

# Sports Nutritionists Adopt the Nutrition Care Process (NCP) Road Map to Develop Individualized Meal Planning for Athletes.

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## Research article

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# Abstract

**Background:** It is considered that the implementation of nutrition care process (NCP) leads to more efficient and effective care, as well as enhancing the roles of dietetics and nutrition professionals in the clinical setting. However, little is known about the NCP being implemented in the sports nutrition setting to deliver nutrition care, especially in meal planning. Therefore, this study aims to identify the process that sports nutritionists (SNs) practise in meal planning to plan meals for athletes and identify the application of NCP.

**Methods:** In-depth interviews, using semi-structured interview questions, were conducted with SNs employed at the National Sports Institute of Malaysia. Five SNs who managed different types of sports were recruited. The interviews were audio-recorded and transcribed verbatim. Data were entered into ATLAS.ti 8 and analyzed using thematic analysis.

**Results:** The following processes were identified: (i) collecting pertinent data; (ii) analyzing the collected data; (iii) determining nutrition prescriptions; (iv) formulating goals and determining actions; (v) implementing actions and recommendations; and (vi) monitoring.

**Conclusions:** This study identified 6 general processes practiced by sports nutritionists in meal planning that comprised of the NCP's interrelated steps, except nutrition diagnosis statement from the Nutrition Diagnosis step of the NCP. A comprehensive process and workflow can help sports dietitians or nutritionists to develop individualized meal plans that can improve athletes' nutritional status, adherence, health and sports performance.

## Background

To improve sports performance, overall health and well-being, as well as to reduce risk of injury, it is essential for athletes to consume optimal nutrients (1,2). Generally, athletes should get sufficient energy from natural sources to provide them with adequate amounts of carbohydrate, protein and fat. Besides that, an athlete's training plan, competition target and food preferences should also be considered (2). When athletes do not follow these recommendations, their performance may be affected. Several cross-sectional studies on athletes' dietary intake found that most of them did not meet their energy requirements during training and competition (3–6).

Meal planning is considered a technique to “translate” diet prescriptions into practical actions (7). Meal planning has been defined as the act of planning menus for specific situations (8). Thus, meal planning provides an overview of the foods and beverages that should be consumed by specific individuals based on their nutrient requirements. A study by Ducrot et al. (2017) found that meal planning is one of the dietary interventions associated with adherence to nutrition guidelines and the consumption of a variety of food groups (9).

A dietitian's or nutritionist's expert knowledge on food composition is required to translate nutrition prescriptions into food choices and choice of meal times (10). In addition, other factors that influence food choices among athletes should also be considered such as taste, convenience, nutrition knowledge and beliefs (11). The high demand of energy in most athletes require them to make more frequent and appropriate food choices. Thus, proper meal planning is one of the nutrition cares that is often provided by dietitians or nutritionists at the end of a counselling process to improve athlete's dietary intake.

A systematic method called the Nutrition Care Process (NCP) was designed to guide nutrition and dietetics practitioners in providing nutrition care to their patients and clients (12). The NCP consists of four inter-related steps, which include: Nutrition Assessment and Reassessment, Nutrition Diagnosis, Nutrition Intervention, and Nutrition Monitoring and Evaluation (12). In most clinical settings, such as hospitals in the European countries (France, Germany, Greece, Italy, Norway, Sweden and Switzerland) (13) and in Korea (14), the NCP has been used as a guideline to deliver nutrition care. In Malaysia, other than being used in the hospital setting, the NCP has been introduced theoretically and practically in the education setting among dietetics students (15). It has been considered that the implementation of NCP may lead to more efficient and effective care, as well as enhancing the role of dietetics and nutrition professionals in all care settings (16). Moreover, NCP is related to individualized nutrition approach as it guides dietitians or nutritionists to assess and evaluate the need for nutrition care according to individual medical conditions, personal preferences and the right to make informed choices (17). Limon-miro, Lopez-teros, & Astiazaran-garcia, (2019) suggested that individualized nutrition intervention not only act as a disease preventive tools but it is also empowers individuals to make healthy choice according to their preferred foods and characteristics (18). However, little is known about the NCP being implemented in the sports nutrition setting to deliver nutrition care, especially in meal planning.

Therefore, this study aims to identify the process of meal planning for athletes as practised by SNs. This study shall identify the application of NCP steps, if any, in a sports nutrition setting, especially in meal planning.

## **Method**

### **Sampling design**

The participants for this study were experts in sports nutrition practice. They were recruited through purposive sampling. Due to the lack of statistical reference regarding the number of sports nutritionists in Malaysia, the researcher went to the National Sports Institute (NSI) to get the required information. Overall, there were 13 sports nutritionists or dietitians identified in Malaysia who were currently working with the NSI (8 sports dietitians/ nutritionists) and the Malaysia Sports School (5 sports dietitians/ nutritionists). Participants who were included in this study were sports dietitians/ nutritionists currently working with national-level athletes, have at least two years of experience in sports nutrition and practically providing meal planning for their athletes. Seven sports nutritionists (all from NSI) met the inclusion criteria, but only five (all females) agreed to participate in this study. Each Sports Nutrition

Officer from the Department of Nutrition, National Sports Institute were individually approached by the researcher. An appointment date, time and location were arranged at the first meeting. As participation was voluntary, participants were free to stop at any time during the interview session. The purpose of this study was explained and informed consent was obtained before the interview began. The names of all the participants were coded into different names.

## Interviews

Face-to-face interviews were conducted at NSI, Kuala Lumpur in April 2019. The duration of an interview session was approximately 30 to 45 minutes. A semi-structured interview guide was used to give the participants room to answer the questions and probes were used to explore the answers provided in-depth (19).

After the semi-structured questions were drafted, a pilot study to test the interview questions was conducted with two sports nutritionists. They were selected from the pool of excluded participants who had less than 2 years of experience in sports nutrition practice. Additional questions and probe questions were added accordingly.

The semi-structured interview guide started by asking the participants to introduce themselves, identify which sports they handled and years of working in the sports nutrition field. Next, they were asked about the conditions that required meal planning and to describe the processes involved during the development of a meal plan. Probe questions such as “Can you explain further?” and “Following that, what else did you do?” were asked. The interviews were audio-recorded and transcribed verbatim. The transcripts that had been produced were then shared with the participants to check for accuracy and adequacy of the description. The validation of transcripts was important to make sure that the researcher’s account truly reflected the true conversation (20) and to manage the issue of reliability or trustworthiness (21).

## Data Analysis

A thematic analysis was conducted and Atlas.ti 8 was used to support the labelling and retrieval of data that had been assigned a particular code (22). This study adopted Braun and Clarke’s (2006) step-by-step guidelines to create meaningful themes (23), as described below:

1. The researcher read each transcript to be familiar with the data input.
2. The transcripts were read more thoroughly and the coding process was applied to related word or words, a complete sentence or an entire paragraph.
3. The potential sub-themes and main themes were identified by gathering all codings that were relevant to each potential sub-theme and theme.
4. The themes were reviewed by checking the potential themes in relation to the sub-themes.

5. The themes were defined and named. Two members of the research team re-reviewed all the sub-themes and codes and independently applied the themes from the finalized themes structure. The discrepancies were reviewed and resolved by in-depth discussion in a group meeting.
6. The report was prepared.

## Results

The participants (all females) involved in this study were full-time workers and had between two and fifteen years of experience in sports nutrition practice. Each of the participants had worked with athletes engaged in different types of sports (racquet sport, power and strength sport, skill sport, team sport and combat sport).

In general, the participants were approached by coaches who had concerns about their athletes' nutrition. They would then proceed with an action plan that consisted of meal planning. Weight management was a major issue of concern to many coaches, as shown below:

*"...then we will look at the coach's concern on their athlete's weight, so if necessary, we will do weight management plan." [SN 2]*

*"When I meet the coach, they will give me a list of athletes and their weight categories. Coach gives athletes current weight and targeted weight based on their weight categories. Then I will determine who can go for weight management either weight reduction or weight increment." [SN 5]*

Subsequently, the following themes emerged as a result of the problems received by SNs from the coaches

1. Collecting pertinent data;
2. Analyzing the collected data;
3. Determining nutrition prescription;
4. Formulating goals and determining actions;
5. Recommending and implementing actions; and

These themes constituted the general processes used by the SNs to develop meal plans for athletes. The sub-themes were the specific processes important enough to be included in each process of meal planning. The result of this analysis is summarized in Table 1. The following section expands on the six general processes with different specific processes that had been identified.

Table 1  
Summary of themes and subthemes

Themes (Process)	Sub-themes (specific process)
<b>Collecting pertinent data</b>	<ul style="list-style-type: none"> <li>∅ Conducting body composition assessment</li> <li>∅ Identify training periodization plan</li> <li>∅ Identify training time</li> <li>∅ Identify food and nutrition-related history</li> </ul>
<b>Analyzing the collected data</b>	<ul style="list-style-type: none"> <li>∅ Analyzing body composition</li> <li>∅ Analyzing dietary intake</li> </ul>
<b>Determining nutrition prescription</b>	<ul style="list-style-type: none"> <li>∅ Calculating energy requirement</li> <li>∅ Determining macronutrient distribution based on g/kg body weight</li> <li>∅ Using food exchange distribution table to distribute macronutrients across the mealtimes</li> <li>∅ Determining the use of supplements</li> </ul>
<b>Formulating goals and determining actions</b>	<ul style="list-style-type: none"> <li>∅ Emphasizing in gradual dietary changes strategy</li> <li>∅ Setting achievable goals</li> <li>∅ Conducting one to one meeting between SNs and athletes to discuss the meal plan</li> </ul>
<b>Recommending and implementing action</b>	<ul style="list-style-type: none"> <li>∅ Dietary education</li> <li>∅ Adjusting and improvising current dietary intake</li> <li>∅ Determining mealtimes (main meal, pre &amp; post-exercise meal) to match with training time</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>∅ Monitoring dietary intake</li> <li>∅ Monitoring body composition</li> </ul>

## Process 1: Collecting pertinent data

To understand the current condition of their athletes, SNs collected data such as: the athlete's body composition, periodization plan, training time, and food and nutrition-related history.

*"I will do body composition assessment first, maybe the skinfold assessment or bioimpedance analysis just to get the baseline measure..." [SN 3]*

*"... check athletes in which competition phase, different athletes different phases; elite athletes maybe in the phase where they don't have time to do weight loss, they have to perform in their competition..." [SN 1].*

*"Athletes training at different times, some at night, some have one session. So, we have to see their training time to adjust mealtime" [SN 5]*

Food and nutrition-related history consisted of several important components, which included dietary assessment, food preferences and food availability:

*"I will do dietary records, if I have time, I will try to do 3 days dietary recall which I will follow the athletes for 3 days. I will ask them to take a picture of their food and beverage intake. But if I have limited time, I just interview and take their 1-day common diet" [SN 2].*

## **Process 2: Analyzing the collected data**

Two main specific processes highlighted by most SNs were the analysis of body composition and dietary intake.

The athlete's body composition was analyzed to identify suitable actions to be implemented.

*"next we will analyze the data [to figure out] how far she/he is from the target. From body composition, we will be able to determine how much weight she/he needs to lose" [SN 1]*

The analysis of dietary intake enabled the SNs to figure out the unsuitable foods consumed by the athletes and whether the athletes were getting enough energy.

*"When we conduct diet recall, one to one, with athletes, we were able to see ... oh he eats rice, fish and suddenly eats chocolate for that particular lunch, so from that we were able to identify the problem." [SN 4]*

## **Process 3: Determining nutrition prescription**

The specific components that were included in the process of determining nutrition prescription were estimation of energy requirement and advice on suitable macronutrient distribution (gram/day). The decision was made based on information that were received during processes one and two. Next, the nutrition prescription values were used to develop a meal plan. The values of macronutrients (in gram/day) were converted into a food exchange list using an exchange system. The food exchange list represents the portion size of each food containing a given amount of nutrient. SNs distributed and rearranged the food exchange list into mealtimes to meet the desired requirement. In addition, the SNs also determined the types of supplements suitable to be included in meal planning. At this point of the

process, SNs would come out with a set of meal plan that consisted of the desired nutrition needs in the form of food group exchange list, together with the portion sizes for each mealtime.

*"We use a quick method to calculate the energy requirement. We also use various formulas to calculate energy requirement, we even use local studies. So, we will calculate based on weight and gender" [SN 2].*

*"...protein requirement we will see either if it is for a man or a women, training phase ... we are not using the percentage to distribute the macronutrient but we use g/kg body of carbohydrate and protein....after all set, we will cross-check with total energy requirement that we prescribe to match with the exchange distribution later on ..." [SN 1]*

*"I used the total of g/day and convert into exchange ... the Atlas of Food Exchange and Portion Size book is my main reference." [SN 2]*

*"...we will decide to give them a dietary supplementation or not, for example in some athletes we allowed them to drink sports drink, but some may not. Calorie from supplement must be included in total energy requirement" [SN 1]*

## **Process 4: Formulating goals and determining actions**

Negotiating with the athletes was an important specific process to make them aware of all the changes they needed to make in their dietary intakes. Specific processes highlighted by the SNs included: gradual changes in dietary intake, setting achievable goals and meeting with SNs to discuss dietary plans.

*"For athletes, we cannot change them instantly into 100% perfect. Some athletes, their dietary intakes [are] not so good and they also know about it. So, we cannot ask them to change immediately. Change it gradually and step by step. We target one change at a time and they will not feel that burden." [SN 1]*

## **Process 5: Recommending and implementing actions**

Recommending and implementing actions were based on the required nutrition prescription that had been determined previously in process three and athlete's negotiation in process four. Athletes were provided with a meal plan that had been developed in process three. Most SNs will not directly explain the details of foods to be consumed but highlight on a few strategies such as dietary education, adjusting and improvising on the current dietary intake and determining mealtimes based on training time. These strategies can guide SNs in designing individualized meal plans.

Based on the meal plan, SNs emphasized on dietary education that included portion size, healthy food choices and suitable foods based on mealtimes.

*"I design the meal planning based on exchanges and I don't really insist on a type of food, but I do give examples. So, for them to understand the exchanges, I will conduct an education session and teach them*

*about exchanges. So, it's like giving them self-efficacy. They know how much they should eat, and they can choose what kind of food they can eat" [SN 2]*

When discussing mealtimes with the athletes, the SNs highlighted the pre-, during and post-exercise meals. The example below is how a SN suggested a suitable food based on mealtime:

*"...but, for example, if athletes finish school quite late, maybe around 2.30-3.00 pm which is 1-2 hours before their training schedule, I would still advise them to take a complete meal but a light one which is easy to digest ... perhaps a sandwich or pizza with vegetables and proteins but less in fat or bread with tuna..." [SN 4]*

There were situations where SNs adjusted the current dietary intake by changing the types of foods and portion sizes to parallel with the recommended meal plan in process three.

*"yes, the food suggestion will be planned based on athlete's diet history or diet record. Then from that, we will make adjustments..." [SN 5]*

In addition, timings for breakfast, lunch, dinner and snacks were suggested according to the athletes' training schedules.

*"Usually the issue of mealtime occurred when there is an early morning or afternoon training because need to include their pre-training meal. If training early as 7.30 am, I will recommend snack such as fruits as pre-exercise meal. And after they finish their training maybe at 10am, then can consume complete meal and we consider as breakfast." [SN 2]*

## **Process 6: Monitoring**

Monitoring is a process that occurred after the meal plan has been provided to the respective athletes. The SNs monitored their athletes' dietary intake and body composition over time. The methods used to conduct the dietary monitoring process included: meeting the athletes during lunchtime to determine what they were consuming, texting athletes and asking whether there were any problems related to the new menus or asking the athletes to take a picture of foods and beverages that they were consuming.

*"...a lot of time, we will try to meet them, to see what they eat." [SN 1]*

*"...after a few days I will contact and ask "How's the menu?" I do the follow-up usually through WhatsApp." [SN 2]*

*"After 1 month I will request the athletes to meet with me and I would assess their body composition to see either the goals have been met or not." [SN 3]*

## Discussion

This study provided the processes that SNs used to develop meal plans for athletes. Based on the interviews, there were six processes involved in the development of meal plans, which began after SNs were notified of the athletes' nutrition-related issues by coaches. The process to developing meal plans for athletes can be viewed in Figure 1.

It was interesting to note that the processes that emerged from the interview sessions followed the steps outlined in the Nutrition Care Process (NCP). According to The Academy of Nutrition and Dietetics, NCP is systematic approach used by dietitians or nutritionists to individualize care by taking into account every individual's needs and values using the best, updated evidence based in critical thinking and decision making (16). Therefore, following such a process may lead to individualized meal planning for athletes. However, this study did not find any themes that were related to nutrition diagnostic statement from the Nutrition Diagnosis step of the NCP. Nutrition diagnosis is expressed using nutrition diagnostic statements that consist of nutrition diagnosis terminologies, etiologies, and signs and symptoms that had been identified in the reference sheets describing each diagnosis (12). The domains that are included in the nutrition diagnosis terminology are mostly suitable to be used in the clinical setting. Thus, this might lead to unfamiliar usage of nutrition diagnosis in the sports nutrition setting. However, additional domains that are related to sports nutrition are suggested to be included because well written nutrition diagnosis can provide clear and concise information about nutrition-related problems specific to an athlete, with etiologies based on symptoms from relevant assessment

Next, the specific processes in each general process were related to sports nutrition practice. These specific processes are different for each nutrition care delivery setting and population (12). The major difference could be seen in the initial process, which was collecting pertinent data. In a sports setting, aside from the identification of food and nutrition-related, the specific components that impacted an athlete's nutrition included body composition, training periodization plan and training time. Thus, identifying these components may lead to individualized meal planning that is specific for athletes.

Assessment of body composition is essential for athletes. According to Thomas et al. (2016), there are associations between body composition and sports performance, but it is reminded that athletes' performances cannot be determined solely by their body weight and composition (2). The tools that are used to assess athlete's body composition varies, such as dual-energy x-ray absorptiometry (DXA), hydrodensitometry, air displacement plethysmography, skinfold measurements, and single and multi-frequency bioelectrical impedance analysis (2). Most SNs used skinfold measurement and bioelectrical impedance analysis (BIA) because they are convenient and easy to assess body composition in the fields. Skinfold measurement is a popular choice because it is convenient and inexpensive, despite some limitations in the standardization of skinfold sites, measurement techniques and calipers (2). However, these limitations may be overcome by attending anthropometry courses offered by the International Society for the Advancement of Kinanthropometry (ISAK), which provide practical skills and advanced knowledge on appropriate measurements of the human body. Even though body mass index (BMI) is one

of the most convenient and widely used field methods to give the general population a picture of their health status without specialized equipment, this mathematical calculation is only able to determine whether one is too heavy for one's current height. BMI is unable to measure one's actual body composition as it is incapable of distinguishing between fat and muscle tissues (24). For example, a lean hockey player with a BMI 25.5 kg/m<sup>2</sup> and an office man with a huge belly and BMI of 25.5 kg/m<sup>2</sup> are both classified as overweight by the BMI scale. Therefore, BMI assessment is not suitable for athletes (24).

Next, in this study, the SNs emphasized training or sports periodization plan. The athletes had specific and individual training periodization programs which integrate different types of training activities, specifically following their training calendars (25). Nutritional periodization was then used to support training periodization. Nutrition periodization is defined as "the planned, purposeful, and strategic use of specific nutritional interventions to enhance the adaptations targeted by individual exercise sessions or periodic training" (26). Thus, understanding the athletes' training periodization plans provides SNs with an overview or framework to match the nutrition strategies with training outcomes (25).

The identification of athletes' training time is another important process as this information will guide SNs in adjusting their athletes' mealtimes. Instead of focusing on breakfast, lunch, dinner and snack, the SNs needed to emphasize on athletes' pre-, during and post-exercise meals. Controlling what is consumed at pre-, during and post-exercise meals is a strategy to optimize an athlete's performance during competition and training sessions (2). It may reduce nutrition-related problems such as glycogen depletion, hypoglycemia, hydration and electrolyte imbalance that may cause fatigue and deterioration of performance output (2). Moreover, this strategy can reduce gut discomfort throughout an event, avoid hunger pangs and reduce gastrointestinal upset that may reduce the enjoyment and performance of exercise. In addition, providing athletes with suitable nutrient timings for pre-, during and post-exercise meals may provide nutrition support for health and further adaptation to exercise, especially during competitive events that take a few days such as a tournament (2). Achieving the amount of carbohydrates and proteins needed in each pre-, during and post-exercise meal depends on factors such as events (mode, intensity and exercise duration), environment, appetite, individual response and preference (27).

Other than that, better understanding of individual food choices, together with their culture and economic background, is one of the essential components in developing individualized meal plans (28,29). This information could help SNs in translating nutrition prescription into acceptable meal options to fulfill the specific macronutrient requirements. Moreover, conducting a discussion with athletes on their food preferences and goals (in process 5) at the beginning of a nutrition intervention would initiate an informed option state rather than just the consideration of a diagnosis based on general recommendations (12). Moreover, this situation will provide athletes with the sense of knowledge and experience of eating healthy according to their own needs, thereby encouraging them to gradually include nutrient-rich foods in their diet (29,30). With this, athletes might not feel burdened and thus may increase the rate of adherence towards healthy eating habits.

Therefore, understanding athletes' body composition, training goals, training times, strategies for pre-, during and post-exercise meals and food preferences, as well as their culture and economic background enabled SNs to develop a comprehensive individualized meal plan for athletes. The individualized meal plan also emphasized on proper nutrient timing and meal composition, which play an important role in optimizing performance and training adaptations (31). In addition, involving individuals in the development of meal plans is one of the key elements of individualized nutrition plan that eventually creates a sense of control and motivation to help individuals maintain short- and long-term adherences (17).

The strength of this study included having participants who were experts in sports nutrition recommendations and having had experience working with national-level athletes competing in different types of sports. Thus, the processes of developing meal plans, derived from the interview, can be applied to athletes competing in various types of sports. Moreover, this study included participants who had 15 years of experience in sports nutrition practice. Additional input or knowledge from experienced participants was valuable as it provided deeper insights regarding nutrition recommendations. Meanwhile, a limitation was also identified. As only five SNs participated in this study, the small sample size meant that the results may not be generalized to the whole sports community. However, Dworkin (2012) suggested that a number of 5-50 participants is adequate for an in-depth interview study (32).

## **Conclusion**

In conclusion, this study identified six general processes that were practised by SNs to develop meal plans for athletes and they comprised of NCP interrelated steps, except for nutrition diagnosis statement from the Nutrition Diagnosis step of the NCP. The processes included collecting pertinent data, analyzing the collected data, determining nutrition prescription, formulating goals and determining actions, recommending and implementing actions, and monitoring. These processes can help sports dietitians or nutritionists to develop individualized meal plans that can improve athletes' nutritional status, adherence, health and sports performance.

Future research should focus on athletes' experience in receiving individualize nutrition care, such as meal planning to identify the challenges and perception that might help sports dietitians or nutritionists to improve and develop nutrition care strategies.

## **Abbreviations**

BIA: bioelectrical impedance analysis; BMI: Body Mass Index; DXA: dual-energy x-ray absorptiometry; ISAK: International Society for the Advancement of Kinanthropometry; NCP: Nutrition Care Process; SNs: Sports nutritionists

## **Declarations**

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# Author's contribution

The concept for this design was designed by NM, NSS and NSS2. Data were collected by NM and MIM. The data were then analyzed by NM, MJS and NSS. Data interpretation and manuscript preparation were undertaken by NM, MJS, NSS, AHAR and MIM. Several drafts were reviewed and commented on by MJS, AA, NHY, RAT and PBK. All authors approved the final version of the article.

# Ethical Approval and consent to participate

This study obtained ethical approval from the UKM Research Ethics Committee (REF NO: UKM PPI/111/8/ JEP-2019-008). The purpose of this study was explained and informed consent was obtained before the interview began.

# Competing interest

The authors declare that they have no conflict of interest.

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# References

1. Kerksick CM, Wilborn CD, Roberts MD, Smith-Ryan A, Kleiner SM, Jäger R, et al. ISSN exercise & sports nutrition review update: Research & recommendations. *J Int Soc Sports Nutr.* 2018;15(1):1–57.

2. Thomas DT, Erdman KA, Burke LM. Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance. *J Acad Nutr Diet*. 2016;116(3):501–28.
3. Dwyer J, Eisenberg A, Prelack K, Song WO, Sonnevile K, Ziegler P. Eating attitudes and food intakes of elite adolescent female figure skaters: a cross sectional study. 2012;1–7.
4. Jagim AR, Zabriskie H, Currier B, Harty PS, Stecker R, Kerksick CM. Nutrient Status and perceptions of energy and macronutrient intake in a Group of Collegiate Female Lacrosse Athletes. 2019;7:1–7.
5. Jenner SL, Buckley GL, Belski R, Devlin BL, Forsyth AK. Team Sport Athletes Do Not Meet Sport Nutrition Recommendations – A Systematic Literature Review. 2019;(3):1–16.
6. Jenner SL, Trakman G, Coutts A, Kempton T, Ryan S, Forsyth A, et al. Dietary intake of professional Australian football athletes surrounding body composition assessment. *J Int Soc Sports Nutr*. 2018;15(1):1–8.
7. Boushey CJ, Coulston AM, Rock CL, Monsen E. Nutrition in the prevention and treatment of disease. Academic Press; 2001.
8. Brown A. Understanding food: principles and preparation. Third edit. Adams P, Rose N, Feldman E, Franco K, Blomo J, editors. Singapore: Thomson Wadsworth; 2008. 654 p.
9. Ducrot P, Méjean C, Aroumougame V, Ibanez G, Allès B, Kesse-Guyot E, et al. Meal planning is associated with food variety, diet quality and body weight status in a large sample of French adults. *Int J Behav Nutr Phys Act* [Internet]. 2017;14(1):12–4. Available from: <http://dx.doi.org/10.1186/s12966-017-0461-7>
10. Mirschin JG, Forbes SF, Cato LE, Heikura IA, Strobel N, Hall R, et al. Organization of Dietary Control for Nutrition-Training Intervention Involving Periodized Carbohydrate Availability and Ketogenic Low-Carbohydrate High-Fat Diet. *Int J Sport Nutr Exerc Metab* [Internet]. 2018 Sep 1;28(5):480–9. Available from: <https://journals.humankinetics.com/view/journals/ijsnem/28/5/article-p480.xml>
11. Birkenhead KL, Slater G. A Review of Factors Influencing Athletes ' Food Choices. *Sport Med*. 2015;
12. Swan WI, Vivanti A, Hakel-Smith NA, Hotson B, Orrevall Y, Trostler N, et al. Nutrition Care Process and Model Update: Toward Realizing People-Centered Care and Outcomes Management. *J Acad Nutr Diet* [Internet]. 2017;117(12):2003–14. Available from: <https://doi.org/10.1016/j.jand.2017.07.015>
13. Yuill KA. Report on Knowledge and Use of a Nutrition Care Process & Standardised Language by Dietitians in Europe. 2012;(September).
14. Kim EM, Baek HJ. A Survey on the Status of Nutrition Care Process Implementation in Korean Hospitals. *Clin Nutr Res*. 2013;2(2):143.
15. Karupaiah T, Reinhard T, Krishnasamy S, Tan SP, Se CH. Incorporating the Nutrition Care Process model into dietetics internship evaluation: A Malaysian university experience. *Nutr Diet*. 2016;73(3):283–95.
16. Swan WI, Pertel DG, Hotson B, Lloyd L, Orrevall Y, Trostler N, et al. Nutrition Care Process (NCP) Update Part 2: Developing and Using the NCP Terminology to Demonstrate Efficacy of Nutrition Care

- and Related Outcomes. *J Acad Nutr Diet* [Internet]. 2019;119(5):840–55. Available from: <https://doi.org/10.1016/j.jand.2018.10.025>
17. Dorner B, Friedrich EK, Posthauer ME. Practice paper of the American Dietetic Association: individualized nutrition approaches for older adults in health care communities. *J Am Diet Assoc*. 2010;110(10):1554–63.
  18. Limon-miro AT, Lopez-teros V, Astiazaran-garcia H. Dynamic Macronutrient Meal-Equivalent Menu Method: Towards Individual Nutrition Intervention Programs. *methods Protoc*. 2019;2(3):78.
  19. Kallio H, Pietil A, Johnson M, Kangasniemi M. Systematic methodological review: developing a framework for a qualitative semi-structured interview guide. 2016;1–12.
  20. Pilnick A, Swift JA. Qualitative research in nutrition and dietetics: Assessing quality. *J Hum Nutr Diet*. 2011;24(3):209–14.
  21. Anderson C. Presenting and Evaluating Qualitative Research: Strengths and Limitations of Qualitative Research. *Am J Pharm Educ* [Internet]. 2010;74(8):1–7. Available from: [http://www.medscape.com/viewarticle/731165\\_3](http://www.medscape.com/viewarticle/731165_3)
  22. Draper A, Swift JA. Qualitative research in nutrition and dietetics: Data collection issues. *J Hum Nutr Diet*. 2011;24(1):3–12.
  23. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* [Internet]. 2006 Jan;3(2):77–101. Available from: <http://dx.doi.org/10.1191/1478088706qp063oa>
  24. Spano MA. Nutritional needs analysis. In: Campbell BI, Spano MA, editors. *NCSA's Guide to Sports and Exercise Nutrition* [Internet]. First edit. United States of America: Human Kinetics; 2011. p. 203–22. Available from: [www.HumanKinetics.com](http://www.HumanKinetics.com)
  25. Stellingwerff T, Morton JP, Burke LM. A framework for periodized nutrition for athletics. *Int J Sport Nutr Exerc Metab*. 2019;29(2):141–51.
  26. Jeukendrup AE. Periodized Nutrition for Athletes. *Sport Med*. 2017;47(s1):51–63.
  27. Kerksick C, Harvey T, Stout J, Campbell B, Wilborn C, Kreider R, et al. International society of sports nutrition position stand: Nutrient timing. *J Int Soc Sports Nutr*. 2008;5:1–12.
  28. Rapacciuolo A, Perrone Filardi P, Cuomo R, Mauriello V, Quarto M, Kisslinger A, et al. The Impact of Social and Cultural Engagement and Dieting on Well-Being and Resilience in a Group of Residents in the Metropolitan Area of Naples. *J Aging Res*. 2016;2016.
  29. Vasiloglou, Fletcher, Poulia. Challenges and Perspectives in Nutritional Counselling and Nursing: A Narrative Review. *J Clin Med*. 2019;8(9):1489.
  30. Vaillancourt V, Le´gare F, Lapointe A, Deschenes, Deschenes S-M, Desroches S. Assessing patients' involvement in decision making during the nutritional consultation with a dietitian. *Heal Expect*. 2012;17(4):545–54.
  31. Kreider RB, Wilborn CD, Taylor L, Campbell B, Almada AL, Collins R, et al. ISSN exercise & sport nutrition review: research & recommendations. *J Int Soc Sports Nutr* [Internet]. 2010;7(1):7. Available from: <http://jissn.biomedcentral.com/articles/10.1186/1550-2783-7-7>

## Figures

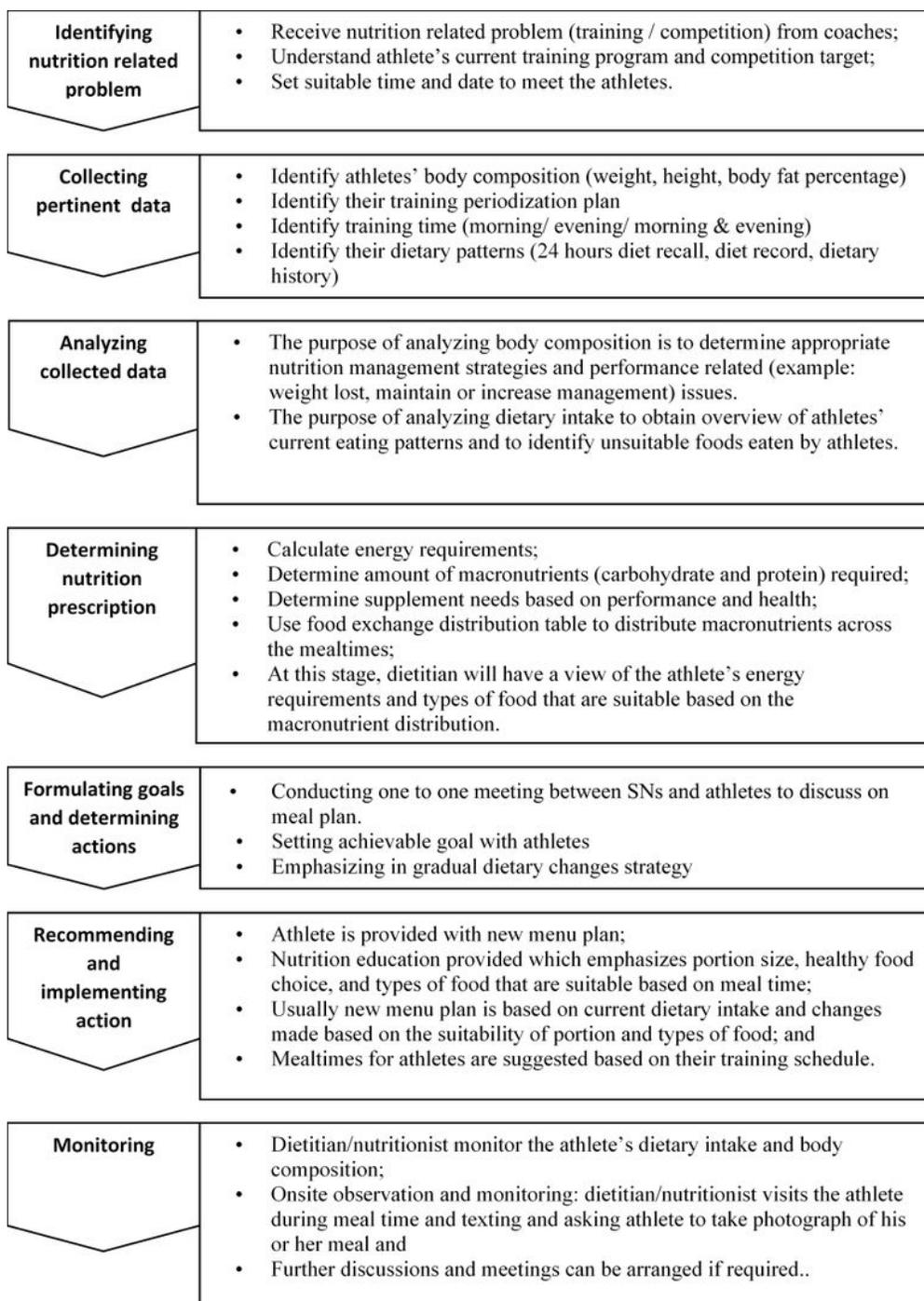


Figure 1 General process on developing meal planning for athlete

Figure 1

General process on developing meal planning for athlete