



Original Article

Dietary Habits and Nutritional Knowledge of Selected Philippine National Combat Athletes: a Cross-Sectional Study

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Article Received: October 26, 2020

Article Accepted: April 7, 2021

Article Published: August 15, 2021 (Online)

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Abstract

Objectives: The study aims to assess the dietary habits and nutritional knowledge of selected Philippine national combat sports athletes and determine the correlation of demographics and sources of nutrition information with participants' dietary habits and nutrition knowledge. **Methods:** This cross-sectional study included assessing boxing and taekwondo Philippine national athletes using the Dietary Habits and Nutrition Knowledge Questionnaire: Filipino Version. Data were analyzed using descriptive statistics and inferential statistics between sports comparison and exploratory correlation and regression analyses. Alpha was set at 0.05. **Results:** A total of 44 participants aged 21+ 3.4 years were able to participate in the study. Responses revealed that 69.44% have fair dietary habits and 73.54% have good nutritional knowledge. Results indicated no significant difference between the two sports in dietary habits and nutritional knowledge ($p>0.05$). Further analyses revealed that years in playing ($r= 0.32, p= 0.04$), and sources of nutrition information, precisely strength and conditioning coach ($r= 0.36, p= 0.02$), and peers ($r= 0.39, p= 0.01$) have a significant correlation with good dietary habit and nutritional knowledge, respectively. **Conclusion:** Overall, Filipino national athletes of boxing and taekwondo have fair dietary habits and sound nutritional knowledge. Furthermore, nutritional knowledge sources are possible relevant factors that may affect the dietary habits and nutritional knowledge of combat sports athletes.

Keywords: Dietary Habits, Nutrition Knowledge, Combat Sports

INTRODUCTION

In the Philippines, boxing and taekwondo are considered famous combat sports because of the international success achieved by their local talents. These sports are characterized by high-intensity intermittent efforts, which require a high nutritional demand.¹ To minimize fatigue and maximize training adaptations, the importance and benefits of nutrition and nutritional strategies are often discussed with consideration to these specific requirements. These sports are also categorized according to weight classes. For an athlete to qualify for a weight category in competition, extreme weight loss measures are being done by athletes as a common practice. These measures place them at

risk for the adverse effects of inadequate energy intake.²

Despite the efforts to impart optimal weight-loss strategies in sports nutrition programs², some athletes remain poorly educated about these nutritional practices and make poor nutritional choices.³ Without proper education, the correct information on proper nutrition cannot be translated into healthy and proper dietary choices⁴, which can interfere with athletic performance.⁵ Athletes regularly engaging in strenuous training for the competition should be aware of the effects of these poor nutritional practices and taught correct strategies to

support their training goals. For example, if their energy needs are not met, there will be a breakdown of lean body tissue, which will cause a loss of strength and endurance. The energy demands in sports like Taekwondo and Boxing should be individualized based on their body composition and weight goals.⁶ A total caloric intake of 60-65 kcal/kg body weight should be the ideal diet for combat sports such as taekwondo. Diets should be composed of high carbohydrates, an adequate amount of protein, and fluids with a low proportion of fats.^{7,8} Providing macronutrient recommendations in the diet requires careful consideration of their metabolic rates, weight loss objectives, energy expenditures during the daily training sessions, and many more.⁹

Thus, these athletes should be informed that maintaining a proper healthy diet is vital to optimize performance during intense training and competition and prevent compromise in immune, endocrine, and musculoskeletal function.¹⁰ In the Philippines, a positive correlation between nutritional knowledge and dietary habits of the athletes concluded the importance and need for proper nutrition information dissemination while considering information sources. It affects scores for both aspects. A total of 85 college athlete respondents aged 16-24 were recruited in this study, representing 17 sports include combat sports such as arnis, karate-do, and taekwondo.¹¹

This correlation, however, was not particular to weight-category sports, where nutrition practices are crucial for both sport participation and performance. Thus, this study primarily aims to determine dietary habits and nutritional knowledge of selected combat sport national athletes. It also aims to determine the correlation of demographics and sources of nutrition information with participants' dietary habits and nutritional knowledge. By providing this feedback, necessary changes and improvements may be integrated to teach proper nutrition information and practices for optimal health and athletic performance.

METHODS

Research Design. This research is a quantitative

cross-sectional study aimed at assessing the dietary habits and the nutritional knowledge of the Philippine National Boxing and Taekwondo teams of years 2018 and 2019. The study was ethically reviewed and approved by the University of Santo Tomas College of Rehabilitation Sciences Ethics Review Committee (UST-CRS) (Protocol Number: SI-2018-003).

Participants. A population census count of 44 athletes of the Philippine National Boxing and Taekwondo teams recognized by the Philippine Sports Commission for the years 2018 and 2019 participated in the study. Purposive sampling was used as teams chosen were the top Philippine combat sports with the most medals won in the Olympics.¹² The study included all members of the senior combat division of each sport, aged 16-35 years, who are currently recognized by the Philippine Sports Commission (PSC) as official members. Athletes with noted nutritional deficiencies or disorders were excluded from the study. Taekwondo Poomsae athletes were also excluded as they were not classified as combat sports categorized by weight. Coaches and other team staff were also excluded from the study.

Instrument. The Dietary Habits and Nutrition Knowledge Questionnaire: Filipino Version ((DHNKQ-Fil) by Pineda et al. was the self-administered tool used to evaluate dietary habits and nutritional knowledge.^{13,14} It is subdivided into the following sections:

1. The demographics section included personal information provided insight about the athlete's nutritional information sources, history of involvement in sport, and any nutritional information sources that may affect their dietary habits and nutritional knowledge.¹³
2. The dietary habits section was composed of 18 questions that evaluated nutritional practices and habits perceived to be necessary for health and performance. Choices ranged from Always (4) to Never (1), with a total score ranging from 18-72. The higher the scores for this section, the better the dietary habits of the athlete.^{13,14}
3. The nutritional knowledge section was composed of 29 questions that tested the

athlete's level of knowledge and information by measuring the extent of agreement of the athlete with each stated information. Choices ranged from Strongly Agree (4) to Strongly Disagree (1), with a total score ranging from 29-116. The higher scores for this section, the better level of nutritional knowledge.^{13,14}

For the evaluation and classification per section, the score key provided in the questionnaire was used.^{13,14} The percentage of these actual section scores was computed against the total possible section score to identify its classification: 0% to 54% as poor, 55% to 69% as fair, 70% to 84% as good, and 85% to 100% as excellent. These classifications were used to interpret the level of dietary habits and nutrition knowledge of the participants.

This instrument was shown to have good and acceptable psychometric properties. Content and face validity resulted in a good overall score of 90% average congruency. Internal consistency resulted in good alpha scores of 0.68 and 0.81 for sections 2 and 3, respectively. Lastly, good test-retest reliability scores were reflected in Pearson's r values of 0.82 ($ICC= 0.79$) and 0.60 ($ICC= 0.60$) for sections 2 and 3 respectively.^{13,14}

Procedures. After receiving ethical approval from the UST-CRS Ethics Review Committee, permission letters were sent to the Philippine Sports Commission for the data collection. Invitations were sent to the Philippine National Boxing and Taekwondo teams. Informed consent was given to the participants and their respective guardians, especially for participants below 18 years. All data gathering procedures were held in their respective training venues. Once consent was secured, researchers briefed the athletes with the questionnaire and cited specific instructions to avoid copying to maintain the accuracy of the data collection results. Appropriate spacing between testers during data gathering ensured confidentiality of answers. Code names were required from the athletes for de-identification. Athletes were allowed to ask questions for clarification and ample time was given to complete the questionnaire with each sheet thoroughly reviewed to avoid missed out answers. Once finished, the researchers secured and analyzed the data collected.

Data Analysis. Data was encoded and analyzed using MS Excel and STATA 15 (serial number: 401506343769). Additional inferential statistics like independent t-test and Mann-Whitney test for comparison of groups, and Pearson's correlation and Spearman tests correlate variables. Descriptive analyses, like frequency, percentage, mean and standard deviation, were done using STATA statistical software. Lastly, logistic regression was done to analyze dietary habits and nutritional knowledge's possible association with the other variables assessed. Final scores for each section were re-classified into two categories (Category 1 (Poor): Poor and Fair final scores; and Category 2 (Good): Good and Excellent scores) for the correlational and logistic regression analyses. Alpha was set at 0.05.

RESULTS

Demographic Data and Source of Nutrition Knowledge. A total of 44 athletes from both teams participated in the study, with adequate representations for both genders, ages, and teams (see Table 1). The mean age for both sports was 21 years old, with males representing most of the subject population. The participants' playing experience ranges from 7 to 10 years, with the taekwondo team having a longer duration of playing years. In general, both teams' athletes did not differ significantly in terms of demographic characteristics ($p>0.05$) and reported nutrition information sources. The most commonly reported sources for all participants were their team coach (79.55%) and strength and conditioning coaches (79.55%), while the least common source was magazine (6.82%).

Summary of Participant Classification. Table 2 summarizes the classification of dietary habits and nutritional knowledge per team. A total of 56.82% of the participants were classified to have poor to fair scores for dietary habits, while 43.18% had a good score for nutrition knowledge, with no significant difference reported between the overall frequency of scores for sections 2 and 3, with p-values at 0.65 and 0.45, respectively ($p<0.05$). Out of 100% total in scores possible for both sections, participants only achieved an overall mean score of $69.44 \pm$

6.07 for section 2 and 73.57 ± 5.26 for section 3. These scores are classified as fair and good, respectively. The mean scores for dietary habits were higher in the boxing team (70.56 ± 6.84) than the taekwondo team (67.98 ± 4.66). These scores contrasted with the mean scores for nutrition knowledge in the taekwondo team

(74.09 ± 5.32), which were reported to be higher than the boxing team (73.17 ± 5.29). Despite these scores, no significant difference was found between their final classification of scores for both sections, where p-values were recorded to be 0.45 and 0.56 for sections 2 and 3, respectively ($p<0.05$).

Table 1. Summary of Demographic Characteristics and Source of Nutritional Information of Participants

	Total (n= 44)	Boxing Team (n= 25)	Taekwondo Team (n= 19)	p-value
Demographic Characteristics				
Age (mean \pm SD)	21.41 ± 4.00	21.6 ± 4.39	21.16 ± 3.52	0.64
19 and below	16 (36.36%)	8 (32.00%)	8 (42.11%)	0.37
20 and above	28 (63.63%)	17 (68.00%)	11 (57.90%)	
Gender (n, %)				
Male	31 (70.45%)	22 (88.00%)	9 (47.37%)	0.27
Female	13 (29.55%)	3 (12.00%)	10 (52.63%)	
Years of Playing* (mean \pm SD)	8.95 ± 4.25	7.92 ± 4.12	10.26 ± 4.15	0.65
Height (cm)	168.95 ± 7.24	166.34 ± 6.67	172.38 ± 6.64	0.56
Weight (kg)	60.78 ± 10.43	59.00 ± 7.33	63.14 ± 13.35	0.45
Source of Nutrition Information (n, %)				
Coach [#]	35 (79.55%)	18 (72%)	17 (89.47%)	0.56
Magazine	3 (6.82%)	2 (8%)	1 (5.26%)	0.45
TV	15 (34.09%)	6 (24%)	9 (47.37%)	0.32
Strength and Conditioning Coach [#]	35 (79.55%)	10 (40%)	15 (78.95%)	0.01*
Parents	16 (36.36%)	7 (28%)	9 (47.37%)	0.13
Social Media	19 (43.18%)	5 (20%)	14 (73.68%)	0.01*
Expert	15 (34.09%)	7 (28%)	8 (42.11%)	0.31
Peers ^{\$}	4 (9.09%)	2 (8%)	2 (10.53%)	0.97
Took nutrition course				
Yes	18 (40.91%)	8 (32%)	10 (52.63%)	0.45
No	23 (52.27%)	15 (60%)	8 (42.11%)	
No answer	3 (6.82%)	2 (8%)	1 (5.26%)	

Note: n=frequency, %=proportion

[#]Operational Definition: Coach refers to person in charge for training the members and making decision during plays of team sports; while Strength and Condition Coach is responsible for the development, and implementation of training programs focused on improving performance, prevention of injuries, lifelong fitness and movement skills.

*No answer from one participant

^{\$}Was originally indicated in the questionnaire as "Others" but was changed due to the responses

*significant difference

Table 2. Summary of Participant Classification

	Total (n= 44)	Boxing Team (n= 25)	Taekwondo Team (n= 19)	p-value
	Frequency Distribution (n, %)			
Section 2: Dietary Habits				
4 - Excellent	0	-	-	0.65
3 - Good	19 (43.18)	14 (73.68)	5 (26.32)	
2 - Fair	24 (54.55)	10 (41.67)	14 (58.33)	
1 - Poor	1 (2.27)	1 (100)	0	
Section 3: Nutrition Knowledge				
4 - Excellent	2 (4.55)	2 (100%)	-	0.45
3 - Good	32 (75.00)	18 (56.25)	15 (46.88)	
2 - Fair	9 (24.55)	5 (55.56)	4 (44.44)	
1 - Poor	0	-	-	
Mean Scores (%)				
Section 2: Dietary Habits	69.44 ± 6.07	70.56 ± 6.84	67.98 ± 4.66	0.45
Section 3: Nutritional Knowledge	73.57 ± 5.26	73.17 ± 5.29	74.09 ± 5.32	0.56

Note: n=frequency, %=proportion

*significant difference

Dietary Habits and Nutrition Knowledge. The respondents were clustered into those low scores as category one and high scores as category two. High scores indicated good dietary habits in the dietary habit section, while low scores indicated bad dietary habits. Among the bad habits reported were drinking carbonated drinks (61.36%), not recording food intake (79.55%), not dieting (54.55%), and not consuming dairy products (61.36%) reflected as items with the lowest scores. Among the good dietary practices reported were eating (79.55%) and drinking (93.18%) regularly, eating fruits (72.73%) and vegetables (70.45%) regularly, and consuming fewer fast foods (59.09%), all of which had the highest reported scores. Table 3 shows the breakdown of each item indicated in the dietary habits section.

For nutritional knowledge, high scores indicated good knowledge where athletes knew the correct information about the item presented. In contrast, low scores were interpreted as the information that needed to be updated and corrected. This section showed the need for athletes to update their knowledge on alcohol (56.82%), effects of excess intake of vitamins (65.91%), and fat function (65.91%), as reflected in the low scores obtained. Items such as the importance of breakfast (93.18%), effects of nutrition on the mental focus (93.18%), pre-competition meal (79.55%), sources of

carbohydrates (90.91%), protein (79.55%), and multivitamins (93.18%) were reported to score high, which indicated that this information is correctly known and understood. Table 4 shows the breakdown of each item indicated in the nutrition knowledge section.

Table 5 summarizes the correlational analyses of nutritional knowledge and dietary habits with factors like demographic characteristics and nutritional information sources. Results revealed that years in playing ($r= 0.32, p= 0.04$) and peers ($r= 0.39, p= 0.01$), and strength and conditioning coach ($r= 0.36, p= 0.02$) are significant factors for good dietary habit and nutritional knowledge, respectively. There was no significant correlation between nutritional knowledge and dietary habits among participants ($p>0.95$).

Further regression analyses revealed no significant association between nutritional knowledge and dietary habit with all factors in the study (see supplementary table 1).

DISCUSSION

Nutrition knowledge and dietary practices are essential considerations in designing nutrition education for athletes and identifying nutritional factors that may affect performance.¹⁵ This study found that most participants' dietary habits and nutrition knowledge were classified as fair (54.55%) and good (75%), respectively. The

Table 3. Per item analyses of responses in Section 2: Dietary Habits (*n*= 44)

ITEM NO.	SECTION 2: ITEM DESCRIPTION	Category 1		Category 2	
		<i>n</i>	%	<i>n</i>	%
1	Frequency of eating breakfast: <i>Gaano kadalas kang mag-almusal sa umaga?</i>	13	29.55	31	70.45
2	Skipping meals: <i>Gano kadalas kang hindi kumakain?</i>	7	15.91	37	84.09
3	Taking of vitamin supplements: <i>Gaano kadalas kang uminom ng vitamin supplements?</i>	19	43.18	25	56.82
4	Taking of mineral supplements: <i>Gaano kadalas kang uminom ng mineral supplements?</i>	18	40.91	26	59.09
5	Frequency of eating breakfast, lunch and dinner: <i>Gaano kadalas kang kumain ng tatlong regular na pagkain (e.g. almusal, tanghalian, at hapunan) kada araw?</i>	9	20.45	35	79.55
6	Recording of food intake: <i>Gaano kadalas mong irekord ang iyong kinakain?</i>	35	79.55	9	20.45
7	Hydration: <i>Gaano kadalas kang uminom ng tubig?</i>	3	6.82	41	93.18
8	Drinking carbonated drinks: <i>Gaano kadalas kang uminom ng mga inuming carbonated (e.g. soft drink, o sparkling water?)</i>	27	61.36	17	38.64
9	Frequency of dieting: <i>Gaano kadalas kang nagdidiyeta?</i>	24	54.55	20	45.45
10	Frequency of eating carbohydrates: <i>Gaano kadalas kang kumain ng mga pagkaing mayaman sa carbohydrates tulad ng tinapay, cereal, pasta o noodles, patatas o kanin?</i>	11	25.00	33	75.00
11	Frequency of eating fruits: <i>Gaano kadalas kang kumakain ng prutas?</i>	12	27.27	32	72.73
12	Frequency of eating vegetables: <i>Gaano kadalas kang kumakain ng gulay?</i>	13	29.55	31	70.45
13	Frequency of eating dairy products: <i>Gaano kadalas kang kumakain ng –dairy products o mga pagkaing gawa sa gatas (e.g. keso, yogurt)?</i>	27	61.36	17	38.64
14	Frequency of eating sweets: <i>Gaano kadalas kang kumakain ng mga pagkaing matamis o mataas sa asukal?</i>	22	50.00	22	50.00
15	Frequency of eating junk foods: <i>Gaano kadalas kang magmeryenda ng mga pagkaing tulad ng chichirya, keyk, kendi, donut o "softdrinks?</i>	12	27.27	32	72.73
16	Frequency of eating snacks: <i>Gaano kadalas kang magmeyenda ng mga pagkaing tulad ng yogurt, popcorn, crackers o prutas?</i>	22	50.00	22	50.00
17	Frequency of eating fast foods: <i>Gaano kadalas kang kumakain ng fast food (e.g. pizza, burger, o fries)?</i>	18	40.91	26	59.09
18	Nutrition information: <i>Gaano kadalas kang maghanap ng impormasyong pangnutrisyon?</i>	21	47.73	23	52.27

Note: Category 1: Poor and Fair

Category 2: Good and Excellent

n=frequency, % =proportion

Table 4. Per item analyses of responses in Section 3: Nutritional knowledge (*n*= 44)

ITEM NO.	SECTION 3: ITEM DESCRIPTION	Category 1		Category 2	
		n	%	n	%
1	Skipping breakfast: <i>Ang hindi pag-aalmusal ay maaaring magkaroon ng negatibong epekto sa paglalaro ng isang atleta</i>	3	6.82	41	93.18
2	Protein consumption: <i>Ang mga pagkaing mayaman sa protina ang pinakamahusay pinagkukunan ng enerhiya</i>	6	13.64	38	86.36
3	Mental performance: <i>Naaapektuhan ng nutrisyon ang kagalingang mental</i>	3	6.82	41	93.18
4	Pre-event meal: <i>Tatlo hanggang apat na oras bago ang paligsahan ang tamang oras ng pagkain</i>	9	20.45	35	79.55
5	Alcohol consumption: <i>Tumataas ang inilalabas na calcium ng katawan kapag umiinom ng inuming alkohol (halimbawa alak)</i>	25	56.82	19	43.18
6	Food guide pyramid: <i>Ayon sa Filipino Food Guide Pyramid, dapat kumonsumo ang isang tao ng 6-8 na serving mula sa pangkat ng pagkaing tinapay, cereal, kanin at pasta o noodles sa isang araw</i>	15	34.09	29	65.91
7	Food guide pyramid: <i>Ayon sa Filipino Food Guide Pyramid, dapat kumonsumo ang isang tao ng 3 na serving ng mga pagkaing prutas sa isang araw</i>	6	13.64	38	86.36
8	Food guide pyramid: <i>Ayon sa Filipino Food Guide Pyramid, dapat kumonsumo ng 1 na serving mula sa pangkat ng produkton gawa sa gatas (halimbawa gatas) sa isang araw</i>	5	11.36	39	88.64
9	Food guide pyramid: <i>Ayon sa Food Guide Pyramid, dapat kumonsumo ng 2 1/2 na serving mula sa pangkat ng pagkaing karne (halimbawa manok, baboy, baka, isda) sa isang araw</i>	3	6.82	41	93.18
10	Concentration: <i>Ang pagkain ng almusul ay nakapagpapabuti ng konsentrasyon</i>	1	2.27	43	97.73
11	Carbohydrate consumption: <i>Ang mga pagkaing mayaman sa carbohydrates ay hindi gaanong nakatataba kompara sa mga pagkaing mayaman sa taba</i>	13	29.55	31	70.45
12	Carbohydrate consumption: <i>60% ng kabuoang kinakain ay dapat manggaling sa mga pagkaing mayaman sa carbohydrates</i>	7	15.91	37	84.09
13	Carbohydrate consumption: <i>Ang mga pagkaing mayaman sa carbohydrates ay higit na madaling tunawin kompara sa mga pagkaing mayaman sa taba at protina</i>	10	22.73	34	77.27
14	Excess vitamin consumption: <i>Ang labis na pag-inom ng/vitamin supplements ay nakakasama sa katawan</i>	29	65.91	15	34.09

Table 4. (Continued)

15	Iron deficiency: <i>Ang anemia ay kakulangan ng mineral na iron sa dugo</i>	5	11.36	39	88.64
16	Fat levels: <i>Ang katamtamang porsiyento ng taba ng katawan sa kababaihan ay 20-25%</i>	9	20.45	35	79.55
17	Carbohydrate food sources: <i>Ang kanin, tinapay, cereal, at pasta o noodles ay mainam na mapagkukunan ng carbohydrates</i>	4	9.09	40	90.91
18	Protein food sources: <i>Ang tokwa, nuts (e.g. peanuts, cashew, nuts) at beans ay mainam na mapagkukunan ng protina</i>	9	20.45	35	79.55
19	Excessive Protein consumption: <i>Ang mga atleta ay nakakaubos nang dobleng dami ng pagkaing mayaman sa protina na higit sa inererekendang kailangan sa isang araw</i>	3	6.82	41	93.18
20	Protein consumption: <i>Ang labis na pagkonsumo ng mga pagkaing mayaman sa protina ay nakabubuti para sa mga atleta</i>	36	81.82	8	18.18
21	Iron food sources and absorption: <i>Ang pinakamainam na mapagkukunan ng mineral na iron ay mga produktong mula sa hayop (halimbawa manok, baboy, baka, isda).</i>	12	27.27	32	72.73
22	Iron food sources and absorption: <i>Ang pagkain ng cereal o tinapay na dinagdagan ng mineral na iron ay dapat sabayan ng iba pang pagkaing mayaman sa vitamin C para sa mas epektibong pagtanggap ng iron sa katawan</i>	4	9.09	40	90.91
23	Protein function: <i>Ang mga pagkaing mayaman sa protina ay tumutulong upang ayusin at palakasin ang mga tisyu ng kalamnan (muscle) at makagawa ng hormones upang mapalakas ang sistemang panlaban sa sakit.</i>	1	2.27	43	97.73
24	Fat function: <i>Ang mga pagkain mayaman sa taba ay kinakailangan sa pang-araw-araw na pagkain.</i>	29	65.91	15	34.09
25	Carbohydrates: <i>Kung ang kinakain sa araw-araw ay kulang sa carbohydrates, ang protina ang ginagamit bilang enerhiya</i>	6	13.64	38	86.36
26	Fiber sources: <i>Ang prutas, beans (i.e. monggo, peas), at oatmeal ang pinagkukunan ng soluble fiber</i>	5	11.36	39	88.64
27	Fiber intake: <i>Ang inirerekendang dami ng fiber sa pagkain ay 25 gramo kada araw</i>	6	13.64	38	86.36
28	Vitamin intake: <i>Ang vitamin C ay kilala rin bilang ascorbic acid</i>	3	6.82	41	93.18
29	Dehydration: <i>Kung hindi ka nauuhaw, maaaring hindi ka dehydrated</i>	22	50.00	22	50.00

Note: Category 1: Poor and Fair
Category 2: Good and Excellent
n=frequency, %=proportion

reported mean scores were higher in nutritional knowledge (73.57 ± 5.26) than dietary habits (69.44 ± 6.07). No significant correlation was found between dietary habits and nutrition knowledge ($p>0.95$). These findings were similar to previous studies that explored dietary habits and nutrition knowledge among these sports.^{15,16}

These studies also reported that age, gender, and information sources affect dietary habits and nutritional knowledge. Although this study found no significant difference among demographic characteristics, some information sources reported a significant difference between teams ($p<0.05$). Strength and conditioning coaches and social media are among the top three recorded sources of nutrition information. However, results show a more significant percentage of athletes from the taekwondo team (78.95%) depending on their strength and conditioning coach and social media (73.68%) compared to the boxing team (40% and 20% respectively).

Considering the availability of sources and accessibility these athletes have with strength and conditioning coaches and social media, the team with more available and accessible sources would be more outstanding. Likewise, other sources with a more significant percentage of athlete responses may indicate that the source is perceived as reliable and made available and accessible to these teams. Burns et al. showed a similar result among athletes whose primary sources of nutrition information were coaches, athletic trainers, strength and conditioning coaches, and dieticians. They had direct and effortless access to these sources. These athletes also perceived these sources as reliable in delivering the correct information for nutrition knowledge and dietary practices.¹¹

Of all reported sources, nutrition courses reflect the exposure of athletes to validated nutrition information. Zawila et al. reported female collegiate cross-country runners who completed a nutrition course scored higher in nutrition knowledge than those who did not take a nutrition course.¹⁷ Comparably, 40.91% of the current study participants have nutrition educational exposure, which may account for the fair dietary habits and good nutrition knowledge scores. Through nutritional courses, an athlete can learn complete, correct, and validated

nutrition information such as benefits of macronutrients and vitamins, the usage of supplements and timing of food intake, hydration, and weight management and nutrition periodization necessary for performance optimization.^{14,18,19}

Dietary Habits and Nutrition Knowledge. A more significant percentage of respondents showed low scores in dietary habits. As the mean scores obtained were classified as fair, investigating which specific dietary habits scored low would help assess whether these practices need interventions for correction or improvement. The same could be said for nutrition knowledge items that were reported to have a high percentage of low scores. Conversely, items found to have a high frequency of good scores would suggest the need to master or maintain these practices and positively influence low-scored participants. It is important to note that this breakdown reflects the dietary habits and nutrition knowledge validated at the time of the study.

Dietary Habits. Good dietary habit scores suggest good eating and nutritional practices.^{19,20} The results indicated that 'drinking water', 'eating three times a day', 'avoid skipping meals' and were the highest scored factors, which were synonymous with practices recorded in an earlier study.²⁰ Participants were found to have good hydration practices to cope with the effects of rigorous training in warm, humid, and poorly ventilated areas and clothing. These effects often include excessive sweating and dehydration, leading to impaired thermoregulatory and cardiovascular functions if mismanaged.^{19,20} Studies show that fluid restriction is a common practice in these sports when achieving weight targets during a competition,^{21,22} thus this practice needs to be monitored well to lessen the risk of hypohydration complications during this period.² Eating regularly with adequate food and water intake assures athletes that they are refueling with enough nutrients necessary to perform well.¹⁴ The participating national athletes and Filipino collegiate athletes from another local study do not skip meals as they are aware of the need for nutrients and energy to train.¹⁵ Fundamental food groups like dairy, meat products, grains, and legumes have been taken in

sufficient amounts.¹⁶ Maintenance and monitoring are essential to maintain the nutritional adequacy ratio of energy intake within recommended levels.²³

Poor dietary habits included dairy and soda consumption and recording of food intake. Dairy intake scores are comparable to earlier studies, which indicated the inadequacy of dairy intake among young and collegiate athletes in terms of amount and recommended servings.^{19,20,24} Dairy products are high in calcium and other vitamins necessary for bone strength and growth, along with cognitive and cardiovascular functions but may result in digestive discomfort.²⁴ Despite this, the reasons behind the low occurrence of this practice have yet to be established.

Athletes were also found to record their daily food intake poorly. This practice could help athletes keep track of daily nutritional habits.²⁵ The Kaiser Permanente Center for Health Research found that food journals

psychologically helped people reflect on their food choices and habits, consequently allowing them to reassess and reconsider better and healthier alternatives. This study showed that participants who kept track of their nutritional intake through food journals lost almost twice as much weight as those who did not. This weight management tool was recommended for athletes who compete in weight divisions, such as in combat sports.²⁵ Lastly, results showed that athletes seemed to consume soda often. It is a practice that is ill-advised as carbonated drinks result in weight gain and gastrointestinal distress.²² The excessive intake of fructose, corn syrup, and other substances found in soda cause an increased risk of gastrointestinal disturbance, delay gastric emptying, and reduces fluid absorption, secreting water into the intestine, increasing the chances of dehydration.^{24,26}

Nutrition Knowledge. Results suggest that these teams are aware of many items and correct information assessed by the questionnaire. These items include recommended amounts, health conditions, and guidelines that may impact sport and physical activity performance. High scores may indicate a clear understanding and awareness of the nutrition information provided, particularly recommended amounts for Filipinos. These include the effects of

skipping breakfast, consuming the recommended amount of meat, effects of nutrition on mental performance, effects of breakfast on concentration, and some roles of protein, among others. Low scores were reported in items such as excessive protein intake, protein knowledge as the best energy source, excess intake of vitamin supplements, and why fats are essential.

Participating athletes showed to have good knowledge of the importance of breakfast. Studies have correlated this meal with improved cognition and academic performance, as nutrition gives the brain proper building blocks to create and maintain connections.^{26,27} Previous studies have reported the deleterious effects of weight cycling and rapid weight loss in weight class sports on mental status.^{28,29} Taking breakfast regularly also significantly improves performance among athletes by returning glycogen in the liver and muscle after the overnight fast.^{24,25} Athletes from the present study believed that breakfast impacted mental performance and knew about its contributions to performance improvement, suggesting that the information they know is par with these studies. Among other information known well by the participants is the recommended amount of protein to take. However, participants failed to correctly identify the effects of excess protein intake and misconstrued protein as the primary energy source. Previous studies reported the same outcome where this misinformation led to protein intakes that proved to be detrimental to participants' health.^{30,31}

This result suggests that the concept of energy may have been misunderstood. Carbohydrates are the primary energy source through muscle glycogen which can be quickly converted during muscle contraction to provide fuel for the central nervous system to function normally.³² Both protein and fat can be used as energy for exercise. However, carbohydrate is most efficiently metabolized by the body. It is the only macronutrient that can be broken down rapidly enough to provide energy during periods of high-intensity exercises, such as combat sports.³³ High protein diets promote muscle development and body fat loss. However, excessive protein intake could cause bone and calcium homeostasis disorders, renal function, liver function,

increased cancer risk and precipitated progression of coronary artery disease.³⁴ High protein intake alone does not translate to lean body mass maintenance, which combat sports athletes would be targeting due to the sport's nature. Daily protein intake for combat sports athletes, who are classified as strength and power athletes, is suggested to be between 1.4 to 2.0g/kg as an excess of this may lead to increased oxidation of amino acids without additional lean mass gain.³⁵ This information needs to be made clear and understood by the study participants.

In addition to that, poor scores were recorded in the information about fat consumption, where the present study showed that athletes believed fat was not needed daily. There are varying results in prior studies related to this concept. Sunuwar et al. reported that fat intakes of Taekwondo players were lower than the recommended dietary allowance.⁷ In contrast, Cho et al. showed that fat intake among collegiate taekwondo athletes was higher than the acceptable range.²³ Fats have many functions that aid in the storage of fat-soluble vitamins, body insulation, blood clotting, muscle movement, and immune processes, and most importantly, for energy availability during long-duration exercise.³³ In taekwondo athletes, there is a greater demand for both aerobic and anaerobic metabolisms that define the role of lipids as an energy substrate during a higher competitive degree.³⁰ It appears that athletes are unaware of these effects or may not fully understand this particular information.

Lastly, information regarding the effects of excess intake of vitamin supplements has been noted as poor in the present results. To utilize nutrients, metabolize and regulate body tissue, vitamins are needed, but this can only be possible with a balanced and healthy diet unless supported by supplements. When taken in excess, this can be toxic and can lead to several health disorders.³⁶ Cho et al. reported significant inadequacies in vitamin C, Calcium, and folate intake among elite Korean Taekwondo players.²³ Inadequacies in micronutrient intake were found to be related to the knowledge and practices these athletes had to maintain or reach their weight category.^{30,37}

A result of fair to poor dietary habits and nutritional knowledge would indicate what nutritional information needs to be closely monitored and corrected among athletes. By identifying which practices and beliefs scored low, nutritionists, coaches, and the athletes themselves are provided a clear picture of which aspects need improvement and change.

Correlation of Dietary Habits and Nutrition Knowledge with Demographics and Sources of Information. Correlational analyses showed that years in playing, peers, and strength and conditioning coach are significant demographic factors affecting dietary habits and nutritional knowledge among the current participant group. The length of the training experience was significantly associated with knowledge among selected adolescent athletes ($p=0.004$).³⁷ Despite reliable preferred sources of nutrition information among athletes, poor nutrition knowledge may still be prevalent.^{3,15} The demographic characteristics, the reliability of the information that athletes receive, and the attitude and behavior towards this information in terms of improving athletic performance may affect athletes' nutrition knowledge and dietary habits. These varying results may also be affected by the limitations of the study. Investigating dietary habits and nutrition knowledge warrants a gold standard for assessing the more accurate and valid outcome. Causation could not be established given the current study design. Result interpretation cannot be generalized to other sports given that the power of the study is low (0.24) due to its small sample size and population.

CONCLUSION

Overall, the dietary habits of the athletes are fair, and their nutrition knowledge is good. Taekwondo players have good dietary habits, while boxers have fair dietary habits. The nutritional knowledge of Taekwondo athletes is good, while that of boxers is good. Most reported sources for all participants were their team coach and strength and conditioning coaches, while the least common source was a magazine. Furthermore, years in playing and sources of nutrition information, precisely strength and

conditioning coach and peers, are possible relevant factors that may affect combat sports athletes' dietary habits and nutritional knowledge.

The present findings suggest developing nutrition education programs to improve the knowledge and develop good eating habits necessary for combat sports athletes to achieve performance and competition goals while maintaining optimal health and athletic capability. A more extensive study involving more sports and teams may be done in future research for more comprehensive analysis and recommendations on dietary habits and nutrition knowledge.

The researchers would like to acknowledge individuals and organizations who have supported this study: Dr. Ivan Neil Gomez and Ms. Catherine Joy Escuadra for guiding the team in conceptualizing and conducting statistical analysis, the Philippine Sports Commission for the accessibility to our subject population, to the coaching staff and athletes of the Philippine National Taekwondo and Boxing Teams who have invested great interest in the development of long-term athletic performance measures through researches like this.

Individual author's contributions

All authors have contributed to the organization and facilitation of data gathering, results analysis, discussion, and writing.

KP conceptualized study concept, design, and process and overall spearheaded the study; SP assisted in the conceptualization of study design and process, verification of analytical methods, and leading of investigators in the structure of the methodology and data collection; RC researched and verified dietary habits and conducted background study and initial requirements for the survey; FC led in the distribution of questionnaires and invitations and supervision of testing on both teams; RO assisted in the research and verification of nutritional knowledge and conducted background study and initial requirements for the survey; AR assisted in the researching and verification of dietary habits and working of

background study and initial conditions for the study;

MS researched and verified nutritional knowledge and conducted background study and initial requirements for the survey; NV assisted in distributing questionnaires and invitations and supervision of testing on both teams.

Disclosure statement

This paper had no financial interest/ arrangement or affiliation with any organizations that may be perceived as a real or apparent conflict of interest in the subject of this research.

Conflicts of interest

The authors of this paper declare no conflicting interest.

Acknowledgement

The researchers would like to acknowledge individuals and organizations who have supported this study: Dr. Ivan Neil Gomez and Ms. Catherine Joy Escuadra for guiding the team in conceptualizing and conducting statistical analysis, the Philippine Sports Commission for the accessibility to our subject population, to the coaching staff and athletes of the Philippine National Taekwondo and Boxing Teams who have invested great interest in the development of long-term athletic performance measures through researches like this.

Supplementary Material

[Supplementary Table 1. Logistic Regress analyses of dietary habits and nutritional knowledge with demographic characteristics and source of nutritional information among boxing and taekwondo athletes](#)

[Supplementary File 1. Filipino Dietary Habits and Nutrition Knowledge Questionnaire \(DHNQ-Fil\)](#)

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