PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

OPEN ACCESS Pakistan Journal of Nutrition

ISSN 1680-5194
DOI: 10.3923/pjn.2019.94.100

Research Article
Hydration Status and 60 m Sprint Performance in Students of Yogyakarta Province, Indonesia

Audy Swari Prahasti, Janatin Hastuti and Neni Trilusiana Rahmawati

Laboratory of Bioanthropology, Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada, Medika Sekip, Yogyakarta 55281, Indonesia

Abstract

Background and Objective: Studies reported that adolescents in Indonesia had low fluid intake and were dehydrated. Dehydration may alter cognitive performance performed by adolescents in school. It may also impair physical fitness. The aim of this study was to examine the difference in hydration status and 60 m sprint performance between boys and girls and to seek the correlation between hydration status and 60 m sprint performance. **Materials and Methods:** In this cross-sectional study, height, weight, body mass index (BMI), urine specific gravity (USG) and 60 m sprint performance of 98 boys and 140 girls aged 15-18 years old of a public senior high school in Yogyakarta Province were measured. Statistical analyses with t-test, Kolmogorov-Smirnov Z test and Spearman's rank correlation were performed. **Results:** The differences in hydration status and 60 m sprint performance between boys and girls were significant ($p<0.01$). Boys had lower USG and achieved higher scores than girls. Hydration status and 60 m sprint performance had a significant negative correlation in boys and together with girls ($p<0.01$) and had an insignificant positive correlation in girls alone ($p>0.05$). There were significant differences in hydration status and 60 m sprint performance between boys and girls. **Conclusion:** These findings indicated that boys have achieved higher performance scores than girls. Furthermore, students with lower hydration status achieved a better 60 m sprint performance than did students with higher hydration status.

Key words: Hydration status, 60 m sprint performance, height, weight, body mass index

Received: May 09, 2018 Accepted: October 26, 2018 Published: December 15, 2018

Citation: Audy Swari Prahasti, Janatin Hastuti and Neni Trilusiana Rahmawati, 2019. Hydration status and 60 m sprint performance in students of Yogyakarta province, Indonesia. Pak. J. Nutr., 18: 94-100.

Corresponding Author: Neni Trilusiana Rahmawati, Laboratory of Bioanthropology, Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada, Medika Sekip Yogyakarta 55281, Indonesia

Competing Interest: The author has declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Water plays a crucial role in the human body, as it acts as a carrier, a thermoregulatory, a lubricant and a shock absorber[1]. Water contributes 60% of the total body weight of adolescent boys and 50% of the total body weight of adolescent girls[2]. A decrease in total body water is caused by lack of fluid intake, pathological processes and a combination of both. Lack of fluid intake was found in senior high school students in Indonesia. Of 75 10th and 11th grade students in senior high school in Jakarta, 64% had low fluid intake[3]. Briawan *et al.*[3] reported that 37.3% of 10th and 11th grade students in senior high school in Bogor drank less than eight cups of water per day.

Hydration status has been reported to be different between males and females. The number of male athletes from National Collegiate Athletic Association (NCAA) Division I who were hypohydrated was greater than the number of their female counterpart[4]. A study by Armstrong *et al.*[5] also reported that urine-specific gravity of female tennis players was lower than that of male tennis players.

A study by Cheuvront *et al.*[6] reported that top male sprinters could run 7.3% faster than female sprinters[6]; male sprinters are able to produce greater ground reaction forces. This ability can therefore produce longer strides[7].

According to WHO[8], adolescents are people between 10 and 19 years old. If low to moderate dehydration occurs in adolescents, their cognitive performance may be altered[9]. Performance on tasks including simple attention, short-term memory, perceptual discrimination, arithmetic ability, visuomotor tracking and psychomotor skills can be impaired by dehydration[9,10]. All of these tasks are usually performed by adolescents in school. Therefore, dehydration in adolescents may impair school performance. For this reason, this study was conducted using physical fitness as a parameter of hydration status.

Hydration status was reported to show correlation with physical fitness. In individuals participating in rigorous physical activity, mild dehydration may result in a reduction in performance. It may lower endurance, increase fatigue, alter thermoregulatory capability, decrease motivation and increase perceived effort[9]. A study by Davis *et al.*[11] reported that dehydration caused a negative impact on intermittent sprint performances.

The study was to examine the difference in hydration status and 60 m sprint performance between boys and girls and to seek the correlation between hydration status and 60 m sprint performance. Therefore, this study is important because it can provide information on how hydration status shows correlation with physical fitness in the case of adolescents.

MATERIALS AND METHODS

Participants: Cross-sectional data of 238 healthy students from SMA Negeri 1 Jetis in Bantul, Yogyakarta Province were obtained in August 2016. The students lived in this city and consisted of 98 boys and 140 girls; they were aged 15-18 years old. Yogyakarta province is one of the largest cities in Indonesia and it is historically and culturally part of Central Java. The majority of their fathers were civil servants, while the student's mothers were housewives.

The date of birth of each student was recorded from the school registers verified by the students. Their parents were informed in writing about the study and agreed verbally for their children to be interviewed. Ethics approval was obtained from the Ethics Committee of Universitas Gadjah Mada (Ref.: KE/FK/825/EC/2016).

Students were required to fill in the data recording and questionnaire form containing one set of items related to personal identity consisting of full name, place and date of birth, address, telephone or cellphone number, class or grade, school, ethnicity, ethnicities of both parents, educational level of both parents and occupation of both parents; urine specific gravity and time needed to complete a 60 m sprint were also required. After filling in the form, the students collected their own urine into a sterile plastic tube. The plastic tubes then were sent to the Laboratory of Clinical Pathology in the Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta for determining their urine specific gravity. Body height was measured to the nearest 1 mm with an anthropometer. Body weight with minimal clothing was measured to the nearest 0.05 kg with a weighing scale. All the measurements were obtained in the morning as far as possible and grouped by sex. Students then completed a single 60 m sprint, whereas the examiner measured the time using a stopwatch and recorded the score. Boys and girls have different classifications of scores (Table 1 and 2) and these classifications were developed by Ministry of National Education[12].

Statistical analyses: Statistical analyses were conducted using SPSS Statistics 23.0. A normality test was first conducted for height, weight, Body Mass Index (BMI) and urine specific gravity. A t-test was used to seek the difference in height, weight, BMI and urine specific gravity between boys and girls if the distribution of data was normal. The difference in 60 m sprint performance between boys and girls was sought using Kolmogorov-Smirnov Z test. The correlation between 60 m sprint performance and other variables was determined using Spearman's rank correlation. A significance level of 5% was used for all analyses.

RESULTS

The distribution of data on height was normal; therefore a t-test was used to seek the difference in height between boys and girls. However, a Mann-Whitney test was used to seek the difference in weight and body mass index between boys and girls because the data on weight and BMI was not normally distributed. These tests showed that there was a significant difference in height and weight between boys and girls ($p<0.01$). Boys had greater mean height and mean weight than girls. Nevertheless, the difference in BMI between boys and girls was non-significant ($p = 0.32$, Table 3).

Table 1: Sixty meter sprint test scores for boys[12]

Score	60 m sprint (sec)
5	0.1-7.2
4	7.3-8.3
3	8.4-9.6
2	9.7-11.0
1	>11.1

Table 2: Sixty meter sprint test scores for girls[12]

Score	60 m sprint (sec)
5	0.1-8.4
4	8.5-8.9
3	9.9-11.4
2	11.5-13.4
1	>13.5

The test showed a significant difference in urine-specific gravity and 60 m sprint performance between the two sexes ($p<0.01$). The mean urine specific gravity value of boys was lower than that of girls. In terms of 60 m sprint performance, boys achieved a greater score than girls (Table 3).

The subjects were classified into three groups based on urine-specific gravity value: euhydrated (urine specific gravity <1.020), hypohydrated (urine specific gravity = 1.020-1.029) and significantly hypohydrated (urine specific gravity $\geq$ 1.030). There was a significant difference in hydration status between boys and girls. Most of the boys were euhydrated, while most of the girls were hypohydrated (Table 4).

Most boys had a score of 3, whereas most girls had a score of 2. The difference between boys and girls was significant ($p<0.01$). A Spearman test was conducted to seek the correlation between 60 m sprint performance and other variables. In boys, there was a non-significant negative correlation between height and 60 m sprint performance ($p>0.05$). Nevertheless, weight, BMI and urine-specific gravity were significantly and negatively correlated with 60 m sprint performance in boys ($p<0.01$). In girls, height and urine-specific gravity were positively and non-significantly correlated with 60 m sprint performance ($p>0.05$). However, weight and BMI were significantly and negatively correlated with 60 m sprint performance in girls ($p<0.01$); (Table 5).

Overall, both BMI and urine specific gravity had a significant negative correlation with 60 m sprint performance. Height was significantly and positively correlated with 60 m sprint performance. There was a non-significant negative correlation between weight and 60 m sprint performance (Table 5).

Table 3: Distribution of students based on height, weight, body mass index (BMI) and hydration status

	Boys		Girls		
Variables	Mean	SD	Mean	SD	p-value
Height (cm)	165.710	6.250	154.620	5.48	<0.01
Weight (kg)	56.690	12.900	50.440	11.52	<0.01
Body mass index (kg m^{-2})	20.540	4.010	21.050	4.43	>0.05
Hydration status	1.020	1.024	1.024	0.01	<0.01

Table 4: Distribution of students based on hydration-status group

Sex/hydration status[13]	No.	Percentage	p-value
Boys			
Euhydrated	38	38.8	<0.01
Hypohydrated	37	37.8	
Significantly hypohydrated	23	23.5	
Girls			
Euhydrated	25	17.9	
Hypohydrated	59	42.1	
Significantly hypohydrated	56	40.0	

Table 5: Correlation between 60 m sprint performance and other variables

	60 m sprint performance					
	Boys		Girls		Both	
Variables	r-value	p-value	r-value	p-value	r-value	p-value
Height (cm)	-0.11	>0.05	0.13	>0.05	0.33	<0.01
Weight (kg)	-0.33	<0.01	-0.24	<0.01	-0.13	>0.05
Body mass index (kg m^{-2})	-0.38	<0.01	-0.23	<0.01	0.34	<0.01
Hydration status	-0.33	<0.01	0.15	>0.05	0.18	<0.01

DISCUSSION

There was a significant difference (p<0.01) between boys and girls in terms of hydration status. The average urine specific gravity value of boys was found to be lower than that of girls (1.020 vs. 1.024). Most of the boys were euhydrated, whereas most of the girls were hypohydrated. This finding is inconsistent with some other studies[4,5,14]. Stover *et al.*[14] also reported that male recreational exercisers had higher urine specific gravity values than their female counterparts. Women were reported to have a higher thermoregulatory threshold to begin sweating[15] and a higher osmolality threshold to induce thirst[16]. A study by Sawka *et al.*[17] reported that both endogenous and exogenous oestrogens enhance arginine vasopressin (AVP) release in response to osmotic stimuli. A study by Gustam[18] found that the percentage of dehydrated adolescent girls was higher than that of their dehydrated adolescent boys (49.0% vs. 40.0%). The authors assumed that the water intake of adolescent girls was less than that of adolescent boys. Boys were also assumed to be more physically active than girls. Therefore, girls could not become thirsty easily and did not drink adequate water. Sulistomo *et al.*[19] stated that women were at a greater risk for dehydration than men because women had less body fluid than men. Adolescent girls have oestrogens that induce body fat accumulation and body fat contains almost no water[20]. A study by Ortega *et al.*[21] concluded that parents with lower educational levels have children who have low fluid intake. In the present study, most parents of the boys attained a higher level of education than most parents of the girls. Therefore, the education level of the parents in the present study might be associated with the hydration status of the students.

In this study, there was a significant difference (p<0.01) between boys and girls in terms of 60 m sprint performance. Boys performed the 60 m sprint better than girls. Most boys had a score of 3, whereas most girls had a score of 2 (Fig. 1). This finding is consistent with observations of Debaere *et al.*[22] who reported that compared with female athletes, male athletes performed two 60 m sprints with higher accelerations

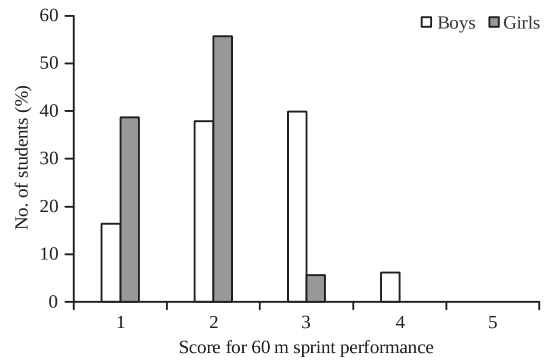

Fig. 1: Difference in 60 m sprint performance between boys and girls

and higher speeds. However, there was no significant difference in step rate between male and female athletes. Male athletes had significantly longer step lengths in most phases. This might be due to the longer leg length of the male athletes. Nevertheless, Debaere *et al.*[22] found that there was no correlation between step rate or step length and sprint performance. The authors concluded that there were other factors in addition to step rate and step length that determine sprint performance. Perez-Gomez *et al.*[23] stated that male subjects were able to produce higher ground reaction forces and therefore produce longer strides. Men were reported to have a higher capacity to produce ATP to maintain muscle contraction than women because men had greater anaerobic power that was due to their higher glycolytic capacity. Glycolytic capacity was found to be higher in type II muscle fibres than type I muscle fibres. Type II muscle fibres occupy more area in men than women.

In the present study, there was a significant difference in height between boys and girls. The mean height in boys was greater than that in girls (165.71 cm vs. 154.62 cm). There was also a significant positive correlation between height and 60 m sprint performance. This finding agrees with Sedeaud *et al.*[24] who stated that taller people produce longer stride lengths. In the current study, boys were found to be significantly heavier than girls (56.69 kg vs. 50.44 kg). There was an insignificant negative correlation between weight and 60 m sprint performance. This finding contrasts with observations of Sedeaud *et al.*[23]. The authors stated in their study that efficiency of sprint could be increased with heavier body mass because of greater muscle strength, ground force and power[24]. In the present study, boys had a slightly and insignificantly lower BMI than girls (20.54 kg m^{-2} vs. 21.05 kg m^{-2}). BMI was found to have a significant negative correlation with 60 m sprint performance. This finding agrees with observations of Nikolaidis *et al.*[25]. However, this finding disagrees with the result of a study conducted by Sedeaud *et al.*[24], where the authors found that speed had a positive correlation with BMI.

In the current study, the Spearman test showed a significant negative correlation between urine specific gravity and a single 60 m sprint performance in boys and together with girls ($p<0.01$). Davis *et al.*[11] reported that the intermittent sprint performance of male collegiate baseball players was impaired when the baseball players were dehydrated. Dougherty *et al.*[26] found that 2% dehydration (2% body mass loss) impaired basketball sprinting performance. Sprinting is an anaerobic exercise and anaerobic power is one of the factors that influences sprint performance[27]. Jones *et al.*[28] stated in their study that dehydration could cause a reduction in anaerobic power and anaerobic capacity.

A study by Baker *et al.*[29] reported that when basketball players were dehydrated, they reduced their exercise intensity, which was shown by a significant decrease in sprint time and enhanced feelings of fatigue. The authors also reported that dehydration was associated with enhanced feelings of leg fatigue and light headedness. According to polyvagal theory introduced by Porges[30], there are three phylogenetic response systems (social communication system, mobilization system and immobilization system) arranged in phylogenetic order and linked to autonomic subsystems. Myelinated vagus is involved in social communication systems (vocalization, listening and vocal expression). Myelinated vagus is a nerve that develops calm behavioural states by preventing the sympathetic nervous system from affecting the heart and suppressing the hypothalamus-pituitary-adrenal (HPA) axis. Hypothalamic paraventricular nucleus is one of the components in the HPA axis. It stimulates the secretion of corticotrophin releasing hormone (CRH) and arginine vasopressin (AVP)[31]. AVP is known as a hormone that is activated when a person is dehydrated and therefore, AVP increases water reabsorption and reduces water excretion[32]. Social communication systems should be implemented before engaging in mobilization behaviours, such as physical exercise. If the myelinated vagus fails, it will impair physical performance[32]. However, this research did not investigate the physiological characteristics.

In the present study, there was an insignificant positive correlation between hydration status and 60 m sprint performance ($p>0.05$) in girls alone. Mettler and Mannhart[33] stated in their review article that dehydration did not affect single sprints but had an effect on repeated sprints instead. Kraft *et al.*[34] reported that anaerobic performance could be impaired by the critical level of dehydration, which was 2.5-3.9% of body weight. However, in the present study, post-event body weight was not measured. Kraft *et al.*[34] also stated that dehydration might be able to only impair anaerobic performance with a critical duration, which was more than 30 sec. In the present study, the students completed the sprint in less than 30 sec. However, the last statement from Kraft *et al.*[34] contrasts with the finding found in boys and together with girls. To the author's knowledge, no one has published an article explaining the correlation between hydration status and a single 60 m sprint performance.

CONCLUSION

There was a significant difference in hydration status between boys and girls. Boys had lower urine-specific gravity than girls. The 60 m sprint performances of boys and girls were also significantly different. These findings indicated that boys have achieved higher performance scores than girls. Furthermore, students with a lower hydration status attained a higher 60 m sprint performance than did students with a higher hydration status.

SIGNIFICANCE STATEMENT

The strength of this study is that it expresses significant correlation between hydration status and 60 m sprint performance in students. This study will be helpful in the determination of hydration status and in monitoring the level of physical fitness and student performance. The results are expected to be used as one of the best screening methods for measuring individual health levels, as well as contributions to scientific knowledge, particularly medical anthropology.

ACKNOWLEDGMENTS

The authors would like to thank the students, directors and teachers of SMA Negeri I Jetis Bantul, Yogyakarta Province, Indonesia for their cooperation in this research. We also thank our students of Medicine, Public Health and Nursing Faculty, Universitas Gadjah Mada for helping in data collection. This research was supported by the Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada (Community Fund Budget Year 2016).

REFERENCES

1. Jaquier, E. and F. Constant, 2009. Water as an essential nutrient: The physiological basis of hydration. Eur. J. Clin. Nut., 64: 115-123.
2. Choudhury, P., A. Bagga, K. Chugh and S. Ramji, 2011. Principles of Paediatric and Neonatal Emergencies. Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.
3. Briawan, D., T.R. Sedayu and I. Ekayanti, 2011. Drinking habits and urine fluid intake in urban areas. J. Clin. Nutr. Indones., 8: 36-41.
4. Volpe, S.L., K.A. Poule and E.G. Bland, 2009. Estimation of prepractice hydration status of national collegiate athletic association division I athletes. J. Athletic Train., 44: 624-629.
5. Armstrong, L.E., C.M. Maresh, J.W. Castellani, M.F. Bergeron, R.W. Kenefick, K.E. LaGasse and D. Riebe, 1994. Urinary indices of hydration status. Int. J. Sport Nutr., 4: 265-279.
6. Cheuvront, S.N., R. Carter III, K.C. DeRuisseau and R.J. Moffatt, 2005. Running performance differences between men and women. Sports Med., 35: 1017-1024.
7. Korhonen, M.T., A. Mero and H. Suominen, 2003. Age-related differences in 100-m sprint performance in male and female master runners. Med. Sci. Sports Exerc., 35: 1419-1428.
8. WHO., 2015. Global standards for quality health-care services for adolescents: A guide to implement a standards-driven approach to improve the quality of health care services for adolescents. World Health Organization, Geneva.
9. Popkin, B.M., K.E. D'Anci and I.H. Rosenberg, 2010. Water, hydration and health. Nutr. Rev., 68: 439-458.
10. Adan, A., 2012. Cognitive performance and dehydration. J. Am. Coll. Nutr., 31: 71-78.
11. Davis, J.K., C.M. Laurent, K.E. Allen, J.M. Green, N.I. Stolworthy, T.R. Welch and M.E. Nevett, 2015. Influence of dehydration on intermittent sprint performance. J. Strength Condition. Res., 29: 2586-2593.
12. Ministry of National Education, 2003. Indonesia Physical Freshness Test. Center for the Development of Physical Quality, Jakarta.
13. Baron, S., M. Courbebaisse, E.M. Lepicard and G. Friedlander, 2015. Assessment of hydration status in a large population. Br. J. Nutr., 113: 147-158.
14. Stover, E.A., H.J. Petrie, D. Passe, C.A. Horswill, B. Murray and R. Wildman, 2006. Urine specific gravity in exercisers prior to physical training. Applied Physiol. Nutr. Metab., 31: 320-327.
15. Lopez, M., D.I. Sessler, K. Walter, T. Emerick and M. Ozaki, 1994. Rate and gender dependence of the sweating, vasoconstriction and shivering thresholds in humans. Anesthesiology, 80: 780-788.
16. Ritz, P., S. Vol, G. Berrut, I. Tack, M.J. Arnaud and J. Tichet, 2008. Influence of gender and body composition on hydration and body water spaces. Clin. Nutr., 27: 740-746.
17. Sawka, M.N., L.M. Burke, E.R. Eichner, R.J. Maughan, S.J. Montain and N.S. Stachenfeld, 2007. American college of sports medicine position stand. Exercise and fluid replacement. Med. Sci. Sports Exercise, 39: 377-390.
18. Gustam, H.B.D., 2012. Risk factors of dehydration in adolescents and adults. Ph.D. Thesis, Bogor Agricultural University, Bogor.
19. Sulistomo, A., N. Sutarina and E. Ilyas, 2014. Hydration Status under General and Special Conditions. Agency Publisher Faculty of Medicine University of Indonesia, Jakarta.
20. Novak, L.P., 1989. Changes in total body water during adolescent growth. Hum. Biol., 61: 407-414.
21. Ortega, A.J., A.M. Lopez-Sobaler, A. Aparicio, E. Rodriguez-Rodriguez and R.O. Anta, 2015. Fluid intake habits among school children in Madrid depend on the educational level of their parents. Nutr. Hospit., 32: 35-36.
22. Debaere, S., I. Jonkers and C. Delecluse, 2013. The contribution of step characteristics to sprint running performance in high-level male and female athletes. J. Strength Condition. Res., 27: 116-124.
23. Perez-Gomez, J., G.V. Rodriguez, I. Ara, H. Olmedillas and J. Chavarren *et al*., 2008. Role of muscle mass on sprint performance: Gender differences? Eur. J. Applied Physiol., 102: 685-694.
24. Sedeaud, A., A. Marc, A. Marck, F. Dor and J. Schipman *et al*., 2014. BMI, a performance parameter for speed improvement. PloS One, Vol. 9, No. 2. 10.1371/journal.pone.0090183
25. Nikolaidis, P.T., A. Asadi, E.J. Santos, J. Calleja-Gonzalez, J. Padulo, H. Chtourou and E. Zemkova, 2015. Relationship of body mass status with running and jumping performances in young basketball players. Muscles Ligaments Tendons J., 5: 187-194.
26. Dougherty, K.A., L.B. Baker, M. Chow and W.L. Kenney, 2006. Two percent dehydration impairs and six percent carbohydrate drink improves boys basketball skills. Med. Sci. Sports Exerc., 38: 1650-1658.
27. Soslu, R., A. Ozkan and M. Goktepe, 2016. The relationship between anaerobic performances, muscle strength, hamstring/quadriceps ratio, agility, sprint ability and vertical jump in professional basketball players. J. Phys. Educ. Sports Sci., 10: 164-173.

28. Jones, L.C., M.A. Cleary, R.M. Lopez, R.E. Zuri and R. Lopez, 2002. Active dehydration impairs upper and lower body anaerobic muscular power. J. Strength Condition. Res., 22: 455-463.
29. Baker, L.B., K.A. Dougherty, M. Chow and W.L. Kenney, 2007. Progressive dehydration causes a progressive decline in basketball skill performance. Med. Sci. Sports Exerc., 39: 1114-1123.
30. Porges, S.W., 2009. The polyvagal theory: new insights into adaptive reactions of the autonomic nervous system. Cleve. Clin. J. Med., 76: S86-S90.
31. Goncharova, N.D., 2013. Stress responsiveness of the hypothalamic-pituitary-adrenal axis: Age-related features of the vasopressinergic regulation. Front. Endocrinol., Vol. 4. 10.3389/fendo.2013.00026.
32. Knepper, M.A., T.H. Kwon and S. Nielsen, 2015. Molecular physiology of water balance. N. Engl. J. Med., 372: 1349-1358.
33. Mettler, S. and C. Mannhart, 2017. Hydration, drinking and exercise performance. Swiss Sports Exerc. Med., 65: 16-21.
34. Kraft, J.A., J.M. Green, P.A. Bishop, M.T. Richardson, Y.H. Neggers and J.D. Leeper, 2012. The influence of hydration on anaerobic performance: A review. Res. Quart. Exerc. Sport, 83: 282-292.