

Dietary Practices, Attitudes, and Physiological Status of Collegiate Freshman Football Players

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ABSTRACT

The purpose of this study was to determine the dietary practices, attitudes, and physiological status of freshman collegiate football players. Thirty-one freshman football players at a National Collegiate Athletic Association division I school completed a self-administered nutrition screening questionnaire designed to determine their dietary practices and attitudes. Fasting blood samples were collected and height and weight were measured. The mean age of these athletes was 18 years. These players reported eating 3.6 times per day and on the average eating out 4.8 times per week. Fast food was the most common choice when eating out (55%). Of these athletes, 42% reported the use of dietary supplements, the most popular one being creatine (36%). Although more than 90% of the athletes recognized the importance of maintaining proper hydration status, greater than 50% believed that protein supplements were necessary for muscle growth and development, protein was the primary source of energy for muscle, and vitamin and mineral supplements increased energy levels. The plasma lipid profiles of the majority (76%) of the athletes were within normal ranges. The data suggest that these athletes may require education about healthy dietary practices and on the proper use of dietary supplements. This is not only important to help improve performance but to also promote healthy dietary practices in the long term.

Key Words: athletes, nutritional knowledge, biochemical status

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Introduction

American football is a popular sport that involves high-intensity activity, training, and competition. American football is a strength and power contact sport and is referred to as a multiple-sprint sport because of the repeated short-duration bouts of high-intensity exercise mixed with long periods of low-inten-

sity exercise and passive recovery (1). Accordingly, the nutritional needs of these athletes will vary considerably depending on the level of their participation and position on the team.

Wang et al. (19) observed an increase in height, weight (from 213 to 268 lb), and body mass index (BMI) (from 27.7 to 32) of elite high-school football linemen over the past 26 years that could be attributed to either better nutrition, improved training techniques, or the use of performance enhancing drugs, or all three. Similarly, Baumert et al. (2) observed that high-school athletes had healthier dietary behaviors than nonathletes did, they were more likely to have breakfast daily, and consume dairy products, fruits, and vegetables on a daily basis. However, no differences were observed between the 2 groups in reported consumption of red meat, fried foods, and snack foods (2). Limited information is available on the dietary practices and habits of collegiate football players.

Currently the National Collegiate Athletic Association (NCAA) governs 607 schools with football programs, of which 38% are division I schools, 26% are division II schools, and 36% are division III schools (11). Given the popularity and competitiveness of collegiate football, it is important to understand the nutritional needs of these athletes, to develop programs that will improve the athlete's dietary intakes, and enhance their performance. Slavin (17) recommends a one-time baseline nutrition assessment of all healthy athletes, which may include medical history, physical and anthropometric measurements, biochemical tests, and nutritional evaluation. Additionally, appropriate nutrition counseling is important to ensure that these athletes do not compromise their training or performance. However, to provide adequate and appropriate nutrition advice and counseling, it is important to better understand the nutritional needs of this population, their practices, beliefs, attitudes, and knowledge, all of which will influence not only the advice given but also the athletes' compliance with the recommendations that are made.

Young athletes at the collegiate level, especially at the NCAA division I level, are considered "high profile" because of their level of competition, which may put them at risk of poor dietary behaviors and practices because of lack of nutrition knowledge, peer pressure, and higher training and performance expectations (7, 12, 13). Because of the high level of competitiveness, these athletes may be susceptible to the latest fad diets or dietary supplements and may be willing to try any dietary manipulations to enhance their performance (15, 16). This population group is bombarded with misinformation with the promise that they can improve their performance and competitive edge (9). In addition to training and competition, collegiate athletes also have to deal with the pressures of college life, which can also influence their dietary intake (12, 14). Unsound dietary practices can have a negative impact not only on performance but also on the overall health of the athlete. Given that these athletes are highly vulnerable, it is important to provide them with adequate knowledge that will enable them to make healthy dietary choices and to recognize the importance of good nutritional practices. To develop effective programs it is necessary to understand the current practices of the target population that may influence their nutritional status. Therefore, the main objectives of the present study were to (a) determine the dietary practices of freshman collegiate football players; (b) determine dietary attitudes and beliefs of freshman collegiate football players; (c) identify nutrition education topics of interest to the freshman collegiate football players; (d) determine the physiological status of the freshman collegiate football players. The null hypothesis tested in the present study was: The collegiate freshman football players will not exhibit any significant problems with regard to their dietary practices, attitudes, beliefs, and physiological status.

Methods

Subjects and Data Collection

Thirty-one freshman football players at a NCAA division I school completed a self-administered nutrition-screening questionnaire at the start of the season during yearly physicals. The athletes completed the screening during their first week on campus before the start of classes, training, and practice sessions. The questionnaire was designed to determine current eating habits, dietary practices, supplement usage, personal body composition goals, desired topics for nutrition education, nutrition beliefs, and attitudes of these freshman athletes. For the complete questionnaire, see Rosenbloom (14). Body weight and height were measured with light clothing and without shoes using standard, calibrated scales. Table 1 shows the physical characteristics of these collegiate, freshman football players. Forty-five percent of these players

Table 1. Physical characteristics of collegiate freshman football players ($n = 31$).

	Mean \pm SD
Age (years)	18.2 \pm 0.5
Height (inches)	73 \pm 3
Weight (lb)	210 \pm 37
Body mass index (kg/m ²)	27.6 \pm 3.6

were Caucasian, 52% were African American, and 3% were of mixed race.

At the time of the screening a 12-hour fasting blood sample (25 ml) was collected from each athlete by venipuncture into Vacutainer tubes by a trained phlebotomist. Complete blood chemistry tests (Chem-Screen[®] panel) and blood lipid profiles were run on all serum samples (Quest Diagnostics, Irving, TX). The complete blood chemistry includes tests to detect bone, liver, and kidney disorders and diagnosis of diabetes, and iron disorders. The blood lipid profile includes an analysis of total cholesterol (TC), triglyceride (TG), and high-density lipoprotein cholesterol (HDL-C) concentrations. The low-density lipoprotein cholesterol was calculated on the basis of TC, TG, and HDL-C concentrations. All biochemical tests are standard automated analytical tests conducted by the laboratory on a routine basis with coefficient of variance \leq 5%. All players signed an informed consent form before participation in the yearly physical in accordance with university guidelines.

Data Analysis

The completed questionnaires were numerically coded and frequency analysis was conducted using the Statistical Program for Social Sciences software (SPSS, version 9.0, Chicago, IL). Mean \pm SD was calculated for age, height, weight, BMI, and the biochemical tests. Responses from the athletes and the results of the biochemical tests were examined by position of the athlete on the team; however, given the small sample size within each position, no significant differences were observed and therefore data from all players were combined and analyzed as a group.

Results

Dietary Habits

The freshman football players appeared to have a normal eating pattern; on average they reported eating 3.6 (\pm 1.0) times per day, with a high frequency of dining out, 4.8 (\pm 4.1) times per week. The most common dining places patronized by the athletes were fast food (55%), followed by cafeteria/buffet style food (16%), Mexican (10%), American grill (7%), seafood (7%), Chinese (3%), and pizza (3%). When asked to describe their current eating habits, 39% of these athletes

ranked them as good, 58% ranked them as fair, and only 3% ranked them as poor.

Athletes enjoyed a wide variety of foods in their diet, with only 26% avoiding sweets, 13% avoiding fried foods, 10% avoiding fat and oils such as mayonnaise and salad dressings, 7% avoiding fast foods, dairy, and fish, and 3% avoiding red meat. Fifty-two percent of the athletes reported that they avoided alcohol. The fluid consumption practices of these athletes suggest that they may not be consuming the minimum required amount of fluids. Only 26% of the athletes reported consumption of more than 5 cups of fluid during a typical workout session, whereas 52% reported consumption of 3–5 cups, 19% reported consumption of 1–2 cups, and 3% reported that they did not consume any fluids during a typical workout session.

Current supplement usage indicates that they are not very popular among this group of freshman athletes, with only 42% reporting use of some form of dietary supplements. The most common supplement used by these freshman collegiate football players was creatine (36%), followed by vitamins (23%), protein shakes (13%), herbs (7%), amino acids (3%), energy boosters, and others, such as energy bars (3%). Interestingly, 52% of these freshman athletes reported that they were aware of the NCAA banned and restricted substances, whereas 48% reported that were not aware of this information.

Body Composition and Body Image

The mean BMI of these freshman athletes was 27.6 kg·m⁻². However, when examined by position on the team, the offensive linemen were observed to have the highest BMI (33.1), followed by linebackers (27.9), punter (27.5), running backs (27.3), defensive backs (26.3), kickers (24.5), wide receivers (24.1), and quarterback (23.8). This suggests that there are different body composition requirements on the basis of position in the team.

Given the impact of body composition on performance ability, it was not surprising that all of these young athletes had 1 or more personal body composition goals, with an increase in lean body mass being a common goal. Given the potential negative influence of excess body fat on performance, it was interesting to observe that 81% of the athletes wanted to gain lean mass, 52% wanted to reduce body fat, 13% wanted to maintain current body composition, and 3% wanted to lose weight, suggesting that these athletes may be aware of the impact of body composition on individual performance. In conjunction with their body composition, body weight is another issue that these athletes have to be concerned with because it can affect performance. Whereas 32% of these athletes reported that it was very easy to maintain their in-season weight, 42% reported that it was somewhat easy for

them to maintain their in-season weight. However, 19% of the athletes reported that it was somewhat difficult to maintain their body weight, and 7% found it very difficult to maintain their weight. Likewise, 23% of the athletes reported that they were very satisfied with the physical appearance of their body, 71% were somewhat satisfied, and 7% were somewhat dissatisfied with their current physical appearance. This further suggests that both body composition and body weight are of concern to these athletes and they would benefit from education on how to achieve these goals.

Nutrition Attitudes and Education

Table 2 presents the attitudes and beliefs of these athletes with respect to various nutrition practices commonly recommended or practiced by coaches, trainers, and athletes. The mean score on the nutrition attitudes and beliefs questions, which were used to measure the athlete's nutrition knowledge, was 5.55 (± 1.72), suggesting that approximately half of the questions were incorrectly answered. A score of 11 is indicative of a perfect score, which none of the athletes achieved, further suggesting that these athletes can benefit from nutrition education programs. The majority (>50%) of these athletes believed that protein is the main source of energy to the muscle, protein supplements are necessary for muscle growth and development, vitamin and mineral supplements increase energy levels of athletes, and sports drinks were not an appropriate substitute for water to replace fluid losses. In line with the fluid consumption practices, it is important to note that although these athletes were familiar with their fluid needs and recommendations, they were unclear about how to replace their fluid losses. It is clear from these data that these athletes need to be educated about the role of various nutrients and proper hydration in athletic performance.

Table 3 presents the percentage of athletes expressing a desire to learn about several nutrition-related topics. The most requested topic was nutrition for peak performance (97%). Given the athletes' desired body composition and body weight goals and their limited nutrition knowledge, their interest in nutrition is important to recognize and appropriate nutrition education programs should be developed to address the needs of this group of athletes. Not surprisingly, 94% of these freshman male athletes did not express any desire for counseling about eating disorders.

Physiological Status

Table 4a,b,c presents biochemical data of these athletes. For the overall group no abnormal laboratory values were observed, except for a slightly elevated serum phosphate concentration. Twenty-four percent of these freshman football players had TC greater than 200 mg/dl. Although we were unable to detect significant differences in blood lipid profiles of these athletes on

Table 2. Attitudes and beliefs of collegiate freshman football players on various nutrition-related topics.

	Percentage of athletes		
	Agree	Disagree	Don't know
Carbohydrates and fats are the main source of energy for muscles	74	23	3
Sweets should not be eaten before an athletic event	65	23	13
Eating carbohydrates makes you fat	7	84	10
Meals high in fat should be consumed 2 to 3 h before training or competition	19	32	48
Protein is the primary source of energy for muscles	61	32	7
Protein supplements are needed in addition to diet, for muscle growth and development	52	26	23
Fluids should be replaced before, during, and after athletic events	97	3	—
Powerade and other sports drinks are better than water for replacing fluid losses	3	71	26
Athletes can rely on thirst to ensure fluid replacement during and after competition	13	71	16
Dehydration decrease athletic performance	90	7	3
Vitamin and mineral supplements increase energy level	65	3	32

Table 3. Interest in learning about various nutrition topics by collegiate freshman football players.

Topic	Percentage of athletes expressing an interest*
Nutrition for peak performance	97
Weight gain	81
Tips on eating out	71
Exercise and fitness programs	65
Weight control	52
Cooking demonstrations and meal preparation	48
Grocery store tour	39

* Total percentage is greater than 100 because individual athletes could select more than 1 topic.

the basis of their position in the team given the small sample size, descriptive data suggest a trend. The offensive linemen had the highest TC concentration (185 mg/dl), followed by wide receivers (177 mg/dl), linebackers (175 mg/dl), running backs (174 mg/dl), defensive backs (162 mg/dl), kickers (154 mg/dl), punter (145 mg/dl), and quarterback (136 mg/dl). Overall, as a group these athletes appeared to be in normal nutritional and hydration status on the basis of the different biochemical parameters tested.

Discussion

The results of this descriptive study suggest that although as a group no major problems were identified

with respect to the athlete's dietary practices and physiological status, there is room for improvement. On the basis of responses to the nutrition attitudes and beliefs questions, it appears that these athletes may have a few misconceptions regarding the role of macronutrients, especially protein, vitamins and minerals, and fluids, in the diet of an athlete who is trying to achieve peak performance. The results also suggest that these freshman collegiate football players may benefit from nutrition education and counseling to promote healthy dietary habits and practices. Although nutrient intake was not assessed in the present study and the blood lipid profile was within normal ranges, the reported heavy reliance on fast foods suggests that the diets of these athletes may be high in total fat, saturated fat, and cholesterol content. Additionally, in the present study, only 3% of the athletes reported avoiding red meat. These dietary practices can have a negative consequence on the long-term health status of these young athletes if they are not provided proper nutrition guidelines.

Nattiv et al. (12, 13) observed that collegiate athletes in contact sports had significantly greater high-risk behaviors, such as greater frequency of smokeless tobacco use and greater frequency of alcoholic beverage consumption during off-season, compared with athletes in noncontact sports. Although 52% of the freshman football players in the present study reported avoiding alcohol, considering that the mean age of this group was 18 years, and the legal drinking age is 21 years, this is not a surprising finding. Additionally, this self-report on alcohol consumption should be viewed with caution given that this is a sensitive issue

Table 4a. Biochemical indices of nutritional status of collegiate freshman football players.

Test	Mean \pm SD	Normal range*
Hemoglobin (g/dl)	15.5 \pm 0.7	13.4–16.9
Hematocrit (%)	47 \pm 2	38.5–49.0
Mean corpuscular volume (fl)	90 \pm 6	79–93
Mean corpuscular hemoglobin (K/ μ L)	30 \pm 2.4	27–32
Mean corpuscular hemoglobin volume (g/dl)	33 \pm 1.0	32–36
Serum iron (μ g/dl)	107 \pm 33	45–180
TIBC† (μ g/dl)	328 \pm 27	250–390
Saturation (%)	33 \pm 11	15–50
Total bilirubin (mg/dl)	0.4 \pm 0.2	0.3–1.6
Direct bilirubin (mg/dl)	0.1 \pm 0.02	0.0–0.3
Total protein (g/dl)	7.5 \pm 0.3	6.4–8.4
Albumin (g/dl)	4.4 \pm 0.2	3.0–5.5
Globulin (g/dl)	3.1 \pm 0.2	1.9–4.0
Albumin/Globulin ratio	1.5 \pm 0.1	1.1–2.3
Creatinine (mg/dl)	1.4 \pm 0.14	0.6–1.2
BUN/Creatinine ratio	11.7 \pm 2.0	10–20
Alkaline phosphatase (U/L)	95 \pm 30	<351
Aspartate aminotransferase (U/L)	25 \pm 8	<49
Alanine aminotransferase (U/L)	19.5 \pm 7	<54
Glutamine aminotransferase (U/L)	23 \pm 9	<48
Lactate dehydrogenase (U/L)	152 \pm 26	<231
Thyroid-stimulating hormone (mU/L)	2.9 \pm 1.6	0.70–6.40
Glucose (mg/dl)	97 \pm 11	60–110

* Tests performed by Quest Diagnostics, Irving, TX.

† TIBC = Total iron binding capacity

Table 4b. Blood lipid and lipoprotein concentration of collegiate freshman football players.

Test*	Mean \pm SD	Normal range†
Total cholesterol (mg/dl)	169 \pm 36	120–199
Triglycerides (mg/dl)	104 \pm 60	<200
HDL-C (mg/dl)	54 \pm 14	>40
LDL-C (mg/dl)	95 \pm 26	<130
TC/HDL-C ratio	3.5 \pm 1.7	<5.1
LDL-C/HDL-C ratio	2.0 \pm 1.1	<3.7

* HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol; TC = total cholesterol.

† Tests performed by Quest Diagnostics, Irving, TX.

and individuals may not be reporting truthfully. Similar to the present study, Selby et al. (15) observed that 42% of male athletes reported consumption of alcohol during the competitive season, which increased to 60% during the off-season. These findings suggest that young athletes should be provided proper education and guidance, and monitored to help prevent such high-risk behaviors.

Table 4c. Serum electrolyte concentrations of collegiate freshman football players.

Test	Mean \pm SD	Normal range*
Sodium (mEq/L)	140 \pm 2.1	135–145
Potassium (mEq/L)	4.7 \pm 4.3	3.5–5.3
Calcium (mEq/L)	9.8 \pm 0.4	8.9–10.5
Phosphate (mg/dl)	4.9 \pm 0.5	2.5–4.6
Magnesium (mg/dl)	2.1 \pm 0.5	1.7–3.0
Chloride (mEq/L)	107 \pm 104	94–108

* Tests performed by Quest Diagnostics, Irving, TX.

The percentage of the collegiate football players in the present study using vitamin and mineral supplements (23%), is lower than that reported by Sobal and Marquart (18), who reported that 47% of high school and collegiate athletes used supplements, Chapman et al. (4), who observed 43% of high school athletes using supplements, and the 1988–1991 NHANES III survey, which identified 24–37% of 20–29-year-old men and women using supplements (6). Selby et al. (15) observed that approximately one-third of the collegiate athletes surveyed (26%) used vitamins daily, both during the competitive season and off-season. Similarly, a survey of the Syracuse University football team revealed that multivitamin pills were consumed by 50% of the players, 30% used vitamin E, 20% used vitamin C, 24% used calcium, and 15% took iron supplements (16). Likewise, Burke and Read (3) observed that 31% of elite Australian football players used vitamin and mineral supplements regularly, with the most common ones being a multivitamin/mineral preparation or a B-complex mixture. Although 22% of the Australian football players consumed these supplements to enhance performance, the most common reasons given for using supplements were to compensate for poor nutrition and lifestyle practices, combat respiratory infections, and excess alcohol consumption (3). More recently, Krumbach et al. (9) examined the prevalence of vitamin and mineral supplement usage by NCAA division I collegiate athletes. Fifty-seven percent of these athletes reported use of supplements, with female athletes having a greater frequency of usage (59.3%) than males (55.3%). The common reason given by the male athletes for taking supplements was “improved athletic performance” (43%). Multivitamins with minerals were most frequently used, followed by vitamin C, multivitamins, calcium, and iron. Additionally, Sobal and Marquart (18) and Krumbach et al. (9) observed basketball players to be taking vitamin and mineral supplements less frequently than athletes in other sports, suggesting that the rate of supplement usage and the type of supplement used may be specific to the nature of the sport. In addition to vitamin and

mineral supplements, creatine was the most common supplement used by the athletes in the present study, suggesting that these athletes may be taking these dietary supplements to enhance their performance and achieve body composition goals. Considering the cost of supplements and their limited effectiveness as ergogenic aids, especially in the presence of a balanced diet, it is important that athletes, coaches, and trainers be provided with basic nutrition knowledge regarding diet, ergogenic aids, and nutritional supplements.

Depalma et al. (5) examined the weight-control practices of lightweight football players. Seventy-two percent of the athletes used both exercise and fasting as a means to control body weight, suggesting that these athletes may suffer from dysfunctional eating behaviors, which may be a result of the requirements imposed on these athletes by their sport. Additionally, this group of athletes identified teachers and coaches as important factors who influenced and encouraged these eating behaviors (5). Selby et al. (15) observed that 14% of male athletes perceived themselves as overweight, 26% dieted on a daily to weekly basis, and 18% reported being told by their coaches to modify their weight. Similarly, Burke and Read (3) observed that body mass was an important issue among elite Australian football players, and Chapman et al. (4) observed that 76% of high-school varsity football players expressed an interest in losing weight. Although only 3% of the freshman football players in the present study wanted to lose weight, 81% expressed a desire to gain lean mass. The differences in body composition goals observed in the various studies suggest that these groups of athletes may have slightly different goals as they mature and as their level of competition increases. However, the body composition data suggest that these athletes would benefit from education programs that address weight management, dieting, and body image concerns of the athletes and those that provide guidelines to achieve appropriate body weight and body composition goals. Additionally, coaches and trainers working with these athletes should be advised and educated about these issues and how to handle them when working with individual athletes.

Nutrition knowledge, as assessed by attitudes and beliefs, of the freshman collegiate athletes in the present study indicate that there are some misconceptions regarding the role of various nutrients in the diets of athletes. Although the athletes in the present study recognized the role of adequate hydration, their fluid intake practices and knowledge with regard to fluid replacement appears to be inadequate. Although adolescent athletes reported that sports drinks would be more beneficial than water for rehydration (4), in the current study 71% of the football players disagreed with this statement. Overall, this suggests that these freshman football players need to be educated about proper rehydration techniques. Given that football

players play under hot climatic conditions with heavy protective equipment, it is important that they be educated about proper hydration before, during, and after exercise and games. Because of the increased sweat losses typically experienced by football players, it is important that these athletes consume carbohydrate-electrolyte beverages to replace the electrolytes lost through sweat and also to meet the energy needs of the athletes.

Jacobson and Aldana (8) compared the nutrition knowledge and practices of college varsity athletes. Seventy-two percent of these athletes believed that athletes need additional vitamins and 77% believed that vitamins were major contributors to individual energy level. Likewise, 65% of the athletes in the present study had a similar belief regarding the role of vitamins, suggesting that these athletes would benefit from information on the role of vitamins in sports nutrition. Results from the present study suggest that these athletes believe that protein plays a major role in fueling the energy needs of the athlete, and protein supplementation is commonly used mainly to increase muscle size and power. With respect to carbohydrate and fat, 74% of the athletes in the present study correctly identified the function of carbohydrate as to provide immediate energy and 29% identified fat as the largest body store of energy. Overall, it appears that these athletes would benefit from an explanation of the role of macronutrients and micronutrients in the diet of the athlete. Given that the young athletes in the present study expressed an interest in learning about the role of nutrition in performance and healthy eating practices, this nutrition education should be initiated early during the athletes' careers to prevent poor habits in the long term. Chapman et al. (4) examined the effectiveness of sports nutrition programs in improving nutrition knowledge of high-school varsity football players. A positive correlation was observed between nutrition knowledge score and carbohydrate intake and a negative correlation was observed with fat intake, suggesting that if proper guidance is provided, the dietary intakes of these athletes can be improved.

Millard-Stafford et al. (10) examined the cardiovascular disease risk profile of collegiate football players. Linemen were taller and heavier than other players. Offensive linemen had greater percentage of body fat (21.2%) and defensive backs had the lowest (10.3%), suggesting that position in the game may influence dietary practices. Offensive linemen had the highest mean TC (206 mg/dl) and TG (132 mg/dl), and lowest HDL-C (37 mg/dl). A similar trend was observed in the blood lipid profiles of the freshman football players in the present study. Although overall the young freshman players in the present study had a normal lipid profile, 24% of these athletes had TC levels greater than 200 mg/dl, suggesting that it is important to

monitor their nutrient intake and blood lipid profiles over the long term.

In summary, results of the present study suggest that these young freshman football players can benefit from nutrition education programs targeted at improving their dietary and fluid intake practices. Educating the athletes to make wise food choices will be of benefit not only in the short run (performance) but also in the long term (prevention of chronic disease).

Practical Applications

On the basis of the results of the present study and those of previous studies, it is important that athletes and all individuals working with them, including coaches and trainers, be educated about proper eating habits, hydration practices, and on the appropriate use of nutrition supplements, which can assist in achieving peak performance without compromising their growth and development. Collegiate athletic associations should consider using the services of a qualified sports nutritionist to provide sound nutrition education and counseling to these young athletes.

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