of their devices for convenience and easier access to continue gaming due to the addictive behavior that they have developed which prevents them from detaching themselves from their gaming devices [11, 16].

The final variable, physical activity level, presents that most university students mainly were determined to have low physical activity levels, similar to the previously related studies [10, 16, 26], which state that gamers perform little to no physical activities. However, the data still presents a close difference between moderate and high PAL, compared to the low PAL, which indicates that when combined, the part of the sample that performs vigorous and moderate physical activities

has a higher number than the other.

All variables that were tested have a weak relationship with video gaming addiction level except for the meal times during breakfast and dinner. For the food intake, only fruits, meat and protein intakes resulted in a weak negative relationship with gaming. This means that as the gaming addiction level of the respondents escalates, their frequency of intake for these foods decreases. Dark leafy vegetables, deep yellow vegetables, milk and dairy, rice and products, processed foods, sugar and confectionary, mixed foods, and non-alcoholic beverages, all have weak positive relationship to gaming addiction level (frequency of intake increases as GAS increases). Rudolf et al. [3] stated a decreased mean fruit intake of eSports and video game players. Puolitaiv et al. [26] also concluded that higher screen time results in lower amounts of vegetables and fruits intake. The frequent intake of mixed foods, sweets, and processed foods follows the findings of Delfino et al. [30] who stated that excessive use of digital devices was associated with high content of snacks, fried food, and sweets in their sample. This is also related to the association of food preferences and gaming addiction level which states that gamers are more likely to eat sweet, salty, or energy-dense foods [15] because of the psychological distress that they acquire from gaming [3, 12, 13].

Meal skipping was found to have a weak positive relationship to gaming addiction levels. The same interpretation was found between the self-reported loss of appetite and meal place convenience. This indicates that as the respondent engage in excessive gaming, they tend to skip meals, feel loss of appetite, and eat their food in front of their device also increases. This may be due to the gamer's desire to progressively increase their time to engage in video games, as observed by a study among adolescents who skip meals and frequently engage in gadgets [29]. Parallel implications may be observed towards eating in front of gaming devices – to increase their time to use their gadgets and to continue gaming after meals conveniently.

Loss of appetite may be caused by the stress that competitive gaming induces [12] which in turn causes the inhibited feeling of hunger [31]. Food preferences have a weak positive correlation with gaming addiction level, indicating a higher tendency to eat sweet and salty snacks as the gaming addiction level increases [16, 26, 28].

Physical activity level has a weak positive relation with gaming addiction level. As the tendency of the gamer to become pathologic increases, their physical activity level also increases. This is the opposite of the studies which state that sedentary behavior and decreased physical activity are observed among gamers [3, 12]. However, a 2021 study about lifestyle behavior and musculoskeletal health profiles of video gamers found that participants can still perform moderate-intensity physical activity despite the high duration and frequency of gameplay [32]. This means that despite engaging in games, respondents may still find the time to perform physical activities.

5 Conclusion

In this study, the video gaming addiction level was determined by analyzing the gaming addiction score of the university students using the gaming addiction scale. The results stated that most university students are pathologic gamers or may exhibit excessive, compulsive, and problematic use of video games. Only less than a quarter were determined to be non-pathologic. University students have a decreased frequency of intake for fruit and protein and a higher frequency of intake for foods which were caloric-dense such as those rich with carbohydrates (i.e., rice and products), snacks that are ready to eat and can be easily bought such as the processed foods, and those under the mixed foods categories like burgers, fries, biscuits, and pizzas. Sweet foods like those under the sugar and confectionaries, and sweetened non-alcoholic beverages were also preferred. University students identified as pathologic were more likely to skip meals, feel a loss of appetite during gaming, eat in front of their gaming devices, and eat meals later. All were fond of sweet and salty snacks and disliked foods that were bitter to taste. Physical activity levels of university students were primarily low. However, almost half of them still engage in moderate and vigorous physical

activities, therefore implying that gaming addiction level does not restrain the respondents from performing physical activities.

In summary, associations of video game addiction level towards dietary habits, video game addiction level and physical activity level were observed. The frequency of intake for vegetables, milk and dairy, rice and products, processed foods, sugar and confectionary, mixed foods, and non-alcoholic beverages increases as the gaming addiction level increases (weak positive relationship). Frequency of intake for fruits and meat has an inverse relationship with gaming addiction level (weak negative relationship). Hence, the consumption of these foods was less likely with increasing video game use. The tendency of university students to skip meals, feel a loss of appetite, and eat in front of their gaming devices also increases with their GAS scores. Food preference was also found to have an association with video game addiction level, whereas increasing GAS scores led to a higher tendency to eat sweet and salty snacks. PAL has a weak positive relationship with video gaming, implying that university students can still perform physical activities despite their increasing use of video games.

This paper will help establish the starting point for other studies about the relationship between the video gaming lifestyle and its implications for nutrition and physical activity levels. It also provided a different perspective regarding the physical activity level among university students who engage in video gaming. However, due to the purposive nature of the study, the results are limited within the sample. They may not be used to generalize the population of all university students within the age range.

6 Recommendations

The findings of this study can have implications for public health. In contrast, interventions to promote awareness regarding proper food intake, diet, and physical activity level may be provided to people who engage in gaming. These interventions must focus on offering nutrition and diet tips that can be affordable and convenient to the university-student gamers and must revolve around the proper and complete food consumption which follows the recommended daily intakes that the gamers miss. Moreover, the results of this study also suggest an improvement in the methodology where nutritional status may be considered in the association also to investigate if these results have a relation to the current status of the respondents which can further discover more evidence to support the effects of gaming to nutritional and diet behaviors. Focusing on just one variable (i.e., video gaming lifestyle and food intake, or video gaming lifestyle and physical activity level) rather than using mixed methods to analyze and correlate each may provide a more accurate result that may give an in-depth investigation of the possible relationship that video gaming may have to other health-related factors. A lot of the results also did not conform to the reviewed literature. They revealed that despite the video game use, intake of fruits and vegetables and engagement in physical activity level increases, and these findings may imply further studies also to investigate the perspectives of pathological gamers towards diet and nutrition, which induces them to eat healthy and perform physical activities.

In addition, an enhancement in terms of the research design may also be done by which quantitative study that uses parametric measures should be performed so that the results can be used to generalize the people who engage to gaming, and not just limit the results among the study participants. Measuring the portions of the food intake, rather than the frequency alone, may also be considered for future studies to produce a more empirical justification of the foods consumed by the respondents. Finally, the stated enhancements that this study needs serve as an opportunity for potential research under the same subject to expand the number of local studies dealing with nutrition and video gaming.

Statements and Declarations

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Data Availability

Data is available upon request from the author.

Competing Interest

The authors declare no known competing interests.

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Ethical Considerations

The Institute of Human Nutrition and Food, College of Human Ecology, University of the Philippines Los Baños approved the study. The survey questionnaire includes written informed consent forms for the participant to agree on before their research participation.

Author Contributions

M.C.J.L.A.: conceptualization, methodology, validation, formal analysis, investigation, resources, data curation, writing–original draft preparation, writing–review and editing, visualization, project administration, funding acquisition. **R.I.B.M.**: methodology, formal analysis, writing–review and editing, supervision. All authors have read and agreed to the published version of the manuscript.

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