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DRINKING REGIME IN ATHLETES

Jana Jurikova (a)*, Jakub Zlinsky (b)
*Corresponding author

(a) Masaryk University, Faculty of Sports Studies, Department of Kinesiology, 5 Kamenice, Brno, Czech Republic, jurikova@fsps.muni.cz
(b) Masaryk University, Faculty of Sports Studies, Department of Kinesiology, 5 Kamenice, Brno, Czech Republic, 101772@mail.muni.cz

Abstract

Fluid intake, especially water, is essential for human life and also necessary for physical and mental function. The aim of this study is to find out whether men and women attending sport activities at the Faculty of Sports Studies of Masaryk University Brno keep their drinking regime. The research was carried out by using the questionnaire method. We obtained 186 completed questionnaire forms. Respondents were 108 men and 78 women aged 15-24. First, the anthropometric parameters such as body weight, height and BMI were taken. Based on the BMI value, respondents were divided into the following categories: underweight, ideal weight, overweight, weak obesity, middle obesity, severe obesity. In the next phase, respondents were questioned on the weekly frequency of physical activity performed and the physical activity type. Then, the questions focused on their drinking regime, amount of fluid consumed per day and type of the most frequent beverages. The research reveals that the majority of men and women belong to the ideal weight category. Most male respondents perform physical activity 3 times per week, and female respondents, twice a week. Most favourite physical activities are ball games for men and fitness for women. Most respondents keep their drinking regime. Research shows that most men (40.7%) and women (30.8%) drink between 2-2.5 litres of fluid per day. The most typical drink is water for both men and women. Most respondents, both male (65%) and women (62%), give positive responses to the question whether they believe that their fluid intake is sufficient.

Keywords: Fluid intake, men, women, amount of fluid consumed per day, beverages.

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1. Introduction

It is highly important to keep drinking regime when one performs sport activity. Fluid intake affects performance, well-being and health in general. Improper drinking regime might result in mental and/or physical failure of a sportsperson (Hrubý, 1987).

Fluid intake prior to physical activity

The fundamental principle for each sportsperson is to commence the activity itself with the highest possible reserves of liquid in the body. Therefore, it is essential that all losses after preceding training, as well as losses accompanying the effort to minimise the body weight in sports concerning weight categories, to be covered. The sportsperson is supposed to ensure fluid balance in his/her body by sufficient drinking regime.

Fluid intake during physical activity

The amount of fluids should be regularly refilled during physical workout. In general, a sportsperson might drink 300-400 ml of fluids just before the performance, which is a comfortable volume of fluid in the stomach. This volume should be regularly refilled during the workout (Maughan & Burke, 2002).

The most suitable drinks for immediate refill of fluid are diluted glucose solutions. Similar substances are the base for sport drinks and solutions to treat diarrhoea.

Nowadays, the fluid intake is promoted by a wide range offer of cool and tasty drinks that are ideal to cover fluid losses after physical workout. These drinks are at the same time rich for energy and ions which enhance regulation of water within the body. It is advisable to vary flavours of drinks during long-term physical activity and thus to support self-imposed drinking regime.

Fluid intake after physical activity

To ensure restoration of fluid balance within the body, it is necessary to drink 150% of liquid loss. A sportsperson should ideally attempt to cover liquid losses between each performance, in order to attain optimal hydration. After medium or heavy hypo hydration, this ideal condition might occur with a 4-24-hour delay. It has been proven that the majority of sportspeople usually manage to cover only 30-70% of liquid loss. This means that, after training, most sportspeople suffer from light or medium dehydration. Once physical activity is being finished, the increased perspiration and further fluid loss by urine represent another rehydration need. Sufficient rehydration after physical workout depends on the equilibrium between fluid intake and continual losses. This issue should be taken into account to prevent acute dehydration (fluid loss 2-5% of body weight with the interval for relax shorter than 8 hours).

Beverages during sport activity

The feeling of thirst usually appears with a certain degree of dehydration, therefore it is essential to refill fluids before this warning signal. In case of missing thirsty feelings, fluid income during physical activity cannot be sufficiently covered. Any means increasing the fluid consumption is beneficial. It has been proven that flavoured drinks increase the fluid intake during sport activity up to 50% in comparison with plain water. The taste of drink is thus highly important (Maughan & Burke, 2002).

Sport drinks play, together with vitamins and minerals, a crucial role among nutritional supplements.

Ideal refreshing drink should comply with the following:

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- It should be of sour or slightly tart taste, possibly slightly bitter (by no means sweet, since sweet taste increases the feeling of thirst).
- Temperature should be between 8 and 10°C or higher (never about 0°C – ice cream or cool drinks cause mucosal congestion in the mouth and pharynx, with consequent increased thirst).
- It should be slightly sparkling (slightly carbonated by dioxide).
- It should contain minerals of volume up to 1% (this concerns particularly salts – sodium chloride and potassium chloride).
- It should contain substances which enhance blood circulation, i.e. caffeine to improve blood supply in the tissues.

This ideal drink is, however, far from reality. Sparkling drink is not convenient for sportsmen due to its flatulent effect on the digestive system, with a negative influence on sport performance. An amount of minerals reaching 1% would lead to unacceptable taste. Further, this amount would be pointless, since an average person loses a substantive amount of electrolytes only if the daily volume of sweat exceeds 5-7 litres. (Hrubý, 1987)

Standard value of blood osmolality is 290 ± 10 mOsmol/kg in men and 285 ± 10 mOsmol/kg in women. Osmolality of sport drink is influenced by all diluted agents. Osmolality of body liquids is a starting point in the production of sport drinks, which might be divided into three categories as follows:

- Isotonic – osmolality equal to 290 ± 15 mOsmol/kg
- Hypotonic – osmolality equal to or less than 250 mOsmol/kg
- Hypertonic – osmolality equal to or more than 340 mOsmol/kg

Isotonic drinks have identical osmotic pressure as body liquids. Their production process originated from osmolality of body liquids. It was worked on the presumption that these drinks would be the most convenient sources to cover the body need for fluids, minerals and energy. Nevertheless, human sweat is of lower osmolality than body liquids. Therefore, an increased consumption of isotonic drinks might lead to higher electrolyte intake which exceeds the current need. This state leads to higher concentration in extracellular fluids and the breaking of osmotic equilibrium between extracellular fluid and cells. Isotonic drinks might be well used for performance of high intensity and also after the end of physical activity in the regeneration phase as the first supply of fluid, energy and minerals.

Osmolality of hypotonic drinks is lower than body liquids. Due to this fact, hypotonic drinks are much more convenient to use during physical activity than isotonic ones. The persisting problem is to choose proper concentration of final drink. Electrolyte loss and energy need during performance is influenced by several factors such as time duration, temperature, humidity and eating habits (persons with higher consumption of salt lose more sodium in their sweat than people with lower consumption of salt).

Hypertonic drinks have higher osmolality than body liquids. Their usage for sport purposes is prevailingly not recommended and ill-considered usage might disrupt inner electrolyte equilibrium. These drinks can be used for extreme exhaustion of electrolyte reserves, but never in the course of physical workout. (*Pitny rezim napoje pro sportovce*, 2016)

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2. Purpose

The aim of this study is to find out how men and women attending sport activities at the Faculty of Sports Studies of Masaryk University Brno keep their drinking regime.

3. Materials and methods

Subjects: The research was carried out with sportspeople attending physical activities at the Faculty of Sports Studies of Masaryk University.

Methods: The research was achieved by using the questionnaire method. Questionnaires were anonymous. Out of 205 questionnaires in total, 194 were submitted back, 8 of which ill or partially filled in. The total number of questionnaires involved in the survey was 186, and the rate of return was then 90.7% (Zlínský, 2009).

The questionnaire consists of three parts, 15 questions altogether. The first part focuses on basic data of respondents. Representation of respondents according to age and gender is given in Table 01.

Table 01. Representation of respondents according to age and gender

Age category [years]	Men	Women	No. of respondents in total
15–24	38	38	76
25–34	48	30	78
35–44	14	4	18
45–54	8	6	14
55–64	0	0	0
Total	108	78	186

Source: Study of authors

Respondents were asked to provide their body weight and height. On the basis of these data, the body mass index (BMI) was calculated, and respondents were divided into categories based on BMI, according to Table 02.

Table 02. International Classification of adult underweight, overweight and obesity according to BMI

Classification	BMI (kg/m2)	
	Principal cut-off points	Additional cut-off points
Underweight	<18.50	<18.50
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
Normal range	18.50 - 24.99	18.50 - 22.99
		23.00 - 24.99
Overweight	≥25.00	≥25.00
Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
Obese	≥30.00	≥30.00
Obese class I	30.00 - 34.99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

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Source: Adapted from WHO (1995, 2000 and 2004)

The second part of the questionnaire focused on the frequency and type of physical activity. The third part aimed at the volume and type of consumed drinks. To fill in the questionnaire takes about 3-5 minutes. The obtained results were further processed into tables and graphs in MS Word and MS Excel programs. The STATVYD program (Buňka, Kříž, & Hrabě, 2005) was used for statistical analysis.

4. Results

BMI values in male respondents are given in Graph 01, and values for females are given in Graph 02.

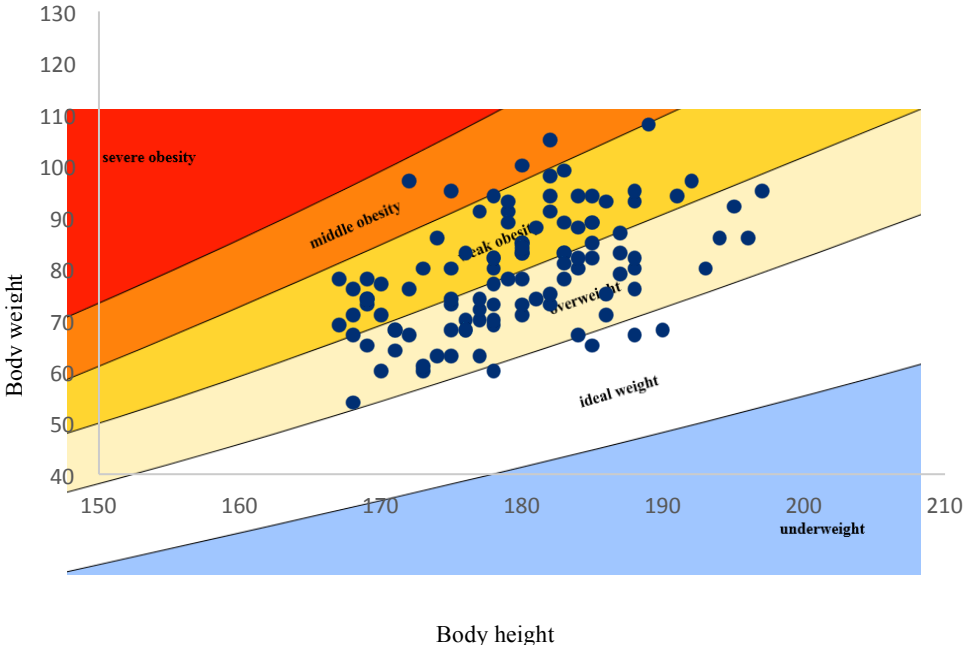

Figure 01. BMI values in male respondents

Source: On the basis of BMI categories – BMI values (*Index tělesné hmotnosti*, 2016) – Study of authors

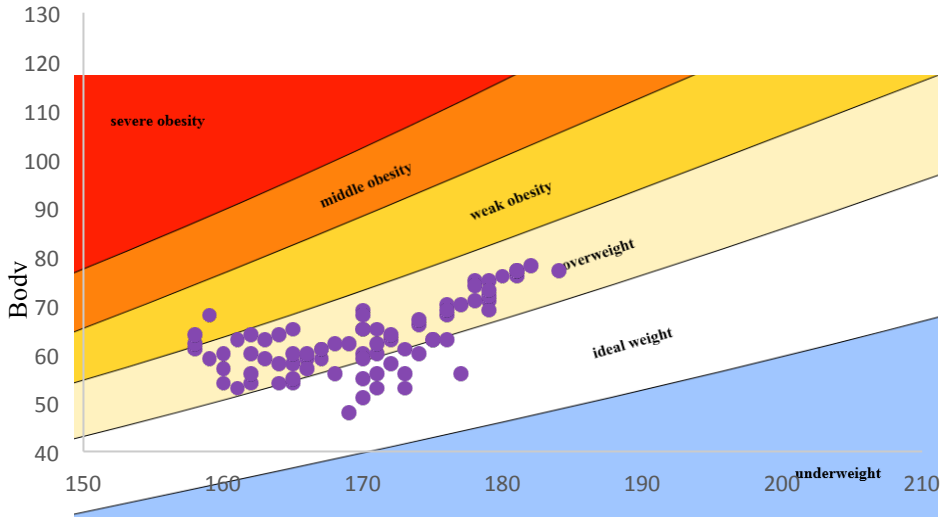

Figure 02. BMI values in female respondents

Source: On the basis of BMI categories – BMI values (*Index tělesné hmotnosti*, 2016) – Study of authors

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Graph 03 shows the frequency of physical activity in male and female respondents.

Graphs 04 and 05 show the most common sport activities in men and women.

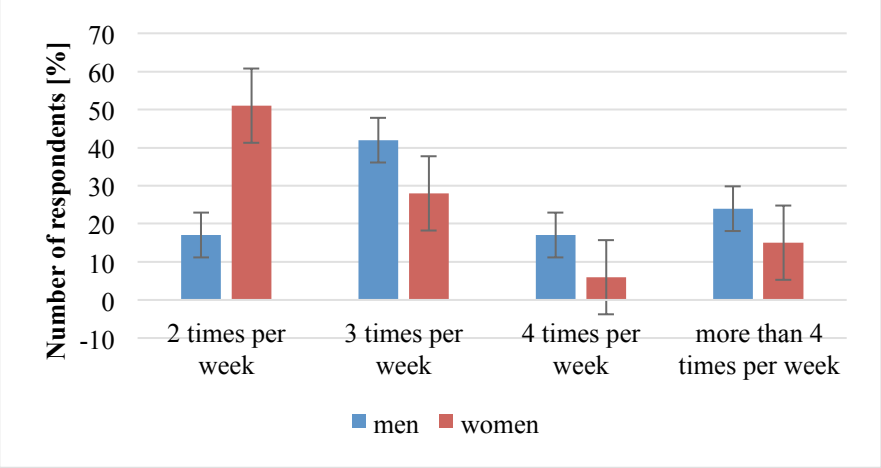

Figure 03. Frequency of physical activity in male and female respondents
Source: Study of authors

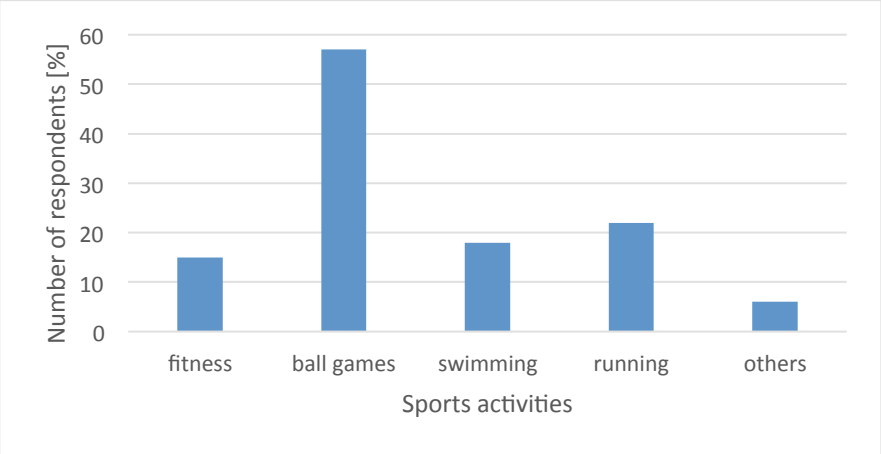

Figure 04. Type of the most common sport activity in men
Source: Study of authors

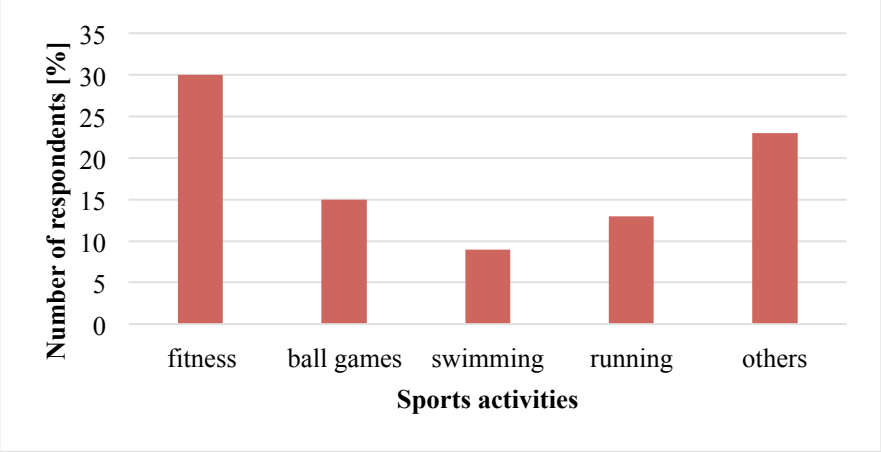

Figure 05. Type of the most common sport activity in women
Source: Study of authors

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Fluid intake, especially water, is essential for human life and also necessary for physical and mental function (Özen et al., 2015). Tables 03 and 04 focus on the drinking regime of the observed sportspeople.

Table 03. Total amount of fluid intake in women

Amount of beverages [l]	Age of women [years]			
	15-24	25-34	35-44	45-54
0.5-1.0	2	2	0	6
1.0-1.5	12	4	0	0
1.5-2.0	12	6	2	0
2.0-2.5	10	12	2	0
2.5-3.0	2	2	0	0
3.0-4-0	0	4	0	0

Source: Study of authors

Table 04. Total amount of fluid intake in men

Amount of beverages [l]	Age of women [years]			
	15-24	25-34	35-44	45-54
0.5-1.0	0	2	4	0
1.0-1.5	4	2	0	0
1.5-2.0	8	10	0	0
2.0-2.5	12	26	0	6
2.5-3.0	8	6	4	2
3.0-4-0	6	2	6	0

Source: Study of authors

The following two graphs depict the favourite beverages for respondents: men and women.

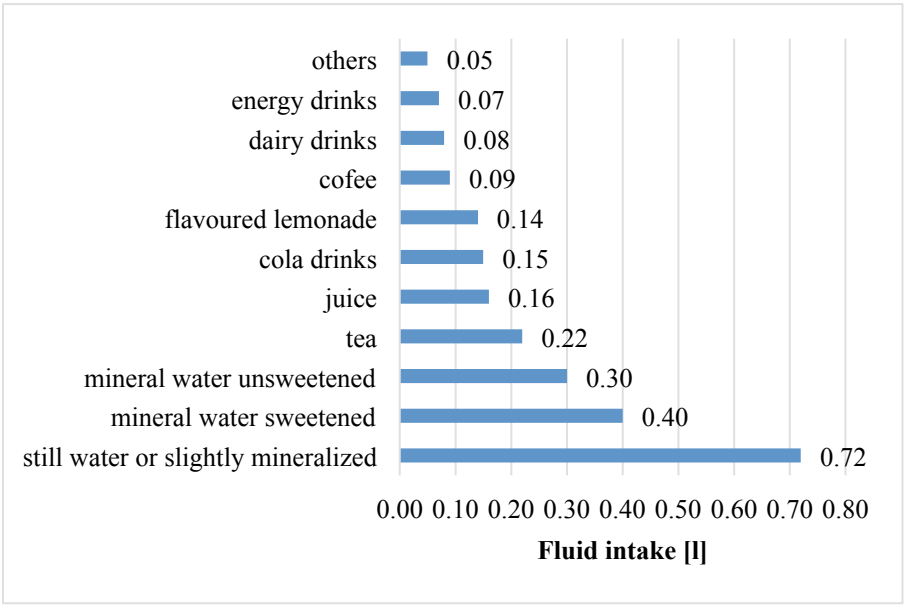

Figure 06. Beverage type and its average consumption in male respondents
Source: Study of authors

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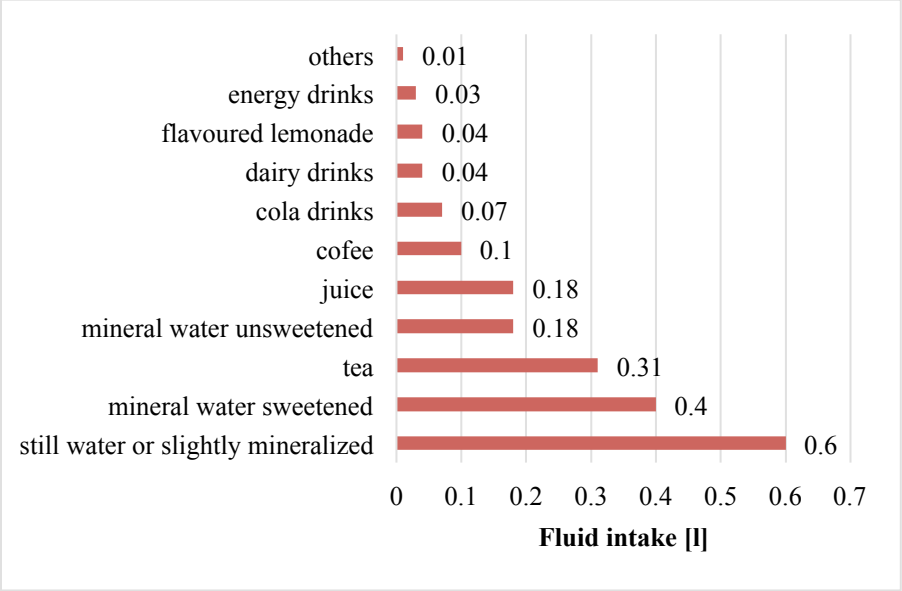

Figure 07. Beverage type and its average consumption in female respondents
Source: Study of authors

Table 05 shows the self-assessment of respondents on the sufficiency of their drinking regime.

Table 05. Response to the question whether the respondent considers his/her drinking regime sufficient

Respondents	Response [%]	
	Yes	No
Men	65	35
Women	62	38

5. Conclusion

The vast majority of respondents in this research belong to age category 25-34 years, and the second biggest age category is 15-24. This fact reflects the reality that the sport offer of the Faculty of Sports Studies is prevailingly used by young people.

Respondents were further divided into categories on the basis of their BMI values, which might, on the first sight, give an impression that one third of men and 1 woman would be overweight. However, a BMI exceeding 25 does not necessarily signal overweight in sportspeople, but it rather concerns higher volume of muscle mass. As for the BMI in males, statistical significance at a significance level of 0.05 was found among normal and overweight BMI statuses.

Fe = 212.2113

$F_{0.95}$ (1.94) = 3.9423

None of the observed men belongs to underweight category, on the contrary, underweight has been found in 5 female respondents. It gives evidence of the female effort to get closer to skinny models that represent an ideal of beauty in the media. As for the BMI in females, statistical significance at a significance level of 0.05 was found among normal and underweight BMI statuses.

Fe = 160.7477

$F_{0.95}$ (1.73) = 3.9720

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Anecdotal evidence indeed suggests that Czech sportsmen particularly excel in individual activities like rowing, javelin throw and decathlon, sports with above-average BMI requirements (25-27 kg/m^2), where average participants are about 190 cm tall (Grasgruber & Hrazdíra, 2013).

Concerning the frequency of physical activity, a highest number of men (42%) report that they perform the activity 3 times per week, which is consistent with the recommendation. In order to exploit maximum benefits for health, physical activity should be provided 3-4 times per week for at least 45 minutes. The highest number of women performs the activity twice a week, i.e. they should increase frequency.

Next question focused on the type of most common sport. Most men (58%) reported, quite predictably, ball games. Ball games, including basketball, volleyball, foot tennis and especially football, are very popular among men in the Czech Republic. Besides the most popular sports such as (following ball games) jogging, swimming and fitness, men further reported in "other" category the following sports: cycling, ice hockey, tennis and squash. The most frequent sport activity reported by women was fitness – 39% of female respondents gave this answer. Fitness is nowadays also very popular both in men and women. In our respondent group, however, merely 17% men selected this sport. Besides the most popular sports such as (following fitness) ball games, jogging and swimming, women further reported in "other" category the following sports: spinning, rock climbing, modern dance, squash and Pilates. None of the respondents chose Nordic Walking, which is however getting more and more popular these days.

Concerning the drinking regime, it is recommended to consume minimally 1.5 litres of fluids daily; most male respondents claim to keep this amount. Nevertheless, athletes quite often finish exercise in fluid deficit (Sawka et al., 2007), which has resulted in considerable interest in understanding factors influencing fluid recovery (Maughan, Leiper, & Shirreffs, 1997; Shirreffs, Armstrong, & Cheuvront, 2004; Shirreffs & Maughan, 2000; Campagnolo et al., 2017). As our research has revealed, 31.6% of men aged 15-24, 54.2% of men aged 25-34 and 75.0% of men aged 45-54 drink about 2-2.5 litres of fluids daily. Concerning men aged 35-44, the majority of them (42.8%) drink more than 3 litres of fluids daily. Statistical significance at a significance level of 0.05 was found among men in different groups of age.

$\chi^2 = 53.5108$

$\chi^2_{0.95\,(15)} = 24.9958$

The same percentage is found in women – 31.6% of women aged 15-24 drink either 1-1.5 or 1.5-2 litres daily. The daily volume of 2-2.5 litres of fluids is consumed by 40% of women aged 25-34, and the same number of women aged 35-44 drink either 1.5-2 litres or 2-2.5 litres daily. All questioned women aged 45-54 responded that they drank merely 0.5-1 litre of fluids, which might signal a potential risk of dehydration, especially during sport activity when higher fluid intake is required. Statistical significance at a significance level of 0.05 was found among women in different groups of age.

$\chi^2 = 57.5489$

$\chi^2_{0.95\,(15)} = 24.9958$

Ingestion of food and fluid during exercise has the potential to improve performance by influencing one or more of the factors that limit exercise performance (Maughan, 2001). All in all, the highest number of observed men (40.7%) and women (30.8%) consume 2-2.5 litres of fluids daily, which

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is in accordance with nutritional recommendations. Statistical significance at a significance level of 0.05 was found among both of them, men and women in different groups of age.

$\chi^2 = 64.2066$

$\chi^2_{0.95\,(15)} = 24.9958$

Fluid intake from drinking water, beverages or eating foods is necessary for physical and mental function. Because water is the largest constituent of human body, it is essential for human life (Lieberman, 2007; Popkin, D'Anci, & Rosenberg, 2010), and water loss causes various health problems. Although mild dehydration, defined as a 1-2% loss of body weight resulting from water loss (Kleiner, 1999), may cause a reduction in exercise performance, thermoregulation and appetite (Manz, Wentz, & Sichert-Hellert, 2002; EFSA, 2010), the loss of more than 4% body water may lead to difficulties with concentration, headaches, and increases in body temperature and respiratory rates (EFSA, 2010; Özen et al., 2015). In addition to drinking water, beverages such as juice, soft drinks, tea serve as important sources of water intake in our diet. Drinking regime includes exclusively non-alcoholic drinks; coffee is excluded due to its diuretic effects. Therefore, assessing the volume of total fluid intake in populations is important from a public health perspective. In addition, it is also important to assess the intake of different sources of fluids. During the last decades, the diversity of fluid types with different nutritional composition has increased substantially. These fluids contribute to total intake more than water (e. g. energy, minerals, additives or caffeine), raising the question of their impact on health (Guelinckx et al., 2015).

Results of our research have revealed that for our respondents, both male and female, water (either bottled or tapped) is the most common source of fluid, followed by slightly mineralized water. On average, men drink 0.72 litres per day, while women only 0.62 litres. Other items found in the drinking regime of men, with decreasing popularity, are: sweetened mineral water, unsweetened mineral water, tea, juice, Cola drinks and flavoured lemonades. Other items found in the drinking regime of women (again with decreasing popularity): sweetened mineral water, tea, unsweetened mineral water, juice, Cola drinks. There are not significant differences between men in women concerning the types of beverages. Statistical significance at a significance level of 0.05 was not found among males and females regarding the type of beverages.

$\chi^2 = 0.3273$

$\chi^2_{0.95\,(10)} = 18.3070$

Guelinckx (2015) compared the popularity of beverages among adults from 13 countries. His conclusions fully correspond with ours; he has found out that water is the most typical drink for people in these countries: Mexico, Brazil, Spain, France, Germany, Turkey, Iran, China and Indonesia. In other countries involved in his research (Argentina, United Kingdom, Poland and Japan), people prefer hot drinks.

Based on responses to the last question of this survey, most men (65%) and women (62%) are content with their drinking regime. It is obvious from foregoing responses that the majority of men (87%) and women (87.2%) alike consume about 1-1.5 litres of fluids daily.

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References

Buňka, F., Kříž, O., & Hrabě, F. (2005). *Statistický software STATVYD verze 2.0 beta*. Zlín: Univerzita Tomáše Bati.

Campagnolo, N., Iudakhina, E., Irwin, C., Schubert, M., Cox, G. R., Leveritt, M., & Desbrow, B. (2017). Fluid, energy and nutrient recovery via ad libitum intake of different fluids and food. *Physiology & Behavior, 171*, 228-235.

EFSA (European Food Safety Authority). (2010). Panel on Dietetic Products, Nutrition, and Allergies (NDA): Scientific opinion on dietary reference values for water. *EFSA J., 8*(3): 1459. DOI: 10.2903/j.efsa.2010.1459

Grasgruber, P., & Hrazdíra, E. (2013). Anthropometric characteristics of the young Czech population and their relationship to the national sports potential. *Journal of Human Sport & Exercise, 8*(2), 120-134.

Guelinckx, I., Ferreira-Pêgo, C., Moreno, L. A., Kavouras, S. A., Gandy, J., Martinez, H., ... Salas-Salvadó, J. (2015). Intake of water and different beverages in adults across 13 countries. *Eur J Nutr, 54*(Suppl. 2), S45-S55.

Hrubý, S. (1987). *Pitný režim sportujících.* Praha: Sportpropag.

Index tělesné hmotnosti. (2016). Retrieved from https://cs.wikipedia.org/wiki/Index_tělesné_hmotnosti

Kleiner, S. M. (1999). Water: An essential but overlooked nutrient. *J. Am. Diet. Assoc*., *99*(4), 200-206.

Lieberman, H. R. (2007). Hydration and cognition: A critical review and recommendations for future research. *J. Am. Coll. Nutr., 26*(5 Suppl), 555-561.

Manz, F., Wentz, A., & Sichert-Hellert, W. (2202). The most essential nutrient: Defining the adequate intake of water. *J. Pediat., 141*(4), 587-592.

Maughan, R. J. (2001). Food and fluid intake during exercise. *Can. J. Appl Physiol., 26*(Suppl.), S71-S78.

Maughan, R. J., & Burke, L. M. (2002). *Sports nutrition: Handbook of sports medicine and science.* Malden: Blackwell Science.

Maughan, R. J., Leiper, J. B., & Shirreffs, S. M. (1997). Factors influencing the restoration of fluid and electrolyte balance after exercise in the beat. *Br. J. Sports Med., 31*(3), 175-182.

Özen, A. E., del Mar Bibiloni, M., Pons, A., & Tur, J. A. (2015). Fluid intake from beverages across age groups: A systematic review. *Journal of Human Nutrition and Dietetics, 28*(5), 417-442.

Pitny rezim napoje pro sportovce. (2016). Retrieved from http://www.lekarnadomu.cz/pitny-rezim-napoje-pro-sportovce

Popkin, B. M., D'Anci, K. E., & Rosenberg, I. H. (2010). Water, hydration, and health. *Nutr. Rev., 68*(8), 439-458.

Sawka, M. N., Burke, L. M., Eichner, E. R., Maughan, R. J., Montain S. J. & Stachenfeld N. S. (2007). American College of Sports Medicine position stand. Exercise and fluid replacement. *Medicine and Science in Sports and Exercise, 39*(2), 377-390.

Shirreffs, S. M., & Maughan, R. J. (2000). Rehydration and recovery of fluid balance after exercise. *Exerc. Sport Sci. Rev., 28*(1), 27-32.

Shirreffs, S. M., Armstrong, L E., & Cheuvront, S. N. (2004). Fluid and electrolyte needs for preparation and recovery from training and competition. *J. Sports Sci., 22*(1), 57-63.

WHO. (1995). *Physical status: The use and interpretation of anthropometry*. [Report of a WHO Expert Committee. WHO Technical Report Series 854]. Geneva: World Health Organization.

WHO. (2000). *Obesity: Preventing and managing the global epidemic*. [Report of a WHO Consultation. WHO Technical Report Series 894]. Geneva: World Health Organization.

WHO. (2004). *WHO expert consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies*. Geneva: The Lancet.

Zlínský, J. (2009). *Pitný režim u sportovců*. [Diploma thesis]. Brno; Faculty of Sports Studies, Masaryk University.