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Original Paper

EVALUATION OF THE IMPACT OF NUTRITION KNOWLEDGE ON NUTRITION BEHAVIOUR AND DIET IN A PHYSICALLY ACTIVE PERSON'S COHORT

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Specific high physical and psychological load energy expenditure should be covered by balanced diet that is adapted to physical load. Food intake is one of the vital processes that support body activity and maintain physical working capacity in special environment. Various objective and subjective factors have an impact on body energy expenditure and determine a definite amount of food energy. Dietary intake influences the readiness and training performance outcome. The purpose of the study was to evaluate the diet of physically active persons before and after a nutritional education course and determine the impact of nutrition knowledge on nutrition behaviour and diet in two subgroups: respondents with a standard BMI level (BMI < 25, in the interval 18.5–24.9) and overweight respondents with BMI ≥ 25, in the interval 25.0–29.9. Participants aged 22–35 years, who had daily physical activity and physical load, were selected for the study group. We divided respondents into two subgroups: respondents with standard BMI level (BMI < 25; BMI in the interval 18.5–24.9) and overweight respondents with BMI ≥ 25 (BMI in the interval 25.0–29.9). Nutritional education course included the theoretical part (lectures) and practical part (dietary diary self-assessment) as well as a quiz that allow to evaluate nutrition knowledge level in the selected cohort of respondents with BMI < 25 and BMI ≥ 25. We provided intervention before and after a nutritional education course by using the standardised questionnaire "Diet 3-day menu diary" and standardised survey "Physical activity during the current life period", which allowed to evaluate the balance between the daily intake for energy recovery and daily physical activity as energy expenditure. We determined the value of the main dietary components (protein (%), carbohydrates (%) and fat (%), as well the total amount of energy (kcal) in the diet before the nutritional education course (Diet 1st) and after the nutritional education course (Diet 2nd) in the selected cohort of respondents with BMI < 25 and BMI ≥ 25. The study group participants preferred a diet with a higher amount of fat and lower amount of carbohydrates compared with nutritional recommendation for general population. There were no significant differences in Diet 1st components between overweight and standard BMI groups. Analysis of post-course (Diet 2nd) dietary diary showed a statistically exact significance of fat level (%) and carbohydrate level (%), and no statistically approved changes in protein level (%) intake. Nutritional knowledge of the study group participants after the nutritional education course was evaluated by using a standardised test in points (1–10), which showed that about 60% of the respondents received an assessment "good". The results of the study can be used to develop optimal diet planning during the pre-training period before planning physical exercises with high physical and psycho-emotional load, in order to benefit physical exercise performance.

Keywords: *dietary diary, nutrition education, dietary habits.*

INTRODUCTION

Nutritional principles can be applied to improve a healthy lifestyle and to support physical health, welfare, and physical working capacity. Physical health status and working capacities are indirectly related to dietary habits. Humans can decide to optimise dietary intake and to follow dietary principles that can benefit performance (Farina *et al*., 2017; Dyal *et al*, 2022). Daily physical activities vary in a wide spectrum of physical and psychological loads, and therefore, nutritional knowledge and understanding of the importance of the diet are essential key points for supporting individual physical capacity and to benefit performance. Dietary specialists recommend for the general population the following proportions of main diet components: protein (15%), carbohydrates (60%) and fat (25%), and for physically active persons (athletes, military personnel) – a special keto diet with high fat intake (about 75%), limited carbohydrates (about 5%) and protein (20%) intake (Beals *et al*., 2018; LaFountain *et al*., 2019; Farina *et al*., 2020), which supports physical capacities during special physical activities (Lutz *et al.,* 2012; Wentz *et al*., 2014). Daily physical training is essential for improving physical preparedness, physical endurance, physical fitness, physical skills, and a balanced diet is essential to support physical and mental activities (Sygit, 2016; Bukhari *et al*., 2018). Nutrition knowledge and education level, responsibility, and attitude to duties are important motivation factors for using balanced diet that allow one to support physical readiness under stressful surrounding factors of extreme environment, examination of daily serving service members of US revealed improvement of consumption quality that improved diet quality (Dyal *et al*., 2022). The adapted diet for physically active persons includes the consumption of nutrient components in adequate quality and quantity, which provide energy for metabolic processes associated with restoring, renewal, and growth (Carlson *et al*., 2013; Wardle *et al*., 2021), formation of muscle energy reserves, and to optimise physiological processes (Kullen *et al*., 2016; O'Leary *et al*., 2021).

A balanced diet that is adapted to physical load provides energy requirements for physical activity, improves performance results, increases muscle strength components, physical fitness, and endurance, and favours renewal processes in the body, as well recovery processes after injuries (Mullie 2013; Beals *et al*., 2015; Teo *et al*., 2017; Cole 2021), provides metabolic processes with energy that is used for restoring, renewal, and growth. Therefore, nutrition education is important for planning a diet for physically active persons. A healthy and balanced diet provides suitable consumption of the nutrient components for the corresponding metabolic processes, it is essential to ensure valuable and optimal physiological processes in situations of a changing environment with adequate physical and mental activity (Teo *et al*. 2017; Karl *et al*. 2021).

A balanced diet favours the formation of physical and cognitive working capacity, components of physical endurance, maintaining the course of development restoration processes after a physical load, which has a positive effect and decreases the risk of traumatic injuries, and maintains optimal body composition (Wentz *et al*., 2014; La Fountain *et al*., 2017; Teo *et al*., 2017). An individual optimal energy value of the diet can be calculated from the energy value of nutrient components, compared with the daily physical activity rate energy consumption and body composition. The main nutrients are proteins, carbohydrates, and fat. Essential components of the diet are water, fat soluble vitamins, water soluble vitamins, various microelements (calcium (Ca), magnesium (Mg), zinc (Zn), iron (Fe), potassium (K), sodium (Na), and vitamins (Lutz *et al*., 2012; Kullen *et al*.; Liu *et al*., 2017).

Nutrition knowledge and education level, individual responsibility, and attitude to duties are important motivation factors for using a balanced diet that has benefits for physical activities in extreme environments (Hörnell *et al*., 2010; Pograjc *et al*., 2010). The purpose of the study was to evaluate the impact of a nutritional education course on the dietary intake of physically active persons before and after the nutritional course, and determine the impact of nutrition knowledge on nutrition behavior of respondents with a standard BMI level and an overweight BMI level.

MATERIALS AND METHODS

The study group included physically active persons, (n = 42), age 22–35 years and median age 24 years (Q1= 23 and Q3 = 27), who had the same daily physical load that included aerobic and anaerobic physical activities. The study group included both sexes (male n = 38, female n = 4), but due to the small number of female respondents we did not analyse the effect of sex. All subjects gave their informed consent. The study group participants were involved in a six-month training period. The current height of responsdents was determined by an anthropometer with accuracy of 0.001 m. Body mass was measured by scale with accuracy of 0.1 kg. Body mass index (BMI) was calculated as body mass (kg) divided by height squared (m^2). The study group participants were divided into two subgroups: respondents with a standard level of BMI < 25 in the interval 18.5–24.9 (n = 20), and respondents with an overweight level of BMI ≥ 25 in the interval 25.0–29.9 (n = 22). Nutrition education was given at the beginning of the training session. The nutrition education course "Dietary base and its adaptation to physical load" included eight academic hours with a theoretical (lectures) and practical part, where respondents completed the three-day dietary diary questionnaire twice: before and after the nutrition education course (Diet 1^{st} and Diet 2^{nd}). The dietary diary questionnaire was developed according to standards for dietary epidemiology guidance (Willett, 2013). The collected data was used to calculate the energy value of the daily dietary main nutrients components (protein, carbohydrates, and fat) before (Diet 1^{st}) and after nutrition education (Diet 2^{nd}), as well as the total energy value of the diet (in kcal) for the two groups of respondents (standard and overweight level of BMI). The results of a nu-

trition knowledge quiz were presented as an assessment using 1–10-point scale according to standardised methodology (Izard, 2005) after the nutrition education course. All data were entered into MS Excel. The statistical analysis was performed using IBM SPSS Statistics 27.0 version. Quantitative values were described by descriptive statistic parameters (median (Mdn), first quartile (Q1) and third quartile (Q3) of daily dietary components and total energy consumption across the BMI respondent groups (standard and overweight BMI) before and after nutrition education (Diet 1st and Diet 2nd). Comparison between the two BMI groups was made using the Mann–Whitney U Test because of the non-normal distribution of the data. p values < 0.05 were considered statistically significant.

The limitations of our study were that due to the small number of female respondents differences between gender were not analysed. In the current study we did not take into account participants with BMI 30. In the comparison between the two BMI groups, the Mann–Whitney U Test was used because of non-normal distribution of the data. In the study we could not exclude an individual approach to self-assessment questionnaire data in the dietary diary.

RESULTS

Nutrition education course was organised with the purpose of improving and balancing food intake that adapt the diet to planning the physical load and the outcomes of physical exercise performance, and support physical health and body composition. The analysis of anthropometric data allowed dividing the participants into two subgroups with a standard level of BMI (n = 20), with BMI in the interval 18.5–24.9, and with overweight level of BMI (n = 22), with BMI in the interval 25.0–29.9. Participants of the selected groups fulfilled the pre-course (Diet 1st) and the post-course (Diet 2nd) three-day dietary diary. Analysis of collecting data revealed that study group participants had from three (Q1) to five (Q5) meal times per day, with variable choice of food and products (up to 25 different titles). Food intake included various vegetables (fresh and cooked), eggs (boiled and cooked), a wide choice of milk and milk products (cheese, cottage cheese, kefir, yogurt, cream etc.), meat (beef, chicken, pork), and meat products (sausage, salami, Frankfurter sausages etc.), fish and fish products, fruits (bananas, apples, oranges etc.), full grain-crop products (oat flakes, breakfast flakes, bread, porridge, pasta etc). Respondents' daily diet depended on individual nutritional behaviour, their theoretical knowledge, and respondents' individual attitude and clear understanding of the importance of nutrition.

Assessment of physical activity levels of participants was based on a self-assessment questionnaire data in a dietary diary, where different physical activities were included. Daily physical activity included basic occupational activities, physical training, and physical activities in leisure time. The variation of the questionnaire data on daily physical activity revealed that 21.4% of respondents had physical activities at a light level, 61.9% at a moderate level fixed for of respondents, and 14.3% at a high level. One respondent (2.4%) was critical in his self-assessment protocol and evaluated his physical activity level as low.

The evaluation of Diet 1st showed levels of protein, carbohydrate and fat components (Table 1). The median fat consumption energy value (%) component of the total energy value of the Diet 1st (in kcal), was high compared to specialists' recommendations (till 25%) for the general population, but lower than in keto-diet recommendations (till 75%). Analysis of Diet 1st for the standard BMI (BMI < 25) subgroup showed that the median fat consumption energy level (%) was 49.38%, with variability 36.10% (Q1) – 53.92% (Q3), compared to 43.42% with variability 38.25% (Q1) – 51.88% (Q3) in the overweight BMI (BMI ≥ 25) subgroup. Mann–Whitney U test analysis revealed no statistically approved differences between respondent groups, the distribution of fat level (%) is the same across categories of respondent groups with standard BMI and overweight U = 41.0, p = 0.624). The median carbohydrate consumption in Diet 1st was lower than the value of carbohydrates recommended by nutritional specialists. The median carbohydrate

Table 1. Main dietary component consumption energy level (%) in Diet 1st and Diet 2nd respondents across BMI level

Dietary diary		Group 1, BMI in standard interval			Group 2, BMI in overweight interval			Mann–Whitney test	
		median	Q1	Q3	median	Q1	Q3	U test	p
Diet 1st	Proteins (%)	17,73	12.87	22.86	20,99	15.48	22.94	57.0	0.521
	Fat (%)	49,38	36.10	53.92	43,42	38.25	51,88	41.0	0.624
	Carbohydrate (%)	32,72	27.36	41.77	43,6	33,7	35.78	49.0	> 0.999
	Energy (kcal)	3230.0	2294.0	3593	3033	2432	3510	46.0	0.910
Diet 2nd	Proteins (%)	18.35	14.32	19.92	17.23	15.59	21.78	149.0	0.853
	Fat (%)	41.52	37.95	44.74	48.96	41.49	52.21	217.0	0.011
	Carbohydrate (%)	41.78	38.68	43.52	34.74	29.92	37.94	54.0	0.002
	Energy (kcal)	2779.0	2158.0	3628.5	3132.0	2252.5	3454.5	143	> 0.999

Group1 – respondents with BMI < 25, BMI level in standard interval (18.5–24.9).

Group2 – respondents with BMI ≥ 25, BMI level in overweight interval (25.0–29.9).

consumption energy level was 32.7%, with variability 27.36% (Q1) – 41.8%(Q3) in Diet 1st for the standard BMI (BMI) subgroup and 35.78% with variability 28.45% (Q1) – 39.74% (Q3) in the overweight BMI (BMI ≥ 25) subgroup. Statistical tests analysis revealed no statistically approved differences between respondents' groups, the distribution of carbohydrates was the same across categories of respondent groups with standard BMI and overweight BMI, $p > 0.999$. The median protein consumption (%) in the Diet 1st corresponded to nutritional recommendation, median protein energy level was 17.73% with variability 12.87% (Q1) – 22.86% (Q3) in the Diet 1st for the standard BMI (BMI < 25) subgroup and 20.99% with variability 15.48% (Q1) till 22.94% (Q3) in the overweight BMI (BMI ≥ 25) subgroup. Statistical test analysis revealed no statistically approved differences between respondents groups, the distribution of proteins in diet was the same across categories of respondents' groups with standard BMI and overweight BMI, Mann–Whitney U test, U = 490.0, $p = 0.521$. The median total energy (kcal) consumption value in Diet 1st in the standard BMI (BMI < 25) subgroup was 3230.0 kcal with variability 2294.0 kcal (Q1) – 3593.0 kcal (Q3), compared to 3033.0 kcal with variability 2432.2 kcal (Q1) – 3510.0 kcal (Q3) in the overweight BMI (BMI ≥ 25) subgroup. Statistical tests analysis revealed no statistically approved differences between respondents groups, the distribution of total energy consumption was the same across categories of respondents' groups with standard BMI and overweight BMI, Mann–Whitney U test, U = 46.0, $p = 0.910$.

The study participants attended the nutrition education course "Dietary base and its adaptation to physical load", which included eight academic hours with theoretical and practical parts, and on completion they answered a quiz. Knowledge about balanced diet is essential for expenditure of energy and support renewal processes in the body. Evaluation of quiz results after intervention with theoretical nutritional education course showed that about 60% of respondents had a "good" level of knowledge (7.9 of 10 points) and the others had a satisfactory assessment — 5.8 points.

At Diet 2nd after the nutrition education course, the median fat consumption (% energy) remained high compare to recommendations. At Diet 2nd in the standard BMI (BMI < 25) subgroup, the median consumption energy level was 41.52%, with variability from 37.95% (Q1) – 44.74% (Q3), compared to fat consumption in Diet 2nd in the overweight BMI (BMI ≥ 25) subgroup – 48.96% (variability 41.49% (Q1) – 52.21% (Q3). Statistical tests analysis revealed that distributions of fat level (%) were statistically significantly different in respondent groups with standard BMI and overweight BMI, Mann–Whitney U test, U = 217.0, $p = 0.011$. The median carbohydrate consumption (% energy) at Diet 2nd was lower than in the nutrition recommendations At Diet 2nd in the standard BMI (BMI < 25) subgroup, the median carbohydrate consumption was 41.17% (variability 38.1% for Q1 and 43.2% for Q3, while in the overweight BMI subgroup — 33.7% with variation 29.4% (Q1) — 36.5% (Q3). Statistical tests analysis revealed statistically significant difference in distributions of carbohydrates in respondents` groups with standard BMI and overweight BMI, Mann–Whitney U test, U = 54.0, $p = 0.002$).The median protein consumption energy level (%) from the total energy in Diet 2nd was close to nutritional recommendation. In Diet 2nd, the median protein consumption (% energy) was 18.35% (Mdn) with variability 14.32% (Q1) — 19.92% (Q3) in the standard BMI (BMI < 25) and 17.23% with variability 15.59% (Q1) — 21.78% (Q3) in the overweight BMI (BMI ≥ 25) subgroup. Statistical tests analysis revealed no statistically approved differences in distributions of proteins in respondent groups with standard BMI and overweight BMI, Mann–Whitney U test, U = 149.0, $p = 0.853$. median total energy (in kcal) consumption at Diet 2nd for the standard BMI (BMI < 25) subgroup was 2779.0 kcal (Mdn) with variability 2158.0 kcal (Q1) – 3628.0 kcal (Q3) in the respondents with overweight BMI (BMI ≥ 25) subgroup – 3132.0 kcal with variability 2252.5 kcal (Q1) – 3454.5 kcal (Q3). Statistical tests analysis revealed no statistically approved differences in distributions of proteins in respondent groups with standard BMI and overweight BMI, Mann–Whitney U test, U = 143.0, $p > 0.999$.

Analysis of the water intake in Diet1st showed that the median daily water consumption was 1577.0 ml with variability 895.0 (Q1) – 1972.3 (Q3), which increased at Diet 2nd to 1905.4 ml with variability 1628.9 ml (Q1) — 2170.9 (Q3) ml, and was below the recommended water consumption level.

Analysis of daily dietary intake of participants of study group showed that in post-course diet adequate fruit consumption according to nutritionists' recommendation were followed by 28% of respondents, vegetable consumption corresponded to the guideline — by 49% of respondents, and recommendations for adequate water consumption — only by 50% of respondents, which is well shown by the investigation of diet. Analysis of the intake of fat-soluble vitamins in diet revealed that the recommended dose of fat-soluble vitamins was not achieved, which is associated with the chosen products and their mass in the diet.

DISCUSSION

The choice and intake of balanced correct dietary components influenced the physical performance. Participants of the study group were involved in a wide spectrum of physical activities from low-intensity till high-intensity activity. Inadequate energy intake, depleted energy stores directly led to fatigue, to decrease of the working capacities and performance outcomes (Liu *et al*., 2017). Diet intake was designed to cover the energy expenditure and support the working capacities and physical health (Beals *et al*., 2018; Farina *et al.*, 2020). Respondents from the study group showed a wide spectrum of individual habits of daily intake, which was found also in studies of US and Australian mili-

tary peronnel diets (Kullen *et al*., 2016; LaFountain *et al*., 2019; Farina *et al*., 2020). General recommendations (LR Regulation of the Ministry of Health LR Nr. 212, 2017; Sygit, 2016) for physically active individuals have shown that the components of the diet should be in the following proportions: proteins (15%) carbohydrates (60%), and fat (25%). In the study group participants preferred a diet with a higher amount of fat and a lower amount of carbohydrates: fat (43.4–49.4%, Mdn), carbohydrates (32.7–35.9%, Mdn), proteins (17.7–20.9%, Mdn) in Diet 1st, and a higher amount of fat and a lower amount of carbohydrates in Diet 2nd: proteins (17.2–18.3%, Mdn), carbohydrates (34.7–41.1%, Mdn), and fat (41.5–48.9%, Mdn). Following are the distribution of diet components fixed in both respondent groups with standard BMI value and with overweight level of BMI value. There were no significant differences in the consumption of fat, carbohydrates, and protein at Diet1st between subgroups standard BMI level and overweight BMI, according to the Mann–Whitney U test. The study revealed statistically exact significance in the consumption of fat and carbohydrates in Diet 2nd of respondent group with overweight BMI and respondent groups with standard BMI value: the fat level was higher (Mann–Whitney U test, U = 217.0, p = 0.011) and carbohydrates level was lower (Mann–Whitney U test, U = 54.0, p = 0.002) in diet of respondents with overweight BMI value compared to Diet 2nd of respondents with standard BMI value. The median protein consumption (% energy) was above of the recommended (till 15%) for the general population, but close to the recommended one (till 20%) for the keto diet (Beals *et al*., 2018; LaFountain *et al*., 2019; Farina *et al*, 2020). Analysis of dietary diary showed that intaking food energy was spent mostly for renewal processes (Carlson *et al*., 2013; Wardle *et al*., 2021).

In diet (Diet 2nd) after the nutrition education course, fat consumption (% energy) was also above that in specialist recommendations (till 25%) for the general population, but below that recommended (till 75%) for the keto diet. A ketogenic diet (Volek *et al*., 2016) diet with restricted carbohydrate consumption, moderate protein consumption and high fat consumption leads to nutritional ketosis and represents an approach to enhance health, regulates body composition and maintains physical readiness (Newman *et al*., 2017; McSwiney *et al*., 2018; LaFountain *et al*., 2019).

The evaluation of the total mean value of the diet in kcal showed that it was adequate to the level of physical load, but it was necessary to improve qualitative characteristics such as the balance of macro-components in daily consumption. Analysis of the daily dietary intake of the participants of the study group showed that recommendations for adequate water consumption were followed by only 50% of respondents that could provide a risk for hypohydration and decreased cognitive and physical skills (Kelly *et al*., 2021). Investigation of dietary intake in Diet 2nd of the study group, comprising physically active persons, revealed adequate fruit consumption according to nutritionist's recommendation followed by 28% of respondents, and vegetable consumption corresponded to the guideline for 49% of respondents.

CONCLUSION

Improvement of nutrition education and nutritional knowledge are the keystone that has influence on nutritional behaviour and allows improving the quality and quantity of dietary intake. Knowledge about the dietary intake optimised the performance and supported physical readiness and physical activity. Knowledge about a balanced diet was important for support of individual satisfaction and physical capacities. The study showed that there were no statistically approved differences in the daily intake (in Diet 1st) of proteins, carbohydrates, and fat between the two subgroups of participants with standard BMI value and with overweight level of BMI value, but attendance of the nutritional education course has impact on the participants' nutritional knowledges and behaviour. Analysis of respondents' diet after the nutritional education course (in Diet 2nd) indicated changes in the nutritional behaviour of subgroup participants with standard BMI value and with overweight level of BMI value, specially in the daily intake of carbohydrates and fat. The results of the questionnaire on the balanced diet after the nutrition education showed that about 60% (n = 25) of the respondents received the evaluation "good" (7.9 points from 10). Knowledge about a balanced diet is essential, but not sufficient for complete compliance to dietary recommendations.

Nutrition education had an impact on the choice of diet components by participants, but was not sufficient to reach an adequate and qualitative balanced diet. Therefore, it is important to use dietary supplements to reach the recommended daily dose of fat-soluble vitamins.

ETHICS

Data collection and evaluation were made according to ethical requirements. The Medical Ethics Committee of R?ga Stradiņš University (Rīga, Latvia, No. 6-3/2/59) approved the study protocol for biomedical research. All subjects gave their informed consent.

REFERENCES

Beals, K., Darnell, M. E., Lovalekar, M., Baker, R. A., Nagai, T., San-Adams, T., Wirt, M. D. (2018). Suboptimal nutritional characteristics in male and female soldiers compared to sports nutrition guidelines. *Milit. Med.,* **180** (12), 1239–1246. doi.org/10.7205/MILMED-D-14-00515.

Bukhari, A., Cole, R., Champagne, C., McGraw, S., Moylan, E., Amstrong, N. (2018). Performance nutrition dining facility intervention improves special operations soldiers' diet quality and meal satisfaction. *J. Nutr. Educ. Behav.,* **50** (10), 993–1004. doi.org/10.1016/j.jneb.2018.06.011.

Bouchard, C., Shephard, R. J., Stephens, T. (1994). Physical activity, fitness and health. *Med. Sci. Sports Exerc.,* **26,** 119. doi.org/10.1249/00005768-199401000-00024.

Carlson, A. R., Smith, M. A., McCarthy, M. S. (2013). Diet**,** physical**,** and bone density in soldiers before and after deployment. *U.S. Army Med. Depart. J.,* **4-6**, 25–30. pubmed.ncbi.nlm.nih.gov/23584905.

Cole, R. E., Jayne, J. M., O'Connor, K., McGraw, S. M., Beyl, R., DiChiara, A. J., Karl, J. P. (2021). Development and validation of the military eating behavior survey. *J. Nutr. Educ. Behav.,* **53** (9), 798–810. doi.org/10.1016/j.jneb.2021.04.467.

Dyal, R. N., Deschamps, B. A., McGraw, S. M., Jayne, J. M., Karl, J. P., Cole, R. E. (2022). Healthy Eating Score-7 as a measure of diet quality in a military population. *J. Nutr. Educ. Behav.,* **1**(06), S1949404621008605. doi.org/10.1016/j.jneb.2021.09.019.

Farina, E. K., Taylor, J. C., Means, G. E., Murphy, N. E., Pasiakos, S. M., Lieberman, H. R, McClung, J. P. (2017). Effects of deployment on diet quality and nutritional status markers of elite U.S. Army special operations forces soldiers. *Nutr. J. BMC,* **16** (1), 41. doi.org/10.1186/s12937-017-0262-5.

Farina, E. K., Thompson, L. A., Knapik, J. J., Pasiakos, S. M., Lieberman, H. R., McClung, J. P. (2020). Diet quality is associated with physical performance and special forces selection. *Med. Sci. Sports Exerc.,* **52** (1), 178–186. doi: 10.1249/MSS.0000000000002111.

Hörnell, A., Winkvist, A., Hallmans, G., Weinehall, L., Johansson, I. (2010). Mis-reporting, previous health status and health status of family may seriously bias the association between food patterns and disease. *Nutr. J. BMC*, **9,** 48. doi.org/10.1186/1475-2891-9-48.

Izard, J. (2005). Overview of test construction: Module 6. Quantitative research methods in educational planning. *UNESCO Int. Inst. Educ. Planning.* http://www.iiep.unesco.org/en/overview-test-construction-module-6-10032.

Karl, J. P, Margolis, L. M., Fallowfield, J. L., Child, R. B., Martin, N. M., McClung, J. P. (2022). Military nutrition research: Contemporary issues, state of the science and future directions. *Eur. J. Sport Sci.,* **22,** 87–98. doi.org/10.1080/17461391.2021.1930192.

Kullen, C. J., Farrugia, J. L., Prvan, T., O'Connor, H. T. (2016). Relation between general nutrition knowledge and diet quality in Australian military personnel. *Brit. J. Nutr.,* **115** (8), 1489–1497. doi.org/10.1017/S0007114516000532.

La Fountain, R. A., Miller, V. J., Barnhart, E. C., Hyde, P. N., Crabtree, C. D., McSwiney, F. T., Beeler, M. K., Buga, A., Sapper, T. N., Short, J. A., *et al.* (2019). Ketogenic diet and physical training intervention in military personnel. *Milit.Med.,* **184** (9–10), e538–e547. doi.org/10.1093/milmed/usz046.

Liu, A. G., Ford, N. A., Hu, F. B., Zelman, K. M., Mozaffarian, D., Kris-Etherton, P. M. (2017). A healthy approach to dietary fats: understanding the science and acting to reduce consumer confusion. *Nutr. J. BMC,* **16** (1), 53. doi.org/10.1186/s12937-017-0271-4.

Lutz, L. J., Karl, J. P., Rood, J. C., Cable, S. J., Williams, K. W., Young, A. J., McClung, J. P. (2012). Vitamin D status, dietary intake, and bone turnover in female soldiers during military training: A longitudinal study. *J. Int. Soc. Sports Nutr.,* **9**, 38. doi.org/10.1186/1550-2783-9-38.

McSwiney, F. T., Wardrop, B., Hyde, P. N., Lafountain, R. A., Volek, J. S., Doyle, L. (2018). Keto-adaptation enhances exercise performance and body composition responses to training in endurance athletes. *Metab. Clin. Exper.,* **81**, 25–34. https://doi.org/10.1016/j.metabol.2017.10.010.

Mullie, P., Collee, A., Clary, P. (2013). Socioeconomic, health, and dietary determinants of physical activity in a military occupational environment *Milit. Med.,* **178** (5), 495–499. doi.org/10.7205/MILMED-D-12-00442.

Newman, J. C., Covarrubias, A. J., Zhao, M., Yu, X., Gut, P., Ng, C. P., Huang, Y., Haldar, S., Verdin, E. (2017). Ketogenic diet reduces midlife mortality and improves memory in aging mice. *Cell Metab.,* **26** (3), 547–557.e8. https://doi.org/10.1016/j.cmet.2017.08.004.

O'Leary, T. J., Walsh, N. P., Casey, A., Izard, R. M., Tang, J. C. Y., Fraser, W. D., Greeves, J. P. (2021). Supplementary energy increases bone formation during arduous military training. *Med. Sci. Sports Exerc.,* **53** (2), 394–403. doi: 10.1249/MSS.0000000000002473.

Pograjc, L., Stibilj, V., Ščančar, J., Jamnik, M. (2010). Determination of macronutrients and some essential elements in the Slovene military diet. *Food Chem.,* **122** (4), 1235–1240. doi.org/10.1016/j.foodchem.2010.03.031.

[SPKC. 2018]. Latvijas iedzīvotāju veselību ietekmējošo paradumu pētījums FINBALT veselības monitoringa ietvaros [Research project FINBALT. Health monitoring concerning influence of Latvian population Habits survey] (in Latvian). spkc.gov.lv.

Sygit, K. (2016). Principles of nutrition in sports training and health training. *Prace Naukowe Akademii im. Jana Długosza w Częstochowie*, **15** (4), 157–167.

Teo, L., Crawford, C., Yehuda, R., Jaghab, D., Bingham, J. J., Gallon, M. D., O'Connell, M. L., Chittum, H. K., Arzola, S. M., Berry, K. (2017). Whole dietary patterns to optimize cognitive function for military mission-readiness: A systematic review and recommendations for the field. *Nutr. Rev.*, **75** (2),73–88. doi: 10.1093/nutrit/nux009.

Volek, J. S., Freidenreich, D. J., Saenz, C., Kunces, L. J., Creighton, B. C., Bartley, J. M., Davitt, P. M., Munoz, C. X., Anderson, J. M., Maresh, C. M., Lee, E. C., Schuenke, M. D., Aerni, G., Kraemer, W. J., Phinney, S. D. (2016). Metabolic characteristics of keto-adapted ultra-endurance runners. *Metab. Clin. Exper.,* **65** (3), 100–110. https://doi.org/10.1016/j.metabol.2015.10.028.

Wardle, S. L., O'Leary, T. J., McClung, J. P., Pasiakos, S. M., Greeves, J. P. (2021). Feeding female soldiers: Consideration of sex-specific nutrition recommendations to optimise the health and performance of military personnel. *J. Sci. Med. Sport*, **24** (10), 995–1001. doi: 0.1016/j.jsams.2021.08.011.

Wentz, L. M., Eldred, J. D., Henry, M. D., Berry-Cabįn, C. S. (2014). Clinical relevance of optimizing vitamin D status in soldiers to enhance physical and cognitive performance**.** *J. Spec. Oper. Med.,* **14** (1), 5–66. ncbi.nlm.nih.gov/pubmed/24604440.

Willett, W. (2013). *Nutritional Epidemiology. Monographs in Epidemiology and Biostatistics. Third edition*. Oxford University Press, Oxford, New York, 2013.

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UZTURZINĀŠANU IETEKMES VĒRTĒJUMS PAR UZTURUZVEDĪBU UN DIĒTU FIZISKI AKTĪVĀM PERSONĀM

Augstas specifiskas fiziskas slodzes, kā arī psiholoģiskas slodzes enerģētisko izlietojumu sniedz sabalansētas diētas galvenās uzturvielas olbaltumvielas (OBV), ogļhidrāti (OGH) un tauki (T). Darba mērķis bija novērtēt uzturzināšanu ietekmi par uztura uzņemšanu un izmaiņām diētā fiziski aktīvām personām divās respondentu grupās ar standarta ķermeņa masas indeksa (ĶMI) lielumu un virssvara ĶMI lielumu. Pētījuma dalībnieki (n = 42) bija vecumā no 22 līdz 35 gadiem ar līdzvērtīgu fizisku slodzi un fiziskām aktivitātēm, pēc antropometrisko rādītāju vērtējuma un ķermeņa masas indeksa lielumiem dalībnieki tika iedalīti divās grupās: ar standarta lieluma ĶMI (ĶMI < 25) un virssvara lieluma ĶMI (KMI ≥ 25). Pētījuma dalībnieki apmeklēja uzturzinību kursu "Uztura pamati" un "Uztura nozīme slodzes apstākļos, uzturs pirms un pēc slodzes", teorētisko daļu noslēdzot ar zināšanu pārbaudes testu pēc metodoloģiju, bet praktiskajā daļā pētījuma dalībnieki aizpildīja trīs dienu uztura uzņemšanas dienasgrāmatu gan pirms, gan pēc uzturzinību kursa. Zināšanu pārbaudes tests uzrādīja, ka 60% dalībnieku uzturzināšanu līmenis tika novērtēts 10 punktu sistēmā kā "labs" – 7,9, bet pārējiem – "apmierinošs". Aptaujas dati un to rezultātu analīze norādīja, ka fiziskie un procentuālie apjomi taukiem (T) ir augstāki par ieteicamajām devām, bet ogļhidrātiem (OGH) ir zemāki par ieteicamajām devām. Diētas 1 datu analīze par olbaltumvielu (OBV)%, ogļhidrātu (OGH)% un tauku (T)% enerģijas apjomu diētā un kopējo enerģētisko vērtību (kcal) uzrāda, ka nav noteiktas statiski ticamas atšķirības starp abām grupām (ar ĶMI standarta lielumu (KMI < 26) un ĶMI virssvara lieluma (KMI ≥ 25). Veicot Diētas 2 datu analīzi par ogļhidrātu (OGH)% un tauku (T)%) enerģijas apjomu diētā tika noteiktas statiski ticamas atšķirības starp minētām grupām, bet datu analīze par olbaltumvielu (OBV) % enerģijas apjomu diētā un kopējo uztura enerģētisko vērtību (kcal) statistiski ticamas atšķirības neatklāja. Pētījuma rezultāti izmantojami sabalansētas diētas sastādīšanai personālam ar plānotu augstu fizisku un psihoemocionālu slodzi, kā arī personāla darbībām īpašos vides apstākļos, uzturot efektīvu organisma darbību un darbaspējas.