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Assessment of selected body composition parameters and nutritional habits of American football players in Poland: a prospective and observational study

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ABSTRACT

Introduction: American football is becoming a more and more popular sport in Poland. People practicing this sport have specific nutritional needs. A balanced and rational diet is very important in the process of training an athlete. Not only composition of the body, but also the proper diet is important of the results achieved, deciding on the athlete's success or failure. The aim of the study is to assess the body composition and nutritional behavior of American football players.

Materials and methods: The study was conducted among 46 participants from the American football club 'Towers Opole'. They were split into 2 groups, senior (n = 31) and junior (n = 15). The following measurements were taken: height, weight, body composition (body fat – BF, fat mass – FM, fat free mass – FFM, muscle mass – MM, total body water – TBW) and body mass index (BMI). An evaluation of nutritional behavior through the author's questionnaire was also conducted.

Results: Seniors compared to juniors had – body height (BH): 183.1 cm vs. 174.7 cm ($p < 0.01$), body weight (BW): 94.5 kg vs. 81.6 kg ($p < 0,01$), BMI: 28 kg/m^2 vs. 26.5 kg/m^2 (ns), BF: 21.9% vs. 20.9% (ns), FM: 20.8 kg vs. 17.6 kg (ns), FFM: 74.9 kg vs. 66 kg ($p<0.01$), MM: 71.6 kg vs. 62.6 kg ($p < 0.01$), TBW: 56.6% vs. 57.9% (ns).
The analysis of eating behavior showed that seniors consumed meat and cold cuts every day significantly more often than juniors – 66.7% vs. 28.6% ($p < 0.01$), they consumed cheeses as well as cream and blue cheese more often – 99.33% vs. 71.43% ($p < 0.05$), they mainly supplemented liquids with mineral water – 63.33% vs. 14.29% ($p > 0.05$), and occasionally or not at all with energy drinks – 83.33% vs. 50.00% ($p < 0.05$).

Conclusions: Seniors have higher values of somatic variables than juniors. The prevalence of normal eating habits among seniors and juniors is at a similar level, although the group of seniors had more favorable eating habits than the juniors.

Keywords: body composition; nutritional habits; American football players.

INTRODUCTION

American football is the one of most popular sports in the USA and, as such, there are numerous studies on the physical characteristics of players [1, 2, 3, 4]. Moreover, since American football has a long history, studies examining changes in the body size and composition of players over the years are common [1, 4, 5, 6].

American football is a team sport that requires strength, power and speed [7, 8, 9]. American football in Poland quickly started to develop in 2004 after the establishment of the Polish American Football Association [10], initiated by 2 teams. At the very beginning, the league was formed by 4 teams, who fought for the spot of the best American football team in Poland. The interest in this was so great that several thousand spectators came to the first matches. Currently, American football in Poland is becoming so popular that women also play it. The Polish American Football League already has several dozen teams playing in different leagues [11].

Body composition studies are conducted in many sports ranging from team sports such as football, volleyball, basketball, handball and American football to individual sports such as ski jumping, table tennis and martial arts [12].

An important feature in team games is the combination of endurance with speed and strength. Typically, the range of tests includes anthropometric measurements such as height and weight. On their basis, it is possible to calculate the body mass index (BMI) and identify correct and incorrect body mass. Often, among athletes, excessive body weight (BW) is associated with increased muscle mass (MM) so it is worthwhile to enrich these somatic measurements by examining the body composition with regard to the percentage of fat and lean body mass.

American football requires an exceptional body structure and a combination of speed and power [13]. Extensive studies in various populations have documented the relationship between various fat free mass (FFM) and strength, power, speed and sports performance [14, 15, 16, 17]. Research on American football players is often conducted in the USA. Anzell et al. researched changes in weight and body composition between 1942–2011 among American football players differentiated by skill level (college and professional). All players had a significant increase in BW. In mixed linemen who played at college level, a significant increase in the percentage of body fat (BF) was found [5]. Kraemer et al. researched the body size and body composition of National Football League (NFL) players prior to the start of the regular season. Comparisons to profiles of teams in the 1970s indicate that body mass has increased only for offensive and defensive linemen; however, height and BF among player positions have not dramatically

changed. Furthermore, they found that BMI is not an accurate measure or representation of BF or obesity in NFL players [2].

Athletes are a group of people with specific nutritional needs [18, 19]. A rational and properly composed diet in terms of quantity and quality is a very important element of an athlete's training process. Appropriate nutrition affects muscle strength, efficiency and determines the rate of regeneration after physical exertion. It is important to follow a properly balanced diet before, during and after physical exertion [20, 21].

A proper diet, including increased amounts of energy, protein, vitamin B complex, antioxidants and minerals, favors the improvement of an athlete's health potential and physical capacity [22].

Satisfying the athlete's physiological demand for nutrients requires planning food intake according to recommendations for people with high levels of physical activity. The diet of athletes can be determined with the use of special dietary pyramids [22], such as the Swiss Food Pyramid for athletes; a new dietary model for people with higher levels of physical activity [23, 24].

At the base of the Swiss pyramid is unsweetened drinks, while at the top there are sweets, salty snacks and sweetened drinks; other levels occupy different food groups including vegetables, fruits, whole grains, pulses, protein products, oils, fats and nuts, with a recommended consumption frequency for these products. The pyramid is an innovative instrument supporting nutritional education. Moreover, it helps athletes to make more rational dietary choices adequate to their training load by illustrating the recommended frequency and quantity of consumption of different food groups [23, 24].

The athlete's environment influences dietary choices. The factors which influence these dietary choices include physical and social conditions, quality, quantity, perceived health and comfort [25, 26, 27, 28].

Although, athletes are often characterized by proper eating habits, a large percentage of them do not pay enough attention to their daily diet [29]. Therefore, research on the nutritional habits of athletes is very important [30, 31].

Systematic physical exercise and numerous burdens imposed on athletes with improperly balanced diets may cause nutritional deficiencies. Thus, improper nutrition increases the risk of malnutrition, dehydration or injuries [21].

Due to its short history and the relatively low interest in this sport in Poland compared to other disciplines, in particular football, there are a limited number of studies on the physical characteristics and nutritional behavior of American football players. Therefore, there is a need to profile the structure and composition of the body, as well as the dietary habits of these athletes, in Poland in order to provide basic data for the future.

The aim of the study is to assess body composition and nutritional behavior of American football players.

MATERIALS AND METHODS

Study design, settings and duration

A prospective and observational study was performed. The research was conducted in May 2019. The Strengthening the Reporting of Observational Studies in Epidemiology guidelines were followed.

Nonprobability sampling was used, which was not intended to be used to make generalizations to the general population in statistical terms. Members of the study group were chosen based on how easy they were to access.

Participants

A total of 46 American football players from the 'Towers Opole' team were involved. Two groups: Senior (S) American football players (n = 31) and Junior (J) American football players (n = 15) were examined.

The mean age of S was 27.87 ±6.46 years and in the J was 16.00 ±0.93 years.

Active players who regularly participated in training were included in the study. The research was carried out among the players who did not report any complaints and were present at training on the day research was conducted; 80% of the club's players took part in the research.

Eligibility criteria

The criteria for inclusion in the study group was: an age between 14–40 years old, male gender, informed consent.

Exclusion criteria was: age under 14 or over 40, gender – woman, people undergoing treatment for an injury, presence of contraindications to bioelectrical impedance measures such as a pacemaker or other electronic or metal implant, lack of written consent to participate in the study.

METHODS

The research includes measurements of basic anthropological parameters: height and BW. Body height (BH) was measured with a stadiometer with an accuracy of 0.1 cm and BW was measured with a scale (Tanita MC-980 MA) with an accuracy of 0.1 kg. The BMI was calculated as BW in kg divided by the BH squared in m (kg/m^2).

An analysis of body composition was performed. The body composition variables selected for this study included 4 measures: BF (%) and body fat mass – FM (kg), FFM (kg), MM (kg), and total body water – TBW.

In addition, data on the dietary behavior of the competitors were collected. A quantitative methodology was applied in the form of a diagnostic survey technique using a questionnaire. The questionnaire consisted of 2 parts – the metrics and a part containing 30 single-choice closed questions, with the possibility of giving "yes" for a positive answer, "no" for a negative or in the case of a lack of response "I don't know". The questions concerned, among other things, the number of meals consumed, the frequency of consumption of particular food groups and the types and amount of liquid consumed.

Procedures

All examinations were carried out in May 2019 before training. Before the examination, all participants were informed about the principles and purpose of the examination and gave

their written consent to participate. The participants were instructed not to engage in heavy exercise and not to intake alcohol or caffeine the day before the measurement. All measurements were taken in the morning after 8–10 h of fasting.

Ethical considerations

The study was approved by the Bioethics Committee at the Opole Medical School in Poland (No KB/47/N02/2019). The study was conducted according to the Declaration of Helsinki.

Statistical analysis

Descriptive statistics were used. Arithmetic mean, median, standard deviation, coefficient of variation, minimum and maximum were calculated. The distribution of the variables was assessed in terms of normality using the Shapiro–Wilk test. Student's t-test was used to assess the difference between the averages. Data on dietary habits were presented in percentages. The $\chi 2$ test was used to evaluate and compare eating habits among S and J. The level of statistical significance was set at $p < 0.05$. The α level was set at 0.05 with a confidence interval of 95%. Statistical analysis was performed using Statistica 13 (TIBCO Inc., Tulsa, United States).

RESULTS

Table 1 contains the results of body composition. The average BH of S is 183.6 ±4.3 cm and of J – 174.7 ±4.9 cm. The differences are statistically significant ($p < 0.000001$). The average BW of S is 94.6 ±15.6 kg and is significantly higher than that of J who are 81.6 ±15.6 kg. The differences between the averages in BW are statistically significant ($p < 0.011870$). The mean value of BMI among S is higher at 28.4 ±4.2 kg/m^2 than among J at 26.5 ±4.9 kg/m^2. The mean level of BF in the group of S and J are similar values – 21.96 ±7.9% and 20.95 ±6.7% respectively. The FM expressed in kg is similar in the group of S (20.84 ±9.5 kg) and J (17.63 ±8.3 kg). A higher mean value for FFM expressed in kg is obtained by S – 74.9 ±8.7 kg, compared to J – 66.0 ±8.8 kg. The differences between the averages are statistically significant ($p < 0.002086$). A definitively higher mean value is found for MM in the group of S – 71.67 ±8.3 kg, than for the J – 62.6 ±8.3 kg. The differences between the averages are statistically significant ($p < 0.001118$). The mean values of TBW percentage are similar in the group of S (56.6 ±4.9%) and J (57.9 ±2.5%).

As much as approx. 80% of S and 78.6% of J declared that they eat 4–5 meals a day. The differences are not statistically significant. More than ¼ of the players (26.7% of S and 28.6% of J) have a 3–5 h meal interval. The differences are not statistically significant. Half of the S and 1/3 of the J consume a meal 2 or 3 h before training. There are no statistically significant differences. Most players – 76.7% of S and 78.6% of J – eat a meal up to 2 h after training. The differences are not statistically significant. The vast majority of players refrain from eating a meal up to 2 h before bedtime. The difference between the 2 groups is not statistically significant. The consumption of whole grain bread or whole grain porridge was declared by 83.3% of S and 57.1% of J. There are no statistically significant differences. One third of S (33.3%) and 21.4% of J declared eating vegetables in at least 2 meals. The differences are not statistically significant. The vast majority – 86.7% of S and 92.9% of J – declared that they eat raw vegetables at least once a day. There are no statistically significant differences. About 2/3 of the competitors from both groups, including 73.3% of S and 71.4% of J, eat fruit in at least 1 meal. The differences are not statistically significant. The consumption of raw fruit at least once a day was declared by 43.3% of S and 21.4% of J. There are no statistically significant differences. Daily consumption of meat and cold cuts was declared by 66.7% of S and 28.6% of J. The differences are statistically significant ($p = 0.01809$).

Exactly 80% of S and 85% of J prefer lean poultry. The differences are not statistically significant. Exactly 30% of S and 7.1% of J eat fish once or twice a week. There are no statistically significant differences. Several times a month, less than ½ of the S (44.8%) and more than 1/3 of the J (35.7%) consume legume seeds. The differences are not statistically significant. More than ½ of the S (53.3%) and 71.4% of J declared that they consume milk or fermented milk drinks at least once a day. The differences are not statistically significant. Among S 66.7% and 35.7% of J declared that they consume cottage cheese several times a week. There are no statistically significant differences. Almost all S (93.3%) and the vast majority of J (71.4%) declared eating cheese, cream cheese and blue cheese several times a month. The differences are statistically significant ($p = 0.04860$).

Egg consumption several times a week was declared by 90% of S and 78.6% of J. The differences are not statistically significant. Only 16.7% of S and 7.1% of J declared a reduction in the consumption of animal fats. The differences are not statistically significant.

An almost daily consumption of plant-based fats was declared by 23.3% of S. None of the J declared any plant-based fat intake. The differences are not statistically significant. Most competitors, including 76.7% of S and 71.4% of J, follow a varied diet. The differences are not statistically significant. Half of the examined S (53.3%) and 1/3 of the J (35.7%) drink fluids during exercise. The differences are not statistically significant. Almost all S (90%) and 78.6% of J (86%) drink fluids after exercise. There are no statistically significant differences. More than half of S (63.3%) and only 14.3% of J declared that they mainly drink mineral water to replenish fluids. There are statistically significant differences ($p = 0.00241$).

More than half of the competitors, including 60% of S and 64.3% of J, declared that they drink more than 2.5 L of water per day. The differences are not statistically significant. Most of the examined athletes, including 83.3% of S and 71.4% of J, declare occasional soda consumption. There are no statistically significant differences. Most of the examined S (83.3%) declare occasional consumption of energy drinks. Half of the J drink energy drinks more often than occasionally. There are statistically significant differences ($p = 0.02076$).

Most of the players (80% of S and 78.5% of J) never consume sweets or only do so occasionally. The differences are not statistically significant. Occasional consumption of salty snacks is declared by less than 1/2 of the S (43.3%) and 1/3 of J (35.7%). All other respondents consume salty snacks more often. The differences are not statistically significant. Most athletes (76.7% of S and 78.6% of J) never consume fast-food products or only occasionally do so. The differences are not statistically significant (Tab. 2).

TABLE 1. Characteristics of the somatic features and body composition of competitors

Variables	Players	Mean	Minimum	Maximum	Standard deviation	Coefficient of variation	t	p
Body height (cm)	S	183.58	174.90	194.10	4.3418	2.36509	6.27038	0.000001*
	J	174.67	165.20	181.80	4.8795	2.79361		
Body weight (kg)	S	94.57	75.00	135.00	15.6088	16.50556	2.62766	0.011870*
	J	81.60	60.00	109.00	15.5967	19.11361		
Body mass index (kg/m^2)	S	28.04	23.10	37.40	4.2406	15.12613	1.06233	0.293880
	J	26.54	21.10	35.10	4.9367	18.60103		
Body fat (%)	S	21.96	8.80	39.10	7.8794	35.88921	0.42310	0.674287
	J	20.95	12.50	36.10	6.7062	32.00525		
Fat mass (kg)	S	20.84	9.80	45.10	9.5145	45.65095	1.11773	0.269746
	J	17.63	9.20	33.20	8.3010	47.09334		
Free fat mass (kg)	S	74.97	60.20	95.10	8.6559	11.54568	3.27122	0.002086*
	J	66.03	51.20	78.90	8.7527	13.25495		
Muscle mas (kg)	S	71.67	57.30	90.20	8.2134	11.46088	3.48788	0.001118*
	J	62.63	48.10	74.20	8.2922	13.24069		
Total body water (%)	S	56.61	42.50	64.10	4.8764	8.61401	−0.98628	0.329389
	J	57.93	52.90	62.10	2.5036	4.32155		

S – Senior American football players; J – Junior American football players
* $p < 0.05$

TABLE 2. Characteristics of the nutritional behaviour of players

Question	Percentage of positive answers (%)		p
	S	J	
Consuming 4–5 meals daily	80.00	78.57	0.91287
Meal intervals 3–5 h	26.67	28.57	0.89488
Meal consumption 2–3 h before training	50.00	35.71	0.37540
Meal consumption 1–2 h after training	76.67	78.57	0.88832
Meal intake no later than 2 h before bedtime	76.67	85.71	0.48831
Consumption of whole grain bread and/or whole grain porridge	83.33	57.14	0.06166
Consumption of vegetables in at least 2 meals	33.33	21.43	0.42015
Consumption of raw vegetables at least once a day	86.67	92.86	0.54675
Consumption of fruit in at least 1 meal	73.33	71.43	0.89488
Consumption of raw fruit at least once a day	43.33	21.43	0.15947
Daily consumption of meat and cold cuts	66.67	28.57	**0.01809***
Preference for lean poultry	80.00	85.71	0.64714
Eating fish (1–2 times a week)	30.00	7.14	0.09196
Consumption of legume seeds (several times a month)	44.83	35.71	0.57029
Consumption of milk/yoghurt/kefir (at least once a day)	53.33	71.43	0.25550
Consumption of cottage cheese (several times a week)	66.67	35.71	0.05353
Consumption of cheese, cream and blue cheeses (several times a month)	93.33	71.43	**0.04860***
Egg consumption (several times a week)	90.00	78.57	0.30352
Reduction in the consumption of animal fats	16.67	7.14	0.39121
Consumption of vegetable fats almost daily	23.33	0.00	**0.04873***
Implementation of a balanced diet	76.67	71.43	0.708

Question	Percentage of positive answers (%)		p
	S	J	
Replenishing fluids during exercise	53.33	35.71	0.2757
Replenishing fluids after exercise	90.00	78.57	0.30352
Liquids replenishment mainly with mineral water	63.33	14.29	**0.00241***
Drinking more than 2.5 L of water per day	60.00	64.29	0.78567
Replenishment with sodas and carbonated drinks (occasional and/or not at all)	83.33	71.43	0.36186
Replenishment of fluids with energy drinks (occasional and/or not at all)	83.33	50.00	**0.02076***
Consumption of sweets (occasional and/or not at all)	80.00	78.57	0.91287
Consumption of salty snacks (occasional and/or not at all)	43.33	35.71	0.63210
Consumption of fast-food products (occasional and/or not at all)	76.67	78.57	0.88832

S – Senior American football players; J – Junior American football players
* $p < 0.05$

DISCUSSION

The body composition as well as the nutritional habits of American football players are currently the subject of numerous discussions.

The results of our research indicate that the average BH and BW of the group of S is significantly higher than that of J. Comparing our own research to that of Turkish American football players aged 21.50 ±2.46, we can conclude that they displayed a lower average BH (179.45 cm) than the S but higher than the J [32]. The Japanese players representing Japan in the world championships by position groups were on average 182–193 cm. The BH of the players who were not selected but were also selected as candidates to represent Japan in the World Championships by position groups had a lower BH – 173–180 cm [9]. The American football players representing the "KS Bydgoszcz Archers" club had a BH of 182.8 cm – similar to that of S [33]. In other studies, handball players with a similar average age to the S in this study (28.3 years) have a higher BH of 187 cm than our study groups [34]. The J in our study were shorter than soccer players under 16 years of age [35]. Body height plays an important role in many team games and is extremely important in American football as it makes it easier to catch the ball and allows for a better chance to defend the pass [9].

Comparing the results of our tests to those of competitors from Turkey, lower values of BW were found when compared to S but these were higher in relation to S. The average BW of Turkish competitors is 88.35 ±18.30 kg [32]. American football players from Bydgoszcz had a lighter BW (78.03 kg) compared to both groups in our study [33]. Comparing the S results with those of handball players, there are similar results (93.57 kg) [34]. On the other hand, the average BW of a group of footballers of similar age to J is much lower (63.5 kg) [35]. It should be noted how important the role BW plays in American football is. Lighter people have considerable difficulties in competing with those with a larger body build.

Analyzing the BMI, the average score achieved by both S and J was 28.0 kg/m^2 and 26.5 kg/m^2 respectively. Similar values were obtained by the study of American football players from Turkey (27.42 kg/m^2) [32]. Young footballers of a similar age achieved significantly lower BMI values (20.4 kg/m^2) compared to test results [35]. Among American football players from Bydgoszcz, an average BMI score of 23.34 kg/m^2 was recorded – it is significantly lower compared to both studied groups [33].

Estimating the incidence of overweight and obesity based on calculations of height-weight proportions may give a misleading picture, as a high value of the index may be a consequence of strong muscularity, especially among athletes. Therefore, an analysis of body composition seems to be necessary. Unfortunately, in a sport like American football, in many cases large BW is a consequence of increased BF.

Analyzing FFM, S had significantly more than J, 75 kg and 66 kg respectively. Also, MM is significantly greater in S when compared to J. In S, more years spent on strength training means an increased MM. On the other hand, higher consumption of meat, cold cuts and cheese among S may have increased FM. Slightly lower values of FM were observed in research conducted in Turkey. The athletes from Turkey, depending on their position on the pitch, had an average FFM of between 58.4–73.4 kg [32].

Modern science leaves no doubt that nutrition has an impact on sports performance. The analysis of the research results showed that the nutrition of players did not fully coincide with the model of the Swiss nutrition pyramid for athletes, both in the group of S and J. Such behaviors may have lowered health potential, impaired the development of physical fitness, inhibited sporting achievements and limited the potential that lies in the athlete's body [36].

The number of meals consumed during the day plays an important role in rational nutrition. According to the results of our study, 80% of S and 78.6% of J declared the consumption of 4–5 meals a day. In a study of sportsmen and sportswomen, the analysis of the results showed that only 40.2% of volleyball players and 63.6% of basketball players consumed 4–5 meals [31]. Another study carried out on a group of professional and amateur athletes shows different results; 42%

of professional athletes and 37% of amateurs declared eating 4–5 meals a day [37]. In a study by Gacek, 80% of American football players consumed at least 3 meals a day [38]. Similar results were obtained by Frączek et al. – 84.4% of team game players also declared consuming 3 or more meals a day [29].

An important aspect of a rational model of nutrition is the appropriate regularity and frequency of meals consumed. It is emphasized that regular meal consumption allows for an effective use of the nutrients that are provided in the diet. Unfortunately, only ¼ of the surveyed American football players (26.7% of S and 28.6% of J) maintain a 3–5 h meal interval. In other studies of American football players, regular consumption of meals with a 3–5-h interval between meals was declared by almost twice as many people as in comparison with our studies –48% [38]. In other studies, a regularity of meals every 3 h was observed among 53% of professionals and 48% of amateurs [37]. Similar results in the regularity of meal consumption (46.5%) were obtained among team game players [29]. In a study by Szczepańska and Spałkowska, similar to other studies, 45.8% of basketball players and, similar to the participants of this study, 24.5% of volleyball players consumed meals regularly every 3 h [31].

Quite a high percentage of respondents declared consumption of whole-grain bread or whole-grain groats and legume seeds several times a month. These products should be consumed daily. Research by other authors show that a smaller percentage of professional athletes consume these foods [31, 37].

Vegetables and fruits are particularly recommended due to their high content of minerals, vitamins and antioxidant compounds. They also belong to the group of foods which are sources of carbohydrates of medium or low glycemic index. Our research indicates unsatisfactory results; among the American football players surveyed, only $^1/_3$ of S and $^1/_5$ of J declared eating vegetables in at least 2 meals. A larger percentage of the respondents declared the consumption of fruit in at least 1 meal. In other studies, 54% of American football players declare the consumption of vegetables in at least 2 meals a day [38]. Other athletes consume vegetables more often. Team game players declare the consumption of vegetables in at least 2 meals with a frequency of 44% [29].

A high consumption of raw vegetables was declared. The vast majority of American football players surveyed, declared eating raw vegetables at least once a day. A much lower result was obtained in other studies – only 54% of American football players declared that they consume raw vegetables [38]. Similar results were obtained in studies of volleyball players – 55.9%, and higher among basketball players – 71% [29]. Among team game players, only half of the respondents declared the consumption of vegetables in a raw form [29].

A low percentage of J declared daily consumption of protein products, including meat and cold cuts. The consumption of fish is also low, especially among J. A high percentage of the surveyed S and J declare eating cheese and eggs. The Swiss Sports Food Pyramid recommends choosing between a portion of meat, fish, eggs or cheese daily. The J most often choose cheese and eggs over meat and fish. In another study, a different tendency can be observed; protein products, including meat and cold cuts, were consumed daily by 85% of professionals and 81% of amateur athletes [37]. In another study of American football players, half of them declared that they consume fish 1–2 times a week [38]. Similar proportions (59.3%) were obtained in the study of team players [29]. Lower percentages were obtained in a study of professional and amateur players, 35% and 29% respectively [37]. Among volleyball and basketball players, consumption of cheese and eggs were significantly lower [31].

Consumption of milk or fermented milk and cottage cheese is medium level. The following percentages were recorded among volleyball and basketball players: 63.7% and 77.6% [31]. Among team game players, 40.2% of volleyball players and 41.1% of basketball players consume the examined variable [31].

A high consumption of animal fat and low consumption of vegetable fat was observed, especially among J. This is not in line with the principles of rational nutrition. Research by other authors shows a different tendency. In another study, 42% of American football players limit the consumption of animal fat [38]. Similarly, 50% of team sportsmen and women declared consuming plant-based fat [29].

More than half of the surveyed American football players declared drinking more than 2.5 L of water per day. Slightly higher percentages were found among professional and amateur players at 75% [37], 10.8% volleyball players and 39.3% basketball players [31].

Seniors from our research, significantly more often than J, declared that they mainly replenish fluids with mineral water and occasionally consume energy drinks. From other authors' research, it can be concluded that a similar percentage of athletes supplement their fluids with mineral water [29, 31, 37, 38]. More than half of other American football players declared a reduced consumption of energy drinks (64%) [38], 40% of the players of team sports declared no consumption of energy drinks [29].

In addition to research on the analysis of body composition and proper eating behavior, an important element of future research will be the assessment of functional movements, movement patterns and the risk of injury to players.

Strengths

The strength of the research is the use of an objective method to assess body composition. A plan to conduct a casual longitudinal study is another strength of this study. Another strong point of the article is also the choice of the study group as, in Poland, research is rarely conducted among American football players.

Limitation

The study has several limitations. The 1st is the small number of J footballers surveyed, also due to the statistics used. As well as this, in terms of assessing body composition, the failure to determine the position on the pitch limits the study. Another limitation is also the questionnaire used, the reliability of which has not been assessed. The author's questionnaire

assessing the consumption frequency of selected food groups is lacking in a qualitative domain. Future studies should include the participants of a control group from another discipline of team sports.

Practical implications

Bioelectrical Impedance Analysis as an effective tool for monitoring body composition. An assessment of athlete's nutrition should be carried out in each club because the quantity and quality of meals consumed is of great importance for the physique and the abilities of players in a given sports discipline.

CONCLUSIONS

1. Seniors have higher values of somatic variables than J.
2. The frequency of proper nutritional habits among S and J is similar.

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