Probiotics consumption in physically active individuals

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Abstract

Introduction: It is well known that physical activity (PA) recommendation has positive effects on individual's health status. On the other hand, low levels and excessive exercise can lead to negative consequences, influencing the immune system and changing the permeability of a gut barrier leading to a higher risk for infections and inflammation. Considering the link between gastrointestinal (GI) tract and symbiotic microorganisms, or microbiota, probiotics consumption might have an indirect influence on the health status of individuals with vigorous physical activity. There is an increasing number of studies describing the probiotic effect on immune and GI tract function, affecting the respiratory infections, and the performance of active individuals. This report provides data between probiotic consumption and the health status of individuals with different levels of physical activity. *Methods:* Literature review was focused on the effects of probiotics on health status of general and PA population. In questionnaire-based survey 33 individuals were included. The data regarding PA, eating habits, defecation and knowledge and use of probiotics were collected and analyzed. *Results:* Probiotics have a beneficial effect on health status and performance in PA individuals when consumed regularly and in adequate amount. Although the participant's knowledge about the term »probiotics« was acceptable, the knowledge about the source of probiotics in daily diet was insufficient. Probiotic consumption in form of foodstuff and dietary supplement in the selected population was inadequate. *Discussion and conclusions:* Due to the study limitations observed, e.g. small samples, short periods of probiotic consumption and choice of different probiotic strains, it is difficult to summarize the specific effect of the probiotic consumption on PA individuals. There is a need for additional studies with standardized protocols to confirm the health benefits of probiotics on individuals with

the same level of PA. Based on the questionnaire results we can conclude that the knowledge about probiotic consumption effects of younger generations is insufficient. On behalf of this study results there is a need for educational activities among younger adults also in the aspect of probiotics consumption in relation to PA.

Keywords: Gut microbiota, Probiotics, Physical activity

Introduction

Human GI tract is inhabited by a complex and dynamic population of microorganisms. This so-called gut microbiota has an important role in health and disease of the host. However, its diversity and density varies through the GI tract with the highest cell concentration in the lumen of the colon, where 10^{12} bacteria per gram of content can be found (Walburga et al., 2018). Although the adult-like gut microbiota is formed already in early life, factors such as antibiotics treatment, diet (Wen and Duffy, 2017) and PA can influence the microbial balance (Monda et al., 2017). At least 150 minutes of moderate PA or at least 75 minutes of high intensity activity has a positive health effect (WHO, 2011) that could be mediated also by PA's influence on gut microbiota. Moreover, aerobic activity in healthy individuals has been shown as successful in balancing and enhancing functionality of gut microbiota (Dalton et al., 2019). As the intensity of PA increases, GI symptoms can occur, e.g. nausea, cramping, bloating and diarrhoea, that can be linked to changed intestinal barrier function (Lamprecht and Frauwallner, 2012). Individuals with different levels of PA often consume foodstuff and dietary supplements which affect gut microbiota, e.g. probiotics and prebiotics (Colbey et al., 2018) to maintain GI health. Probiotics are defined as live microorganisms with beneficial effects of host's health if administered in sufficient amount (Hill et al., 2014). On the other hand, prebiotics are fermentable food components which have a beneficial effect on host's health through their impact on composition and/or gut microbiota function (Guarner et al., 2012). The aim of this study was to answer following research questions: a) "What are the knowledge and consumption habits of live microorganisms in individuals with different levels of PA?"; b) "Can probiotics consumption affect health status of individuals with vigorous PA?"; c) "Can probiotics consumption affect performance in individuals with vigorous PA?".

Methods

Theoretical part of the study included literature review on gut microbiota, PA and probiotic consumption on health of PA individuals with the use of different research bases. The literature of the past 10 years was included. Practical part of the study included preparation of the questionnaire which was published on www.ika.si and data analysis. The link to online questionnaire was shared through e-mail and social media to addresses of selected track and field clubs and PA individuals. All participants were informed about anonymity and

data use for research purposes only. Data was analysed with computer program SPSS Statistics 26.0 (IBM, Armonk, NY, USA) within connections between variables were processed.

Results

Probiotics consumption and its effects on physical activity

Results of literature review on probiotics consumption in individuals with different levels of PA are presented in Table 1.

Table 1: Effects of probiotic consumption on some health parameters in individuals with different level of PA

<i>Probiotic strain</i>	<i>Sample</i>	<i>Results (study duration)</i>	<i>Reference</i>
<i>Bifidobacterium bifidum</i> W23, <i>Bifidobacterium lactis</i> W51, <i>Enterococcus faecium</i> W54, <i>Lactobacillus acidophilus</i> W22, <i>Lactobacillus brevis</i> W63, <i>Lactococcus lactis</i> W58	Triathlons competitors, runners, cyclists	Lower levels of TNF- α for 25 % in resting state and after PA, lowering increased level of zonulin; (14 weeks)	Lamprecht et al., 2012
<i>Lactobacillus fermentum</i> VRI-003	Elite endurance runners	Reported shorter duration and lower severity of respiratory infections; (28 days)	Cox et al., 2010
<i>L. acidophilus</i> , <i>Lactobacillus delbrueckii</i> ssp. <i>bulgaricus</i> , <i>B. bifidum</i> , <i>Streptococcus salivarius</i> ssp. <i>thermophilus</i>	Endurance swimmers	Lower number of respiratory infections episodes, improved VO_2 max; (8 weeks)	Salarkia et al., 2013
<i>Lactobacillus</i> , <i>Bifidobacterium</i> , <i>Streptococcus</i>	Runners	Extended time of running to fatigue in environment with higher temperature; (4 weeks)	Shing et al., 2014
<i>Bifidobacterium longum</i> 35624	Swimmers	Reported enhanced recovery after PA in the last 2 weeks in offseason; (6 weeks)	Carbuhn et al., 2018

TNF- α ... tumor necrosis factor alpha
 VO_2 max... maximum rate of oxygen consumption

Knowledge and consumption habits of probiotics in physically active population

In the present study 33 participants were included, 19 females (58 %) and 14 males (42 %) with mean age 19.12 years. Majority (94 %) has been running more than 2 years and 76 % of them were training with high intensity. 48 % of participants did not suffer any issues during running, the rest was experiencing breathing issues. Based on Bristol's Stool Chart (Chumpitazi et al., 2016) the most frequent stool form was type 3, a normal stool form. According to knowledge about the term probiotics the highest percentage (48 %) the answer was that they already heard for the term, but they did not know why are they beneficial. In 55 % family members were the source of information of probiotics. Only 37 % were consuming probiotic food, most commonly fermented milk

products, e.g. yoghurt and cheese. Only 2 participants consumed probiotic supplements. Most of the participants agreed with claims that probiotics have beneficial effects on immune system and regular defecation. Opinions differed on breathing issues claims, enhancing GI symptoms during running and the effect on performance. Based on normality of variables, Spearman's rank correlation coefficient was used and showed a trend of weak negative significant correlation ($r_s = -0,351$; $n = 33$; $p < 0,045$) between variables age and time involved with running.

Discussion

Based on results of clinical studies, there is a trend that probiotics consumption can have an impact on health and performance in PA individuals, if there are criteria fulfilled, e.g. optimal strain use, frequent use and adequate amount of probiotics. Despite positive studies results, there are also limits, e.g. low number of studies, small study samples, short consumption time, incomparability of studies because of different doses and strains of probiotics, unsuitable control in PA and diet regime. Probiotics are often used with other compounds, e.g. prebiotics, protein supplements and antioxidants, thus the study comparison is even more complicated. Furthermore, there is still a lot unknown about probiotics mechanisms. Despite all the studies, the generalisation of probiotics effects and guidelines formation for individuals with different level of PA cannot be made. Moreover, since probiotic consumption can lower the concentration of inflammation parameters, which are important in process of recovery, hypertrophy and physiological adaptations on training, it could have a negative impact on PA. Third research question included data analysis of the given questionnaire. Knowledge about the term "probiotics" was good, although the same was not shown in probiotics sources and use. Since the main source of information were family members, participants could receive misinformation. Small number of participants consuming food with probiotics could also be linked to the low milk and milk products consumption, due to insufficient knowledge on probiotics and their effects. However, they agreed that probiotics have beneficial effects on immunity and regular defecation.

Conclusions

Despite the large number of studies of probiotics consumption in general population, the number of studies of probiotics consumption in PA population is still limited. Mainly, the positive effects of probiotics consumption on immune system, GI tract and respiratory system function and in performance and recovery after PA were observed. Furthermore, results are hardly or not comparable. Therefore, comprehensive meta-analysis should be performed before incorporating the probiotics into individuals diet regime based on the PA intensity. Based on the questionnaire results, we concluded that knowledge of younger generations about probiotics is limiting and could be introduced also by the nutritional counselling and workshops.

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