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DIETARY HABITS OF SHOOTING ATHLETES: A COMPARATIVE STUDY OF SLOVENIAN AND FOREIGN ATHLETES

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ABSTRACT

***Purpose**: Shooting is a sport in which dietary habits and the timing of meals is not often represented. The aim of this paper is to compare the dietary habits, timing of meals and training frequency of Slovenian and foreign athletes.*

***Methods**: The sample included 88 shooter athletes (35 Slovenian and 53 foreign athletes), aged 14 to 60, who participate in competitions. Data by dietary habits, diet, training and BMI were collected via a questionnaire.*

***Results**: Athletes train and compete most frequently using an air rifle. Foreign athletes train more often and spend more time training than Slovenian athletes ($p < 0.001$). The average BMI was 24.9 ± 4.9 kg/m^2 and was higher in athletes who competed at national level (26.8 ± 5.6 kg/m^2) compared to international level (23.0 ± 3.1 kg/m^2) ($p = 0.022$). We found a difference between the groups in lunch ($p = 0.041$), morning ($p = 0.020$) and evening ($p = 0.008$) snacks. Slovenian athletes reached for food during training less frequently than foreign athletes ($p = 0.007$). More than half of the athletes eat their first post-workout meal within 1-2 hours after training but only 8.6% of Slovenian athletes plan a meal after training, in comparison with 54.7% of foreign athletes ($p < 0.001$).*

***Conclusions**: This study highlights significant differences in the timing and frequency of meals and dietary planning by Slovenian and foreign shooting athletes. Foreign*

athletes tend to train more frequently, have better nutritional planning and eat more meals after training than their Slovenian counterparts.

Keywords: *shooting, nutrition, eating behaviour*

PREHRANSKE NAVADE ŠPORTNIKOV V STRELSTVU: PRIMERJALNA ŠTUDIJA SLOVENSKIH IN TUJIH ŠPORTNIKOV

IZVLEČEK

Namen*: Strelstvo je šport, kjer so prehranske navade in režim prehranjevanja slabo raziskani. Namen članka je primerjati prehranske navade, režim prehranjevanja in pogostnost treninga slovenskih in tujih športnikov.*

Metode*: Vzorec je vključeval 88 kategoriziranih strelcev športnikov (35 slovenskih in 53 tujih) med 14 in 60 letom starosti, ki sodelujejo na tekmovanjih. Podatki o prehranjevalnih navadah, prehrani, treningu in indeksu telesne mase (ITM) so bili zbrani z uporabo vprašalnika.*

Rezultati*: Športniki najpogosteje trenirajo in tekmujejo z zračno puško. Tuji športniki trenirajo pogosteje in več časa kot slovenski ($p < 0,001$). Povprečni ITM je bil 24,9 ± 4,9 kg/m² in je bil višji pri športnikih, ki tekmujejo na nacionalni ravni (26,8 ± 5,6 kg/m²) v primerjavi s svetovno ravnijo (23,0 ± 3,1 kg/m²) ($p = 0,022$). Ugotovili smo razlike v pogostnosti uživanja obrokov med slovenskimi in tujimi športniki pri kosilu ($p = 0,041$), dopoldanski ($p = 0,020$) in popoldanski ($p = 0,008$) malici. Slovenski športniki med treningom redkeje posegajo po hrani v primerjavi s tujimi ($p = 0,007$). Več kot polovica športnikov zaužije prvi obrok po treningu v 1–2 urah po vadbi, vendar le 8,6 % slovenskih športnikov načrtuje obrok po treningu, medtem ko to počne kar 54.7% tujih ($p < 0,001$).*

Zaključek*: Študija poudarja pomembne razlike v času in pogostnosti obrokov ter načrtovanju prehrane med slovenskimi in tujimi strelci. Tuji športniki pogosteje trenirajo, imajo bolje načrtovano prehrano in zaužijejo več obrokov po treningu kot njihovi slovenski kolegi.*

Ključne besede: *strelstvo, prehrana, prehranske navade*

INTRODUCTION

Shooting is one of the oldest sports disciplines in the world and has a long history in the Olympics (Molla, Sadeghi & Bayati, 2018). The history of marksmanship in Slovenia dates back to the 16th century (1562), when the society of Ljubljana sharpshooters, one of the first in Europe, is first mentioned (Shooting Union of Slovenia, 1991). Shooting is a sport with over 15 categories and is a skill-based sport where consistency, accuracy, speed shooting and concentration are key features. Strength and endurance are also important for supporting the firearm for long periods (Sports dietetians Australia, 2010). Coaches' experience shows that body sway significantly impacts performance (Mon, Zakynthinaki, & Calero, 2019), which is associated with age, body height and body mass (Hue et al., 2007). Research indicates that the average body mass of shooters is higher than in other sports (Heazlewood et al., 2016; Mon, Zakynthinaki, Cordente, Monroy & López, 2014), but this is due to lean muscle mass (Fortes de Souza, Barroso, Barbosa, Telles & Andries, 2015). Several studies have shown a positive correlation between muscle mass and shooting performance (Mon et al., 2019; Peljha, Michaelides & Collins, 2018). However, extremely low or high body mass can lead to poor muscle stability and thus contribute to poorer results (Hue et al., 2007).

Today it is known that nutrition also contributes to stable body and muscle mass, but not only that. Maintaining concentration, preventing physical and mental fatigue, and promoting adaptation to maximise the benefits from time spent in the shooting range or gym are the primary goals of shooter sport nutrition (Novan, Irianto, Komarudin & Awwaludin, 2021; Spriet & Gibala, 2004). Research shows that bioactive components in foods can influence concentration, focus and relaxation, which are important for shooters (Boyle, Lawton & Dye, 2017, Yilmaz et al., 2023, Machado, Durate, Mostarda, Irigoyen, & Rigatto, 2016). Likewise positioning meals around training sessions is useful for performance, appetite and supporting body composition. Portion-advised and well-timed meals and snacks can prevent over-eating later in the day (Jalph & Kaur, 2023). Choosing high-quality carbohydrate-based meals and snacks with small amounts of protein prior to training helps maximise energy needed by the eyes, muscles and brain for enhanced concentration and stamina (Sports dietetians Australia, 2010). During training sessions, which can last for several hours, it is also important to replenish energy and fluids. For athletes training for more than one hour, it is recommended to ensure adequate carbohydrate intake during exercise. Current nutritional guidelines for athletes advise to consume carbohydrates during exercise at different rates

(30-90 g/h) and in relation to the duration of exercise bouts (Podlogar & Wallis, 2022). In the case of shorter training sessions or competitions (< 1 h), carbohydrate mouth rinsing is recommended, as research shows that carbohydrates can be sensed in the oral cavity, causing an activation of certain brain regions, leading to stimulation of the central nervous system, as shown by improved performance (Chambers, Bridge & Jones, 2009). During training, it is also necessary to ensure adequate hydration. Sometimes, temperatures at the shooting range can be very high or low, both of which increase the risk of dehydration (Morgenthaler & Shumway, 2002). Proper hydration is critical for athletes. Ensuring adequate fluid intake before, during, and after exercise helps maintain performance and prevent dehydration, which can negatively impact focus and precision (Laxmeshwar & Hiremath, 2017). Similarly, nutrition is shown to be an important factor for recovery after exercise. Research indicates that both the timing of the first meal consumed immediately after exercise (within 2 hours of exercise) and its composition (a combination of carbohydrates and proteins) are of significance (Amawi et al., 2024; Nhung & Khanh, 2023). Therefore, planning the post-training meal ahead of the exercise itself is crucial.

From reviewing the literature, we found a very limited number of studies examining the dietary habits of shooter athletes, even though diet, as described, can impact the health and performance outcomes of athletes. Therefore, our intention was to investigate the dietary habits of athletes in relation to training, as well as the frequency of food consumption. The study highlights the importance of timing and composition of meals relative to training (before/during/after training) and aims to provide insight into optimising dietary practices tailored for shooter athletes, potentially enhancing their performance and well-being.

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METHODS

Questionnaire

The questionnaire designed for this study consisted of several sets of validated questions and covered basic socio-demographic data, nutrition and physical/sport activity. We utilised an adapted section of the European Health Interview Survey (EHIS) to evaluate eating habits, including regular diet and dietary type (Eurostat European Commission, 2018). Additionally, we incorporated elements from the pilot study for the Assessment of Nutrient Intake and Food Consumption Among Kids in Europe (PANCAKE) to analyse food and meal frequency (Ocké et al., 2012), as well as a portion of the FFQ designed to assess food intake within the Slovene population (Bizjak, Jenko-Pražnikar & Seljak, 2014). The food choices were based on a validated questionnaire for athletes (Ishikawa-Takata, Okamoto, Taguchi, 2021). The training questionnaire design was carried out by professional coaches and dietitians. The survey questionnaire was initially tested on a smaller sample of athletes to check whether the athletes understood the questions. The final questionnaire included 22 questions items relating to three different areas: demographics, nutrition and sports activity. We forwarded the e-questionnaire to the Shooting Association of Slovenia and Slovenian shooting clubs, and it was also forwarded to 9 foreign countries and their shooting association and clubs (Austria, Italy, Denmark, Norway, Russia, Croatia, Germany, Serbia and Finland). The responses regarding height and weight enabled us to calculate the athletes' body mass index (BMI). BMI is defined as a person's weight in kilogrammes divided by the square of the person's height in metres (kg/m^2).

The study protocol was approved by the Commission of the University of Primorska for Ethics in Human Subjects Research (KER UP) (No. 4264-19-6/23 and 17/01/23).

Participants

161 athletes (65 Slovenian and 96 foreign athletes) took part in the online survey. However, we subsequently excluded 73 (45%) questionnaires from the analysis due to incomplete data or participants not taking part in a competition. The final sample consisted of 88 correctly completed questionnaires, which were answered by 35 Slovenian and 53 foreign athletes.

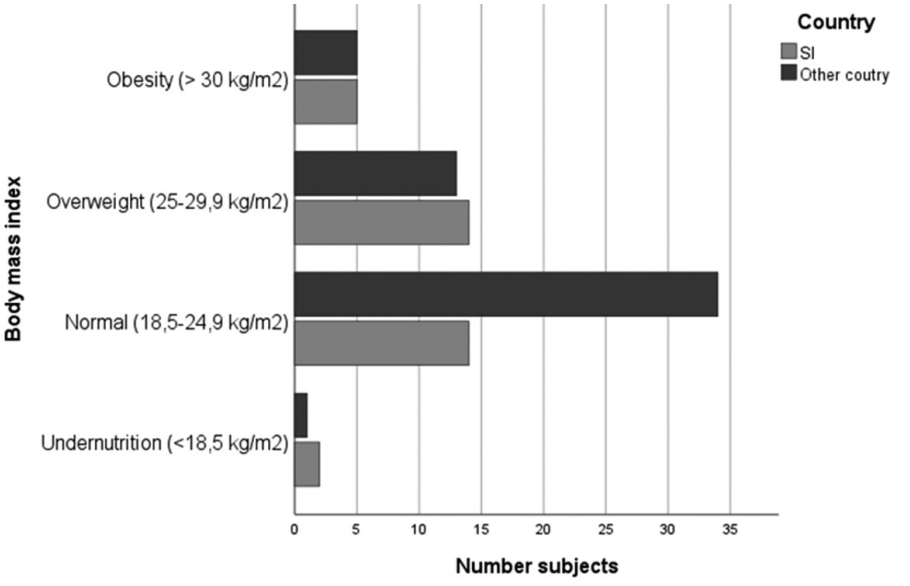
Statistical analyses

The collected data were processed using the IBM-SPSS statistical software version 22.0. Quantitative data analysis was based on descriptive statistics. Normal distribution was assessed using skewness and kurtosis coefficients. To analyse differences in body mass index (BMI) between genders, we used an independent t-test and calculated Cohen's d to assess the effect size. For other variables, we performed the non-parametric Mann-Whitney and Kolmogorov-Smirnov test to compare athletes' groups and used the Wendt formula to calculate the effect sizes (rb). For comparing correlations between BMI and nutrition characteristics, we used the Spearman rho coefficient indicating significant correlations at $p < 0.05$.

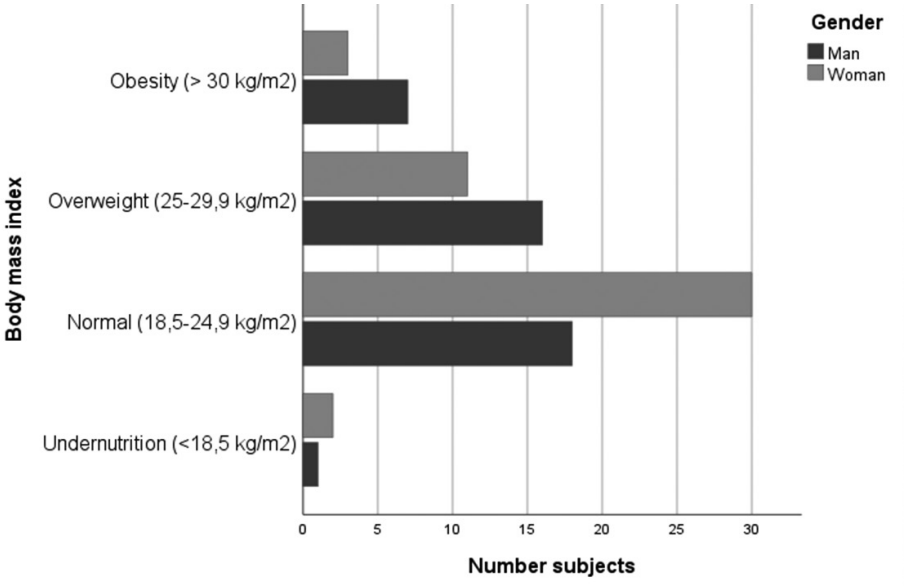
RESULTS

A total of 42 men (48%) and 46 women (52%) took part in the survey. The average age of the participants was 30.6 ± 14.0 years. Of these, 70.5% of the athletes were in the 20-60 age group , 27.3% were adolescents (14-20 years) and 2.3% were older adults (> 60 years). We no found differences in body weight (77.3 ± 16.3 kg vs. 70.9 ± 15.6 kg), BMI (25.8 ± 5.1 kg/m^2 vs. 24.9 ± 4.9 kg/m^2) and height (173 ± 8 cm vs. 171 ± 8 cm) between Slovenians and foreigners. Differences in BMI were found between genders (men: 26.0 ± 4.8 kg/m^2, women: 23.8 ± 4.8 kg/m^2; t = 2.358, d = 0,724, p = 0.021) and between participants in world championships (23.0 ± 3.1 kg/m^2) and national competitions (26.8 ± 5.6 kg/m^2) (Z = 2.332, r_b= 0.585, p = 0.022). The distribution of athletes into BMI groups based on nationality, gender and competition is shown in Figure 1.

A



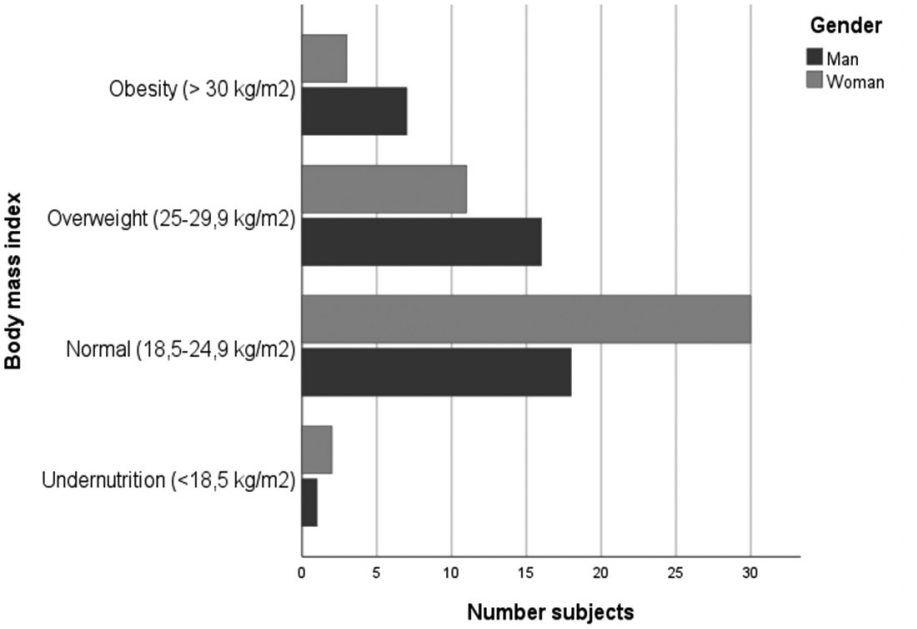
B



A: Comparison of the body mass index of Slovenian and foreign athletes; B: Comparison of the body mass index of athletes by gender;

Fig. 1 A,B: Body mass index.

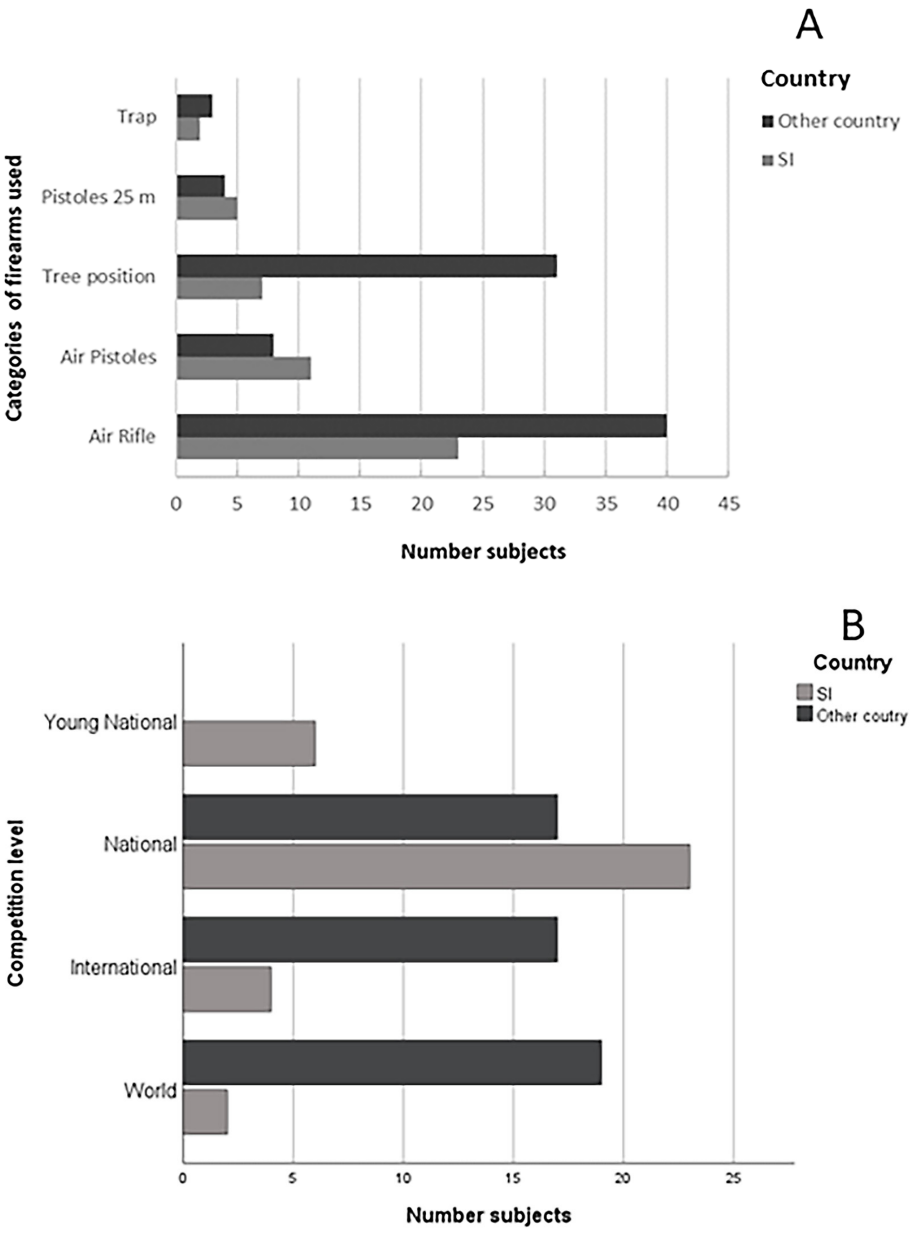
C



C: Comparison of BMI by competition level.

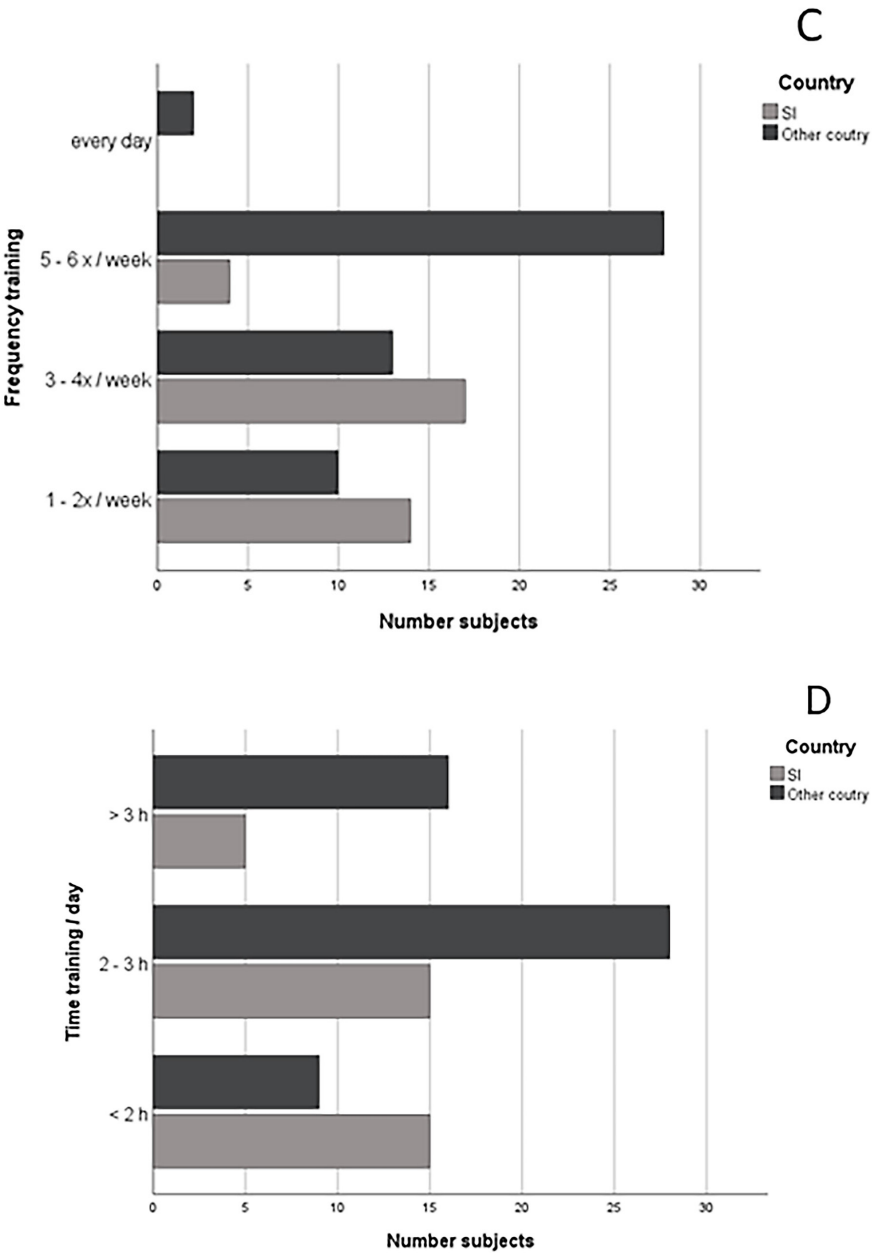
Fig. 1 C: Body mass index.

The athletes train and compete most frequently with an air rifle (Fig. 2A). The two groups differ according to the time they spend training ($Z = -3.682$, $r_b = 0.441$, $p < 0.001$). Foreign athletes train more frequently and spend more time training than Slovenian athletes (Fig. 2C and 2D). However, the time they spend on training is related to the level of competition ($rho = -0.478$, $p < 0.001$). There were also differences between the groups in terms of participation in competitions ($Z = -4.939$, $r_b = 0.585$, $p < 0.001$). Most foreign athletes participate in international competitions (35.8%), while Slovenian athletes participate more often in national competitions (65.7%) (Fig. 2B).



A: Comparison of the firearms categories used by Slovenian and foreign athletes; B: Comparison of the competition level of Slovenian and foreign athletes

Figure 2 A,B: Training characteristic.



C: Comparison of the training frequency (in days) of Slovenian and foreign athletes; D: Comparison of the duration of training (in days) of Slovenian and foreign athletes

Figure 2 C,D: Training characteristic.

Dietary habits of athletes

All Slovenian athletes are omnivores, while among foreign athletes, 74% are omnivores, 13% are vegetarians, the rest have various alternative diets. The frequency of meal consumption is presented in Table 1.

All athletes eat dinner regularly (80.7%), while 61.4% of athletes eat breakfast regularly. We found a difference between the groups at lunch ($Z = -2.045$, $r_b = 0.139$, $p = 0.041$), but otherwise foreign athletes ate lunch slightly less often than Slovenian athletes (83.0% vs. 97.1%). There was also a difference in the morning snack ($Z = -3.117$, $r_b = 0.364$, $p = 0.020$): 58.4% of foreign athletes do not eat it, while it is a favourite meal among Slovenian athletes and is eaten by 51.4%. The exact opposite trend can be observed for the afternoon snack ($Z = -2.632$, $r_b = 0.313$, $p = 0.008$), where we also found a statistically significant medium negative correlation with BMI ($rho = -0.288$, $p = 0.006$). On average, athletes consumed 1.7 ± 0.8 L of fluid per day, of which Slovenian athletes consumed 1.6 ± 0.8 L/day and foreign athletes 1.8 ± 0.8 L/day ($Z = -1.956$, $r_b = 0.085$, $p = 0.496$).

Regarding the timing of training, half of the athletes (50%) ate a meal 1-2 hours before training and a quarter (25%) ate a meal less than one hour before training, we found no differences between the groups. However, we found differences in the choice of food for the pre-workout meal. Slovenian athletes consumed pasta ($Z = -2.058$, $r_b = 0.242$, $p = 0.040$), potatoes ($Z = -1.985$, $r_b = 0.226$, $p = 0.050$) and red meat ($Z = -2.409$, $r_b = 0.284$, $p = 0.016$) more often before training than foreign athletes (Table 2), although the effect sizes for these differences indicate small to moderate significance.

The two groups differ in terms of food intake during training ($Z = -2.697$, $r_b = 0.263$, $p = 0.007$), i.e. Slovenian athletes consume meals less frequently than foreign athletes (11.4% vs. 37.7%), and a total of 72.7% do not consume any food during training. Fluid intake during training is mainly based on water, which is consumed by 80% of Slovenian athletes and 94% of foreign athletes. Athletes consumed on average 0.3 ± 0.2 L/h during training and we found no differences between the groups ($Z = -1.414$, $r_b = 0.176$, $p = 0.157$). Slovenian athletes do not drink coffee, tea or energy drinks, and even among foreign athletes less than 4% do.

Most Slovenian athletes (60%) eat their first post-workout meal within 1-2 hours after training, while more than half (52.8%) of foreign athletes eat their first post-workout meal immediately after training. Another striking difference is that only 8.6% of Slovenian athletes plan a meal after training, while as many

Table 1: Meal frequency

Meal and frequency of consumption	SI N (%)	Other countries N (%)	Total N (%)	p
Breakfast				0.922
Every day	20 (57.1)	33 (62.3)	54 (61.4)	
Occasionally	8 (22.9)	7 (13.2)	15 (17.0)	
Never	6 (17.1)	13 (24.5)	19 (21.6)	
Morning snack				**0.020**
Every day	18 (51.4)	11 (20.8)	29 (33.0)	
Occasionally	7 (20.0)	11 (20.8)	18 (20.5)	
Never	10 (28.6)	31 (58.4)	41 (46.6)	
Lunch				**0.041**
Every day	34 (97.1)	44 (83.0)	78 (88.6)	
Occasionally	1 (2.9)	7 (13.2)	8 (9.1)	
Never	0 (0)	2 (3.8)	2 (2.3)	
Evening snack				**0.008**
Every day	6 (17.1)	24 (45.3)	30 (34.1)	
Occasionally	11 (31.4)	13 (24.5)	24 (27.3)	
Never	18 (51.4)	16 (30.2)	34 (38.6)	
Dinner				0.066
Every day	25 (71.4)	46 (86.8)	71 (80.7)	
Occasionally	7 (20.0)	6 (11.3)	13 (14.8)	
Never	3 (8.6)	1 (1.9)	4 (4.5)	
Time meals before training				0.261
>3 h	4 (11.4)	8 (15.1)	12 (13.6)	
2-3 h	5 (14.3)	5 (9.4)	10 (11.4)	
1-2 h	21 (60)	23 (43.4)	44 (50)	
<1 h	5 (14.3)	17 (32.1)	22 (25)	
Meals enduring training				**0.007**
Yes	4 (11.4)	20 (37.7)	24 (27.3)	
No	31 (88.6)	33 (62.3)	64 (72.7)	
Time meals after training				0.740
<1h	14 (40.0)	28 (52.8)	42 (47.7)	
1-2 h	21 (60.0)	17 (32.1)	38 (43.2)	
>2h	0 (0.0)	8 (15.1)	8 (9.1)	
Meal planning after training				**<0.001**
Yes	3 (8.6)	29 (54.7)	32 (36.4)	
No	32 (91.4)	24 (45.3)	56 (63.6)	

Occasionally: 2-6 days per week; Never: never eats this meal.

as 54.7% of foreign athletes do so ($Z = -4.379$, $r_b = 0.461$, $p < 0.001$). The effect size ($r_b = 0.461$) indicates a moderate to large practical significance. This result indicates a significant difference in dietary habits, as foreign athletes are significantly more likely to plan a meal after training compared to their Slovenian counterparts.

Table 2: Food consumption frequency before training.

Number of meals	**SI N (%)**	**Other countries N (%)**	**Total N (%)**	**p**
Fruits				0.323
Often	12 (34.3)	24 (45.3)	36 (40.9)	
Occasionally	18 (51.4)	23 (43.4)	41 (46.6)	
Never	5 (14.3)	6 (11.3)	11 (12.5)	
Vegetable salad				0.141
Often	15 (42.9)	17 (32.1)	32 (36.4)	
Occasionally	14 (40.0)	19(35.8)	33 (37.5)	
Never	6 (17.1)	17 (32.1)	23 (26.1)	
Soup				0.110
Often	11 (31.4)	10 (18.9)	21 (23.9)	
Occasionally	15 (42.9)	22 (41.5)	37 (42.0)	
Never	9 (25.7)	21 (39.6)	30 (34.1)	
Potato				**0.050**
Often	18 (51.4)	17 (32.1)	35 (39.8)	
Occasionally	13 (37.1)	24 (45.3)	37 (42.0)	
Never	4 (11.4)	12 (22.6)	16 (18.2)	
Pasta				**0.040**
Often	19 (54.3)	20 (37.7)	39 (44.3)	
Occasionally	13 (37.1)	18 (34.0)	31 (35.2)	
Never	3 (8.6)	15 (28.3)	18 (20.5)	
Rice				0.390
Often	18 (51.4)	24 (45.3)	42 (47.7)	
Occasionally	13 (37.1)	18 (34.0)	31 (35.2)	
Never	4 (11.4)	11 (20.8)	15 (17.0)	
White meat				0.116
Often	20 (57.1)	26 (49.1)	46 (52.3)	
Occasionally	13 (37.1)	11 (20.8)	24 (27.3)	
Never	2 (5.7)	16 (30.2)	18 (20.5)	

Number of meals	SI N (%)	Other countries N (%)	Total N (%)	p
Red meat				**0.016**
Often	11 (31.4)	12 (22.6)	23 (26.1)	
Occasionally	20 (57.1)	19 (35.8)	39 (44.3)	
Never	4 (11.4)	22 (41.5)	26 (29.5)	
Fish				0.634
Often	2 (5.7)	11 (20.8)	13 (14.8)	
Occasionally	24 (68.6)	19(35.8)	43 (48.9)	
Never	9 (25.7)	23(43.4)	32 (36.4)	
Milk drinks				0.068
Often	7 (20.0)	22 (41.5)	29 (33.0)	
Occasionally	20 (57.1)	22 (41.5)	42 (47.7)	
Never	8 (22.9)	9 (17.0)	17 (19.3)	
Nuts				0.079
Often	7 (20.0)	19 (35.8)	26 (29.5)	
Occasionally	19 (54.3)	26 (49.1)	45 (51.1)	
Never	9 (25.7)	8 (15.1)	17 (19.3)	

Often: every day; Occasionally: 2-6 days per week; Never: never eats these foods before training.

DISCUSSION

Research shows that body mass can have an influence on body sway during a shot and is therefore linked to shooting success (Mon et al., 2014, 2019). A higher BMI with less body fat can lead to more strength and stability in the joints of the lower limbs, resulting in better static balance in athletes (Kerr & Stewart, 2008). Also, in our case, we have shown that the average BMI of the athletes is slightly above the cut-off that defines a normal value, but due to the reduced body composition measurements, we cannot know whether this is at the expense of body fat or muscle mass. However, the fact is that 12.5% of the athletes had a BMI > 30 kg/m^2, which could have influenced poorer results. Individuals with a BMI over 30 kg/m^2 are less likely to remain in a stable condition and are more likely to become obese than those who are not (BMI < 30 kg/m^2) (Hills & Parker, 1991; McKean, 2010). It is generally recognised that BMI is related to dietary habits and eating patterns.

We have shown that there is a difference in nutrition between Slovenian and foreign athletes. Slovenian athletes are more likely to have a mid- morning

snack and lunch, while foreign athletes are more likely to have an afternoon snack. These meals are usually also the meals that athletes eat before training, so they are an important source of energy for successful training. Athletes most often eat a meal 1-2 hours before training. According to the basic recommendations for sports nutrition, in this case the meal should consist of 1-2 g carbohydrate/kg body weight and 0.3 g protein/kg body weight, and fat intake should be limited (Kerksick et al., 2018). We have shown that athletes often reach for carbohydrate-containing foods and meat before training. We found a difference between the two groups in the consumption of potatoes ($p = 0.05$), pasta ($p = 0.04$) and red meat ($p = 0.02$), which Slovenians consume more often than foreigners. The foods mentioned correspond to the above-mentioned nutrient groups in the guidelines, but it would also be necessary to analyse the quantitative intake, as it often happens that athletes consume too much protein and fat and not enough carbohydrates (Baranauskas, Jablonskienė, Abaravičius, & Stukas, 2020)dietary supplementation and body composition of elite athletes. Materials and Methods: The research subjects were 76.7% of Lithuanian elite athletes ($N = 247$).

Athletes usually spend more than 2 hours/day on the shooting range; during training they usually do not touch food and consume little liquid (0.3 L/h), in most cases water. Shooters may avoid drinking during competition so that they do not have to take bathroom breaks. However, the benefits of being well hydrated far outweigh the disadvantages (Sports dietetians Australia, 2010). Studies show that the consumption of moderate amounts of carbohydrates during exercise leads to a significant increase in psychometric parameters in sports shooters, mainly due to a reduction in false and delayed reactions (Lachtermann et al., 1999). The combination of low fluid intake during training (0.3 L/h) and daily fluid intake (1.7 ± 0.8 L/day) can lead to dehydration. Dehydration can impair focus and concentration and have a negative impact on skills and coordination (Adan, 2012). Shooters should drink adequate fluids to maintain good hydration levels during training and competition (Sports dietetians Australia, 2010). In both groups of athletes, the daily fluid intake was found to be below the recommended values (2 L/day), although the fluid requirements vary depending on the athletes' size and gender as well as the environmental conditions (e.g. hot, humid weather, which can be common during training and competition). Sports drinks may be useful as part of a fluid plan during events as the fluid, carbohydrate and electrolyte mix can improve fluid absorption from the gut, improve mental focus and promote fluid retention (Pérez-Castillo et al., 2023).

Despite the popularity of energy and caffeinated drinks in recent years, we have shown that athletes only use caffeinated drinks to a very limited extent during training, which is a good thing. Consuming caffeinated drinks may have a negative effect in this sport, since it is very important that heart rate is as slow as possible in order to have high concentration and avoid hand tremors. Consuming coffee or caffeine containing beverages within 1-2 hours before and during the competition increases heart rate, hinders aiming during shooting and extends trigger-squeezing times (Diler & Erikoğlu Örer, 2021). On the other hand, eating foods which contain natural compounds that mimic the effects of beta blockers can help calm the nervous system, lower the heart rate or relieve anxiety. For shooting athletes, it is potentially beneficial to include magnesium-rich foods (seeds, nuts, whole grains) (Boyle et al., 2017), flavonol-rich foods such as green or black tea (Yilmaz et al., 2023) and dark chocolate (Machado et al., 2016), tryptophan-rich foods (turkey, eggs, cheese, nuts) (Richard et al., 2009) in their diet. These foods are known to help reduce heart rate, blood pressure and anxiety, while facilitating relaxation and focus.

Nutrition after training is very important from the point of view of regeneration. Recent studies suggest that a recovery meal within 2 hours of exercise, as opposed to a meal that is not consumed, improves recovery (Amawi et al., 2024) and some authors recommend that athletes should consume a carbohydrate- and protein-rich meal or snack within 30 minutes of exercise or competition to improve muscle protein synthesis and promote recovery (Nhung & Khanh, 2023). In our case, 40% of Slovenian and 52% of foreign athletes ate a meal in the first hour after training, but not even a tenth of Slovenian athletes plan what they eat after training, in comparison to more than half of foreign athletes ($p<0.001$).

Although our study presents the eating habits of Slovenian and foreign athletes, there are some limitations. BMI was used as a measure of body size. For more accurate data, it would be reasonable to use a metric providing a more precise assessment of body composition than BMI. This can be evaluated through skinfold measurements, bioelectrical impedance analysis, or DEXA scans. We also only have data on the selection of foods before/during training, but not their quantity. It would also be necessary to analyse the quantitative intake in order to discuss adequate intake. An important aspect of future research also remains the consumption of foods that influence concentration, heart rate, and stress at shooter athletes.

CONCLUSION

This study provides a comparative insight into the dietary habits of Slovenian and foreign shooting athletes, highlighting significant differences in the timing and frequency of meals and dietary planning. Foreign athletes tend to train more frequently, have better nutritional planning and eat more meals after training than their Slovenian counterparts. Since our research has shown that the dietary habits of foreign shooters differ significantly from our own, these results give rise to concern that the diet of Slovenian shooters could be somewhat neglected. The literature emphasises the importance of nutrition for achieving optimal athletic performance, and these results could serve as a warning to Slovenian athletes, coaches and sports nutritionists about the need to focus more on nutrition, drink enough fluids during training and plan meals carefully after training.

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