STUDY PROTOCOL

Official Title: Parental Nutrition Education on the Performance and Body Composition of Young Basketball Players (PNE-YBP)

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Participant

This study involved 30 young basketball players, aged 8 to 13 years, who participated in the Burdur Mehmet Akif Ersoy University Basketball team from May to July 2023. A single-group pre-post quasi-experimental design was used. The sample size was determined based on feasibility within the basketball team context. A post-hoc power analysis was performed using G*Power 3.1 software for a two-tailed paired-sample t-test. With an α level of 0.05, a sample of 30 participants, and an observed large effect size (Cohen's $d = 0.8$), the achieved statistical power $(1 - \beta)$ was 0.95. Therefore, the study was sufficiently powered to detect medium-to-large differences between pre- and post-education measurements. This power level is consistent with previous intervention studies in young or adolescent athletes (5, 17, 18).

Ethics approval

The parents of the players involved in the study were informed about the research; the informed consent form was obtained from all of parents. Prior to commencing the study, ethical approval was secured from the Burdur Mehmet Akif Ersoy University Non-Interventional Research Ethics Committee (Approval No: GO 2023/206, Date: April 5, 2023) before beginning of data collection.

Procedures

Before the start of the study, a questionnaire developed by the researchers was administered to the parents (see additional file 1). This questionnaire included socio-demographic data, eating habits, and an assessment of sports nutrition knowledge for young adolescent players. At the same time, anthropometric measurements of young adolescent players were taken prior to the beginning of sports nutrition education and performance tests. A retrospective 3-day food consumption record form was utilized employing the retrospective recall method. Food consumption was recorded over two weekdays and one weekend day, with the data presented as the average for the three days. The same questionnaire and forms were administered to the

parents post-training, and the performance and anthropometric measurements of the players were reassessed education. Training volume was assessed using a self-reported training diary completed by the players and verified by their coaches. Players recorded the duration (minutes per session) and frequency (sessions per week) of their training over the previous four weeks. Weekly training volume was calculated as the product of session duration and frequency (minutes/week). Assessments were repeated 4 weeks after baseline. The Nutrition Knowledge Level Test was utilized to assess the sports nutrition knowledge of parents and evaluate the effectiveness of the education provided on this topic.

Sport Nutrition Knowledge Level Test

The Sports Nutrition Knowledge Level Test (SNKT) was created by Torres-McGehee et al. (19) and then adapted into Turkish by Dener (20). The test consists of 20 questions, with a scoring scale of 100 points. Each question is assigned a value of 5 points for a correct answer and 0 points for an incorrect response. A correct response to 15 questions (greater than 75 points) demonstrates a sufficient level of knowledge. Higher scores indicate a greater level of sport nutrition knowledge.

Dietary Assessment

The players' parents were requested to complete the 3-day food consumption record form in detail, utilizing the retrospective recall method for the young basketball players. Players were instructed to complete a 3-day food consumption record over three consecutive days (Thursday, Friday, Saturday, or Sunday, Monday, Tuesday), ensuring that one of these days fell on the weekend. They were required to document the foods consumed, including water, along with the quantity (weight, portion), cooking method, and food content. Meal and Food Photograph Catalog (21) and Standard Recipes for Caterings (22) books were used to determine the food quantities and the amounts included in the portions of the meals. The completed food consumption record was subsequently entered into the Nutrition Information System (BEBİS

8.0, Stuttgart, Germany). All 3-day dietary records were analyzed and entered into the Nutrition Information System by the same registered dietitian to ensure consistency in data interpretation and nutrient coding. The Nutrition Information System used in this study has been previously validated for estimating macro- and micronutrient intakes in Turkish populations (23). The mean daily intake levels of energy, macronutrients, and micronutrients for the players were evaluated.

Anthropometric Measurements

Anthropometric measurements such as height, body weight, Body Mass Index (BMI), and body composition were conducted to evaluate nutritional status and monitoring growth. Height was measured with feet positioned side by side and the head in line in the Frankfort plane, ensuring the eye triangle and auricle were at the same level and parallel to the ground. Body weight was recorded with players removing their shoes and wearing light clothing. The device quantifies weight in kg with an accuracy of 0.1 kg. To ensure accurate weight measurement, it was considered that individuals had fasted for a minimum of 4 hours, refrained from fluid intake, and did not experience frequent urination. The calculation of BMI involves dividing an athlete's body weight in kilograms (kg) by the square of their height in meters (m²). Waist circumference was assessed at the midpoint between the lowest rib and the crista iliac crest using a non-elastic tape measure. Prior to the measurement of waist circumference, individuals were instructed to remove any items and clothing that could obstruct the measurement process. To ensure accurate measurement, the individual stood upright with a relaxed abdomen, arms positioned at their sides, feet together, and faced directly towards the person conducting the measurement. The measurements were documented in centimeters with a precision of 0.1 cm. Hip circumference was assessed with the players in a lateral position, measuring from the highest point parallel to the floor using a non-stretchable plastic measuring tape. The players' body compositions were assessed on a non-training day, in a fasted state, wearing light clothing, utilizing bioelectrical

impedance analysis (BIA). Basal metabolic rate was estimated via the BIA device output. To reduce variability, all measurements were taken by the same trained operator at the same time of day (morning) under standard conditions. Participants arrived after fasting for at least four hours, avoided drinking fluids, caffeine, and vigorous exercise for at least 12 hours, emptied their bladders within 30 minutes of the assessment, took off any metal accessories, and were measured barefoot in light clothing in a room temperature (about 22-24 °C). The order of the measurements stayed the same for all sessions, and the device checks that the manufacturer suggested were done before each session.

Performance Tests

Physical performance tests were conducted to assess the players' speed, strength, and endurance. The testing session included a 20-m sprint, vertical jump, handgrip strength, and sit-and-reach flexibility test. All procedures followed validated protocols recommended by the American College of Sports Medicine (24) and the European College of Sport Science (25). Tests were performed in the following order to minimize fatigue effects: flexibility, handgrip strength, vertical jump, and 20-m sprint. Each participant was allowed one familiarization trial per test and two recorded attempts, with the best score used for analysis. Handgrip strength was measured using a Takei 5401 digital dynamometer, vertical jump performance with a Smart Jump System, and sprint time with photocell timing gates. All tests were supervised by trained researchers to ensure standardization and reliability.

Nutrition Education Module

The nutrition education presentation was carried out by the researchers in a single 90-minute session online (via Zoom) following the initial questionnaire, performance tests, and anthropometric measurements. The session involved young basketball players, their parents (e.g. mother, father and/or other primary caregivers), and team coaches to ensure a consistent nutrition message across family and sports settings. The nutrition education encompassed the

macro and micronutrients essential for adolescents during their growth and development, detailing their required quantities and significance in sports nutrition, healthy meal choices, and guidelines for consumption before, during, and after competitions and training sessions. The importance of water intake was elucidated, and guidance was offered regarding the adequate fluid consumption throughout training and competition. The session concluded with a Q&A segment of young players and their parents regarding nutritional management.