

# The relationship between *Prevotella* genus in intestinal flora and exercise and diet styles of professional football players

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## Abstract

**Aim:** This study aims to deal with the relationship between *Prevotella* genus in intestinal flora and exercise and dieting styles of professional football players. **Material and Method:** 10 volunteers, 5 male footballers playing at elite level and 5 sedentary men between the ages of 18-21, participated in the study. In the study, metagenomic analysis of *Prevotella* genus was performed by taking "Stool Sample" from the subjects only for 1 time. A questionnaire was applied to determine the nutritional styles of the subjects. SPSS 20.0 package program and Minitab 17 programs were used in the statistical analysis of the data, and the significance level was taken as  $p < 0.05$ . **Results:** It was determined that professional footballers had higher *Prevotella* type intestinal flora than sedentary individuals and this difference was statistically significant ( $p < 0.05$ ). In addition, it was determined that the groups had different feeding styles, professional footballers' was rich in protein, and sedentary was rich in carbohydrate and vegetables. **Conclusion:** It can be said that differences in exercise and dieting styles lead to differences in *Prevotella* genus. *Prevotella* intestinal flora is a very effective type in carbohydrate fermentation and may have positive effects on athlete's performance developments.

**Key Words:** *Prevotella*, Footballer, Sedentary, Intestinal microbiota.

## Introduction

The microbial population in intestines in the form of colonies that exhibit a genetic variability is known as intestinal flora (1). This population that exists in gastrointestinal track is of vital importance for immune system, digestion, absorption, some neuro-transmitter substances, the production of some vitamins and for the better functioning of some host organisms (2). In the formation of the intestinal flora in the early years of life, types of birth and breast milk, and in later periods of life, nutrition, use of antibiotics, stress, smoking, use of alcohol drinking, prebiotic remedies, sedentary lifestyle and exercise play some crucial roles (3). While a healthy flora prevents the development of many diseases, deformation of intestinal flora are associated with ailments like obesity, cancer, dementia, Parkinson, autism, neurologic disorders, type 2 diabetes,

allergic reactions, and depression (4). Under normal circumstances, 98% of bacteria in the intestinal floras of healthy people are helpful residents, but the line between helpful and harmful types is not very clear and this line varies according to races, variability in the types and the amount and percentage of bacteria (5). A wrong percentage transform these helpful residents into harmful pathogens (5). *Prevotella*, a type residing in intestines, is a gram negative bacteria. Studies show that some *Prevotella* strains can be helpful in decreasing the risk of some cardiovascular ailments, the treatment of glucose metabolism, solving weight problems and that it is associated with fiber-rich dieting (6,7,8).

There are studies supporting the idea that exercise and dieting play an effective role in the formation and arrangement of microbiota populations in the intestines, in the prevention and treatments of some diseases (9). Furthermore, regular exercise, physical and

psychological well-being have been found to be positively contributive (10), which is also important for the formation and arrangement of the intestine flora. Studies demonstrate that dieting styles and habits are important for the intestine residents. Bad, imbalanced or poor diet help the increase of pathogenic types and the decrease of the useful ones and destroys the make up of the flora (11,12). Studies also show that Mediterranean diet increase the amount of *Prevotella*, *Lactobacillus*, *Bifidobacterium* and fecal short-chain fatty acids (SCFA) in the intestine flora while it decreases the amount and intensity of pathogens like *E. coli* (13). Wu et al. (2011) studied the effects of both long and short term dieting habits on the intestine microbiota and found that, in long term dieting habits, consumption of food rich in animal protein and fat increase the amount and intensity of *Bacteroides*, consumption of food rich in complex carbohydrates increase the amount and intensity of *Prevotella* types and that, in short term dieting, the changes in microbiota start within 24 hours, but these changes hardly affect the enterotypes (14). There are other studies showing that, apart from dieting, exercise can also play a significant role in the modification of the intestinal flora, increase the amount and diversity of useful microbial residents, prevent the development of pathogens, and positively affect the absorption, energy distribution and immunity (15). A study also shows that exercise, independently of dieting styles, can increase the microbial diversity, that the microbiotas of sportspersons are associated with the protein content consumed in their diets, that exercise capacity can be affected by the existence of diverse microbiotas and that fat diets increase intestinal inflammation and exercise can treat this inflammation and maintain cellular integrity (16).

## Material and Method

The participants of the study were 10 volunteers, 5 professional footballers and a sedentary group of 5 males between the ages of 18-21 from Hekimoğlu Trabzon FC, playing in TFF (Turkish Football Federation) League 2. The criteria were fixed before the participant selection process and those who did not

meet the required criteria were excluded. These criteria are as follows:

Not having used antibiotics for at least 6 years

- Having a background of 10 years or more in the profession (only for footballers)
- Having no history of an intestinal disorder (for both groups)
- Being a non-smoker and not an alcohol addict
- Not using prebiotics and other prebiotic supplements

All the participants were informed about the study and the procedures, and then the required permissions and informed consent forms were taken from them and their club in compliance with the Helsinki Declaration. For the microbiota analysis, using faeces containers, stool samples were taken from the participants for one time only. These samples, being kept under -20 °C, were sent to a microbiology lab for the metagenomic analysis. The New Generation Sequencing and metagenomic analyses of *Prevotella* type were conducted in the microbiotas of all the participants.

In order to determine the nutrition styles of the groups and the food group they consume, a food consumption questionnaire prepared by the Nutrition and Dietetics Department consisting of 4 main titles (carbohydrate, fat, protein, fiber food) and subgroups was applied. A food consumption questionnaire prepared by the Department of Nutrition and Dietetics was implemented.

## Statistical Analysis

The microbial community obtained was compared with each other using Minitab 17 software for profile and dendrograms were created. Minitab 17 software was used for the calculation of PCA regulations and subsequent correlation analysis. The data obtained were evaluated in the SPSS 20 package program and descriptive statistics were used in the analysis of the data. In the statistical analysis of the *Prevotella* species, the distribution of the groups is homogeneous, but because the subject group consists of 10 people, the

Mann Whitney U test was applied for binary comparisons from non-parametric tests, and the significance level was taken as  $p < 0.05$ .

## Results

When the demographic characteristics of the participants are examined, the average age of professional football players was  $19.8 \pm 0.83$  years, height avg.  $177.20 \pm 0.33$  cm, body weight avg.  $73.60 \pm 7.66$  kg, the average age of the sedentary was  $19.2 \pm 1.30$  years, height avg.  $174.00 \pm 0.50$  cm, body weight avg.  $77.64 \pm 3.36$  kg (Table 1).

Upon the examination of Table 2, it was determined that there was a statistically significant difference in terms of Prevotella type in professional footballers and sedentary individuals ( $U = 1.00$ ,  $p < .05$ ). Considering the rank averages, it was determined that Prevotella was more common in the footballer group than the sedentary ones.

The examination of Table 3 demonstrated that the groups had differendieting styles- professional footballers had protein-based, and sedentary ones had carbohydrate and vegetable-based (fiber food) dieting styles.

## Discussion and Conclusion

This study showed that professional footballers had higher Prevotella intestinal flora than sedentary individuals and groups had different feeding styles. It was found in another study that exercise could increase the number of beneficial microbial species such as Bacteriodaes, Lactobacillus, Bifidobacterium, Prevotella, and improve the development of commensal bacteria and that there was no difference between the professional and amateur athletes and sedentary in terms of Clostridium type.(15,17)) In a study comparing the intestinal microbiota of both professional and amateur cyclists, it was found that in all groups there were intestinal flora made up of many types including Prevotella, high Bacteroides, Eubacterium, Ruminococcus and Akkermansia, and there was abundant microbial diversity. In addition, it was found that relative abundance of Prevotella intestinal flora was higher in cyclists who exercised 20 hours or more per week when compared to those who did 6-10 hours a week. Although the study did not use a diet questionnaire, it suggested that athletes consumed high carbohydrates and this might be related to high Prevotella (18). The microbial community containing prevotella species is known to support the synthesis of BCAA (leucine,

**Table 1.** Average age, height, body weight values of the groups

Variabilities	Goups	N	$\bar{x} \pm ss$	Minimum	Maximum
Age	Professional Footballer	5	$19.8 \pm 0.83$	19	21
	Sedantary	5	$19.2 \pm 1.30$	18	21
Height	Professional Footballer	5	$177.20 \pm 0.33$	173	181
	Sedantary	5	$174.00 \pm 0.50$	168	180
Weight	Professional Footballer	5	$73.60 \pm 7.66$	72	81
	Sedanterr	5	$77.64 \pm 3.36$	65	85

**Table 2.** Comparison of Prevotella Type in Professional Footballers and Sedentary Men

Groups	n	Rank Average	Ranks Total	U	p
Professional Footballer	5	7.80	39.00	1.00	.002*
Sedantary	5	3.20	16.00		

\* $p < 0.05$

**Table 3.** Distribution of Food Consumption of Professional Football Players and Sedentary Men by Groups

Frequency of Food Consumption													
FOOD	Groups	Everyday		3–5 Times a week		1–2 Times a week		Once a fortnight		Once a month		Never	
		<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Red Meat	P.F	3	60	2	40	–	–	–	–	–	–	–	–
	S	–	–	–	–	1	12,5	4	50	–	–	–	–
White Meat	P.F	3	60	2	40	–	–	–	–	–	–	–	–
	S	1	20	1	20	1	20	2	40	–	–	–	–
Dry Beans	P.F	2	40	3	60	–	–	–	–	–	–	–	–
	S	1	20	1	20	2	40	1	20	–	–	–	–
Vegetables	P.F	–	–	2	40	2	40	1	20	–	–	–	–
	S	4	80	1	20	–	–	–	–	–	–	–	–
Rice	P.F	1	20	1	20	2	40	1	20	–	–	–	–
	S	3	60	2	40	–	–	–	–	–	–	–	–
Macaroni	P.F	–	–	2	40	2	40	1	20	–	–	–	–
	S	3	60	2	40	–	–	–	–	–	–	–	–
Sugar and Pastry	P.F	1	20	1	20	2	40	1	20	–	–	–	–
	S	5	100	–	–	–	–	–	–	–	–	–	–

PF: Professional Footballer; S: Sedantary

isoleucine and valine), thereby promoting decrease in muscle damage in exercise through muscle-protein synthesis mechanism and long-term endurance exercise through BCAA. This can be especially useful for athletes who need short recovery time after intense exercise (19,20, 21). In a study examining the intestinal microbiota profiles of physically active and sedentary women, it was found that regular physical activity performed 3 hours a week increased the relative abundance of species such as Bacteroidaes, Prevotella, Lactobacillus, which support health by modulating the microbiota. In addition, it was argued that sedentary lifestyle was associated with the low number of microbiota populations, and more research was needed to be able to determine which dose and type of exercise had a diverse effect on microbiota (22). It was observed that there was a positive change in the proportion of Bacteroides / Prevotella species with exercise applied to healthy and diabetic mice (23). In a study examining the microbial profiles of professional and amateur athletes and sedentary men, it was found that the group that took part in professional sports was

the most diverse group and the sedentary group had the least species diversity (11). Prevotella species are associated with a plant-rich diet that is abundant in carbohydrates and fibers. Prevotella intestinal flora helps digestion of fiber and carbohydrates. In a study comparing two different types of bacteria, 62 subjects who exercised and fed with high fiber, whole grain for 26 weeks, it was found that the group with more Prevotels in their guts lost 2.3 kg more body fat than those with more Bacteriodetes (6).

Among the bacteria that produce SCFA, but are not limited to Bacteroides, Bifidobacterium, Propionibacterium, Eubacterium, Lactobacillus, Clostridium, Roseburia and Prevotel, and SCFAs are said to be the main products of bacterial fermentation of carbohydrates and proteins in the intestine (24). It was determined that prevotella, Lactobacillus and Bifidobacterium species and fecal SCFA levels were high in individuals dieting in Mediterranean style (13). There are many studies showing that feeding with fiber and natural products contributes to the increase in the variety and number of intestinal flora. In a study

comparing the microbiota profiles of European and African children, the African group was fed with fiber foods rich in vegetable protein and the intestinal microbiota profiles were rich and diverse, on the other hand, the European group fed with fat-rich and animal-derived protein, the amount of Firmicutes and Proteobacteria was high. It was determined that the amount of Prevotella, Xylanibacter and Treponema was also high. More SCFA acids were detected in the African group compared to the other group, which is a marker of beneficial gut flora. As a result of the study, researchers argued that modern western diet and rural dieting style were important for maintaining intestinal microbiota diversity (25).

Understanding whether the intestinal flora plays a role in athletic performance and improving outcomes in training and competitions is very important for athletes. Additionally, the relationship between gut microbiota and health is also supported by the literature. Literature also shows that nutrition with fiber content positively affects Prevotella genus, and that the sedentary group with fiber-containing nutrition style has a lower Prevotella genus compared to professional footballers, in this case the exercise adaptation is due to the effect on the microbial profile. Many main factors such as exercise type, exercise duration, intensity, and dieting style have an important place in microbial structuring. This study includes these results and others similar to those in the literature. As a result, it can be said that change in exercise and diet may cause differences on Prevotella genus. Prevotella is a highly effective strain of genus in carbohydrate fermentation and may have positive effects on athlete's performance improvements. Studies with various nutritional or dieting styles and different sports branches can contribute to the further studies in this field.

**Conflict of interests:** The author declared no conflict of interests regarding the publication of this manuscript.

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