

Effect of sports health and exercise research on Olympic game success: An analytical and correlational survey

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ABSTRACT

The aim of this study is to investigate the effects of countries' development level in sports medicine, exercise and sports performance on their success in Olympic Games. Within this purpose, 1027 papers that were published between 2010 and 2018 in the journal of Sports Medicine, of which impact factor was 7.074 in 2017, were examined in analytical and correlational terms considering the first author and total author numbers. Pearson Correlation was utilized to find out the relationships between the papers from various countries and their success at Olympic Games. Regarding the number of medals won by the countries in the 2016, 2012 and 2008, Olympic Games were found significantly correlated with the number of first author ($r = 0.73$) and total author ($r = 0.74$).

Keywords: Olympic success, medals, science, academic publication, success, sport, medicine.

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INTRODUCTION

Olympic Games have been one of the common values that were created by civilization and benefited by the entire society in today's world in which differences are regarded as richness (Parry, 2006). Organized every four years, Olympic Games have gathered cultures, people and countries together for centuries without language, religion and ethnic discrimination. Being the biggest sports organization around the world, these games are means of peace, courage, resolution, justice and cultural exchange. Participating in the Olympic Games and attending to competitions are an ideal for everybody in performance sports field. Olympic Games are one of the most expensive global gatherings in which a large number of athletes, spectators, sportsmen, media representatives and thousands of volunteers around the world participate, and billions of audience watch via communication tools.

In parallel with the thoughts and ideals of Pierre de Coubertin, Modern Olympic Games have still continued to develop with an increasing interest since 1892.

Coubertin asserted that "competitions should be organized with a complete amateur spirit and sportsmanship; various people, cultures, customs and traditions should be introduced and the world should be in peace and serenity instead of war". He advocated his ideal to end the wars around the world, especially in Europe, during the war years and political turmoil; he tried to establish Olympic philosophy in this sense. For Coubertin Olympic Games were not an organization or system, and he suggested it as a living system of thought. In Olympic Games, countries do not compete against each other (IOC, 2015). Within this fundamental ideal framework, Olympic Games are to encourage and contribute to justice, peace and friendly competition, and be against ethnical and racist discriminations (Reid, 2006). The greatest target of countries holding Olympic Games is to introduce their country in the best way to billions of people by means of written and visual press. On the other hand, the Olympics have many benefits for the host country. Some of these benefits include the

restoration of transportation system and landscape, building new sports facilities that will be used in the Olympic Games and then by the people living in that country, the increasing number of tourists, creating a sports culture among individuals of the society etc. (Güçlü, 2001). Additionally, in host countries it is observed that people's interest and support to sports enhance during the years before the Games, which in turn, results in rises in sports investments (Rathke and Woitek, 2008). For instance, London hosted the 2012 Summer Games; and an extra 200 million dollars of public budget was separated for professional athlete development leading up to 2012 (Green, 2007). The Canadian government spent \$C25 million in building training facilities, including the country's first multi-sport training center before the 1988 Games in Calgary (Pettigrew and Reiche, 2016). Countries make short and long-term plans for country resources to be successful in the Olympic Games. Various factors such as development level of country, economic status, Olympic athlete training programs, supporting sports science researches, expanding infrastructure facilities impact the Olympic success. Most of the governments finance professional athletes to make them more ambitious in competitions, especially in the Olympic Games. For instance, Germany separates a big budget for schools developed to identify and train professional athletes. China managed a fund to identify and train the talented athletes, which is a neglected fact for Western nations. Upon the failure in the 1976 Summer Olympic Games, Australia adopted a similar strategy to win a gold medal. In 2000, a great deal of money, about US\$185 million, was expended by Japan on a National Training Center, and in 2003 a budget of about US\$5 million per year is separated for the athletes judged to be potential medal winners (Johnson, 2008; Brad et al., 2016). Swiss federal and cantonal governments spend about US\$35 million to Swiss Olympic yearly; the Swiss National Olympic Committee sets explicit goals to win 8 Winter and 25 Summer medals (www.swissolympic.ch/Portaldata/41/Resources/01_ueber_uns/organisation/SOA_Imagebrosc huere_e_low.pdf; Brad et al., 2016).

Analyzing the factors for Olympic game success has always a topic for a research. Specifically, there are various studies on examining the impacts of variables such as development level of the countries, GDP per capita, population rate on Olympic game success; Andreff (2001) applied sequenced logit model prediction method and stressed that GDP per capita and population ratio enhance a country's chance to win Olympic medal (Andreff, 2001). Another study by Bernard and Busse (2004) assessing the relationship between country development level and Olympic success emphasized the significance of economic resources in raising Olympic athletes (Bernard and Busse, 2004). Additionally, the same study noted that GDP per capita and population ratio are among the factors influencing the national

Olympic performance. A study in Turkey revealed that GDP was of no direct effect on Olympic game success and funds allocated to sports and cultural structure are more effective on success (İmamoğlu, 2016). Another study investigating the transformation of sports success from the 1896 Athens Games to our modern Olympic Games assumed that success in sports branches is closely related to social and cultural conditions (Seppänen, 1981). Kuper and Sterken underlined the advantage of hosting an Olympic Game and they claimed that hosting advantage provides not just in the year of the games, but also in the Olympics four years prior. They indicate that it takes time to create a group of ideal performing athletes' (Kuper and Sterken, 2001), which suggests that hosting the Games creates a training infrastructure that occurs prior to the hosting year, and it may continue after they host.

It is thought that physical education teachers are one of the key factors for young generations to be raised with Olympic consciousness. A study on physical education teachers in Turkey demonstrated that 65.1% of the participants felt that the main reason for Istanbul not to be the host of Olympic Games was the lack of sports culture among individuals. 79.5% of the participants believed that football and sports media distract society from other sports activities. The rate of the physical education teachers and academicians thinking that Istanbul's acceptance of Olympic Games is only a dream was 39.7% (Şenduran and Donuk, 2009). A similar study on trainers reported that 80.2% of the participants assumed that our country must make more serious sports policies to be successful in the Olympic Games (Şahin and Erden, 2017). There is a wide range of researches on Olympic Games; the majority of them is in social science disciplines and its sub-disciplines including history, economy, politics and sociology. Additionally, various perspectives are necessary for Olympic game studies, with a multidisciplinary approach including medical science, psychology, sociology, economy and government policies (Toohey, 2007). Today, sports science pushes the limits of physical and tactical training. Countries vigorously utilize from sports science through universities to be a success in the Olympics. The Chinese government underwent a system of talent identification in which sports colleges, city administrations and sports universities worked collaboratively to get prepared for 2008 Olympic Games (Tan and Green, 2008).

Athletes preparing for the Olympic Games train to possess a stronger, faster, more agile and more flexible physical structure. Competitions/races have become faster paced. The physical and tactical skill differences between the athletes have diminished in time. Within this scope, although all academic efforts in sport science are to improve the athletic performance, the relationships between the research outputs and athletic success also draw attention. Especially, the associations between the

effectiveness of sports science studies and national successes in the Olympic game arouse interest.

The literature reflecting the achievement in the Olympic Games mainly deals with the components except the component studies such as the existence of a command economy, population size and GDP (Pettigrew and Reiche, 2016). Szabo (2014) investigated the academic studies published with high citation level in qualified sport science journals in sports and exercise psychology fields and on Olympic achievements of countries. Szabo (2014) found a correlation between the countries with academicians publishing in qualified journals on sports and exercise psychology fields, and Olympic success of these countries. In a review of the previous studies, there isn't any analytical research that focuses on the relationship between academic papers published in high quality journals on "sports health, exercise and sports performance" and Olympic success. Within this framework, this study was designed to expand "sports and exercise psychology" study by Szabo (2014) and to include publications in "sports health, exercise and sports performance" fields to specify whether the field plays a role on the Olympic game success (Imamoğlu, 2016). This study aims to provide answers to certain questions like which countries have more common sports health, exercise and sports performance researches. Is there any connection between high quality academic research in this field and athletic success? Does the efficiency of these high quality studies also reflect the Olympic game success of those authors' countries?

MATERIALS AND METHODS

For the content analysis of this study, an international and high quality publication on sports health, exercise and sports performance academic field, the "Sport Medicine" journal was revised. "Sport Medicine" ranked first in the list of impact factors by Hopkins (2012) with "5.2" impact point among the journals on sports, health and exercise sciences (Seppänen, 1981). Sport Medicine journal includes publications on sports and athlete health, injury prevention and treatment in sports, exercise for health, education and nutrition in sports. In terms of its impact factor, the Sport Medicine Journal is a reference resource for doctors, sports medicine experts, physiotherapists, and exercise physiologists, coaches and sports trainers (Kuper and Sterken, 2001). This study addressed the papers published in Sport Medicine Journal during the last 9 years (2010-2018). Each academic publication on Sport Medicine was analyzed for the country of origin of the authors. 1027 articles published over nine years were categorized based on the first author and the number of all authors. The articles in this study had a total of 3011 authors. Author/article ratio was 2.91 and each paper was written by three authors on average. Considering the relationship between Olympic

success and country of origin of the authors, only the authors from countries with Olympic rank were reviewed. If the country of the author won no medal in the Olympics, that author was not included in the statistical analysis.

The purpose of this content analysis was to describe the origin or roots of the scientific publication with the highest quality standards in the related field. It was assumed that the majority of the publications were from Anglophone (English as mother tongue) countries. It was presumed that results of low acceptance rate and high impact factor represented the highest publication quality status at international level. Additionally, the study findings implied that "research efficiency in sports health, exercise and sports performance field" was related to athletic success. In this sense, the researchers investigated the relationship between these papers from different countries and the Olympic success of these countries (maybe the highest impact to measure the athletic success at national level). Thus, this study was only exploratory in nature. With aim to check the relationship between the first author's country and total author number of a country and the number of medals in 2016, 2012 and 2008 Olympics, a "Pearson Correlation" test was administered. And the significance level for the test results was $p < 0.05$.

This study investigated "Sport Medicine" journal with the highest impact factor on topics of sports and athlete health, prevention and treatment of sports injury, exercise for health, education and nutrition in sports. However, analyzing all articles in this field within a certain timeframe and theoretical and practical publication categories might provide more precise results. Additionally, the results and the effect of this study were limited with the number of authors in published articles and the number of Olympic medals. And, this study only considered the Summer Olympics and excluded the Winter Olympics.

FINDINGS

Table 1 shows the academic properties of the Sport Medicine Journal. The first and total author numbers that contribute to articles in the journal between 2010 and 2018 are presented in Table 2 by considering authors' nations.

Upon reviewing the countries of authors with published papers in the journal between 2010 and 2018 and Olympic medals of that country, authors from a total of 35 countries were found to contribute to the journal. It was observed that the majority of the first authors in the journal were from Australia, England and the USA. Similarly, when a total number of authors were considered, the number of the contributing authors from Australia, England and the USA were higher (Table 2). For the first authors, the total contributions of the first

Table 1. Sport Medicine Journal impact and download values for 2017.

Download number (2017)	Impact	
	Impact – 2017	h5 Index – 2017
1,173,504	7.074	78

Table 2. The first and total author numbers of the papers published between 2010 and 2018.

Sport Medicine Journal (2010-2018)		
Countries	The first author number	Total author number
Australia	197	593
USA	175	559
UK	154	406
New Zealand	59	134
Netherlands	58	178
France	48	158
Germany	48	105
Canada	47	110
Brazil	36	95
Belgium	25	67
Switzerland	23	68
Spain	21	80
Portugal	18	64
Qatar	16	46
China	12	25
Ireland	11	31
South Africa	9	28
Italy	8	39
Denmark	7	24
Sweden	7	35
Israel	5	7
Singapore	5	21
Slovakia	5	5
Finland	4	32
Norway	4	23
Serbia	4	4
Austria	3	10
Croatia	3	8
Iran	3	10
Japan	3	17
Greece	2	12
Poland	2	4
Tunisia	2	9
Hungary	1	1
Malaysia	1	1
Turkey	1	2
Total	1027	3011

three countries were as 19% from Australia, 17% from the USA and 15% from England. The total rate was 51%, which was higher than all other countries (526/1027). Based on the contribution of all countries to the journal,

the possibility for authors to be from 9 countries was higher than 3% (822/1027). Within this scope, 75% of the published papers were written by authors from 9 countries, and 25% were written by authors from the rest

26 countries.

In three Olympic games held in 2008, 2012 and 2016, considering the total number of authors of the countries and the total number of Olympic medals, Australia, USA, England, Holland and France were ranked as the first five countries (Figure 1).

Based on the International Olympic Committee data (18, 19, 20), it was highlighted that correlation between the first and total author number and the total number of Olympic medals was statistically significant in all cases (Table 3). The correlation between the total number of authors and the number of medals in each of the three Olympics was stronger than the number of the first

authors. When three Olympic Games were considered, the highest correlation for the number of the first author and total authors was in Rio 2016 games. In terms of the total number of medals in three Olympic Games, explanatory (determination) coefficient (r^2) was 55% for the total number of authors and 54% for the first author number. In other words, the number of medals in the Olympic can be explained by 55% of the total author number and 54% of the first author number.

Articles that were published in Sport Medicine Journal in 9 years (2010-2018) are listed as percentages based on the countries contributing to journal and by considering the countries of the first author (Figure 2).

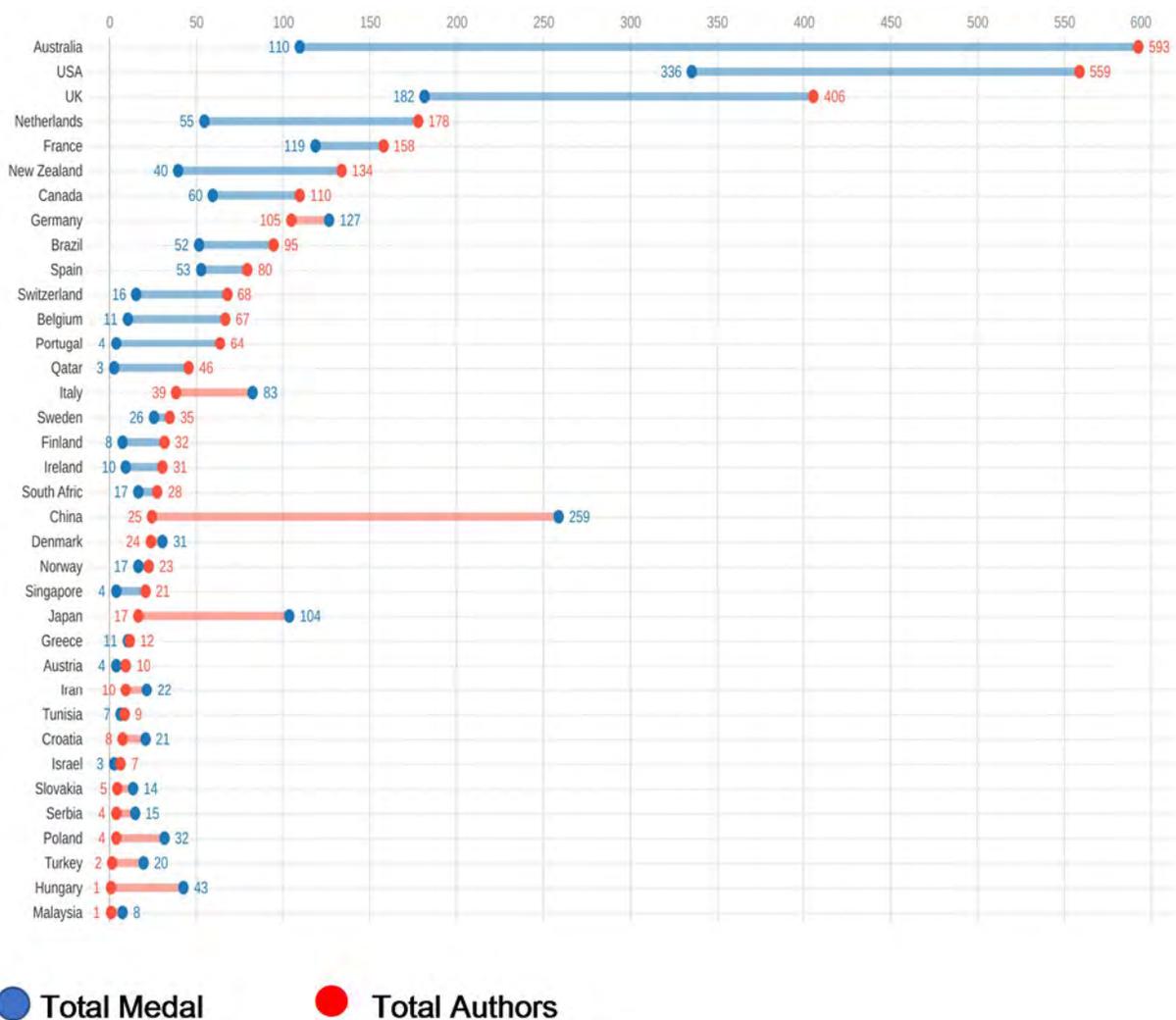


Figure 1. The total author and medal numbers of the countries.

RESULTS AND DISCUSSION

Modern Olympics have gradually increased its importance since 1896 with its *ideal* to be faster, higher,

and stronger and always to a moral sense. Although the Olympics are basically a sports organization, it has become a platform in which countries introduce themselves and their ideologies in political terms.

Table 3. Correlation (r) and explanatory coefficient (r^2 , in the parenthesis) between the total authors, the first author and number of Olympic medals.

	Total author	The first author
Beijing 2008	0.744 (0.55) *	0.728 (0.53) *
London 2012	0.728 (0.53) *	0.721 (0.52) *
Rio 2016	0.767 (0.59) *	0.754 (0.57) *
Three Olympic games	0.746 (0.55) *	0.734 (0.54) *

* All correlations (r) are statistically significant ($p < 0.01$).

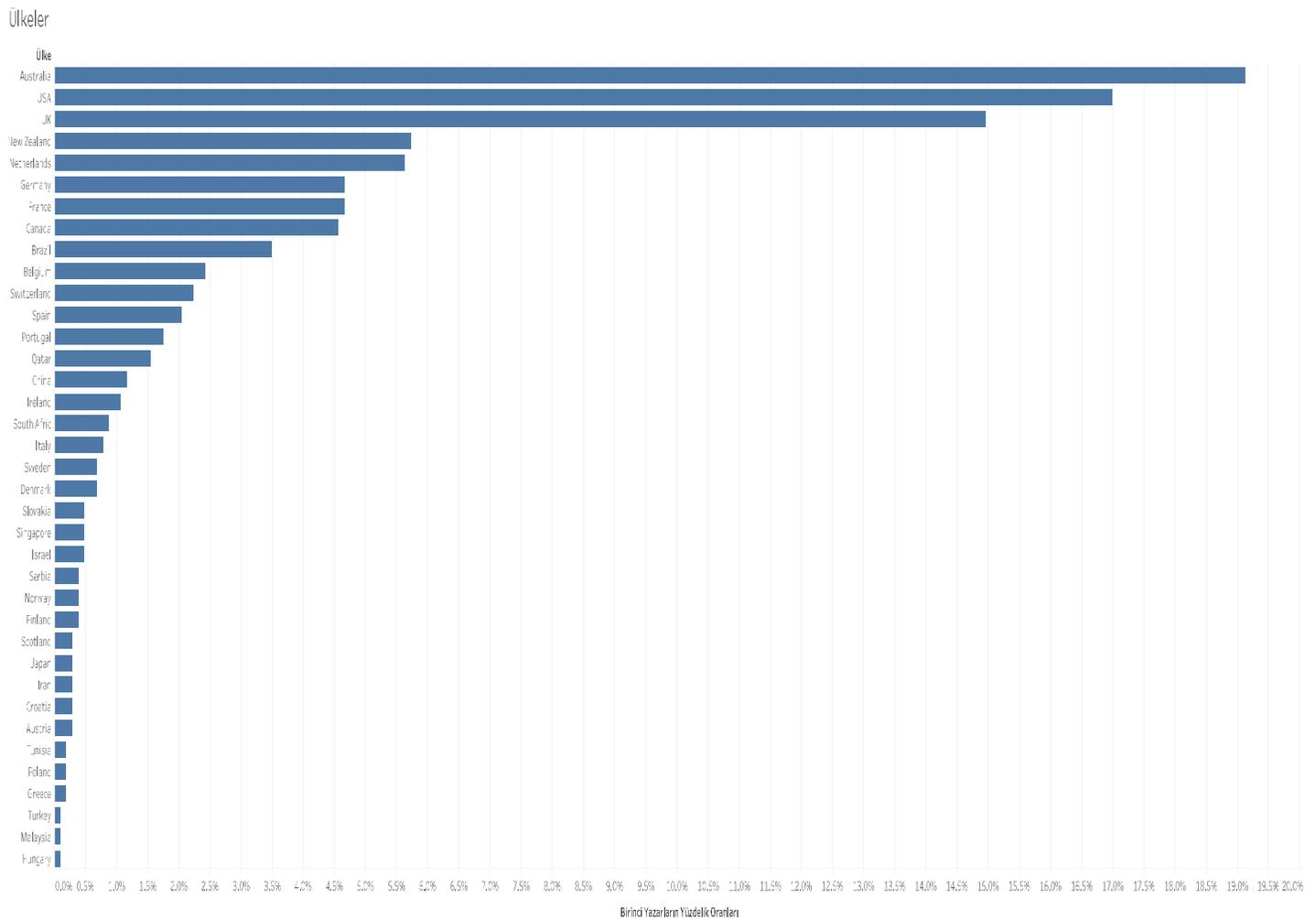


Figure 2. Percentage rank of the countries contributing to the publications for the number of the first author.

Therefore, success in the Olympics has been an absolute target to be achieved rather than an ideal for the countries.

The success of the countries in the Olympic Games has been a popular topic of various academic researches. These studies suggested that developed countries with higher GDP were more consistent with their success in the Olympic Games. It was also reported

that being the host country notably contributed to raise a public interest to detect and train professional athletes and to become successful in the Olympic Games (Green, 2007; Pettigrew and Reiche, 2016).

The analysis of the studies published in 9 years with the highest impact factor in sports and athlete health, prevention and treatment of sports injuries, exercise for health, education and nutrition in sports demonstrated

that the majority of these studies were conducted by academicians from Australia, England and USA (51%), all of which possess the highest number of authors and are also among the 13 richest countries around the world (Şenduran and Donuk, 2009). Andreff (2001) remarked that the possibility of winning an Olympic medal for countries increased with GDP per capita (Rathke and Woitek, 2008). As the countries' welfare has developed, there are more opportunities for both sportive success and scientific research activities. Although there is a strong bond observed between the number of scientific studies in the sports field and Olympic success, it is likely that national income level, research supports in the sports field and other parameters affect this high and strong relationship. Additionally, high GDP per capita contributes to the cultural development of society. Since one of the chief factors in Olympic game success is the cultural readiness, it can be inferred that the higher level of country welfare ensures the permanence of achievement in these games.

Apart from the authors from the USA, England and Australia, it was observed that scholarly publication ratio of New Zealand, Holland, France, Canada, Brazil and Germany was more than 3%. Publication ratio of the authors from the remaining countries was below 3%. The publication language of "Sport Medicine" journal is English and it is published in the USA. Another reason for the interest of authors from the USA, England and Australia to "Sport Medicine" might be cultural bonds due to common historical and cultural roots. However, a finding indicated that the majority of the articles published in the journal were from and/or accepted from English-speaking (Anglophone) countries. It is known that the journals with high impact factor reject most of the good papers due to their low-quality English phrasing, ambiguous abstract, and prejudice for publications in some countries. Thus, it could be stated that quality publications from non-native English speaker countries such as Japan, Greece, China and Russia were not included in Sport Medicine owing to language barriers, cultural differences and lack of opportunities for the academicians to work collaboratively. In addition to all these reasons, scientists from non-Anglophone countries might have preferred publishing quality studies in their native language in journals in their native language.

The number of medals was another dimension of the study, and the exploratory correlation analysis between research output published on Sport Medicine journal (2010-2018) and the total number of medals in three Olympic (2008, 2012, 2016) games revealed that there was a meaningful correlation between these two variables. In a review of the number of medals in three summer Olympics, it was concluded there was 0.74 correlations between the number of academic publications in a country and the number of medals of that country. Besides, as the publication number of a country increase in terms of the first author status,

change variance in medal number of that country rises up to 54%. Similarly, high number of publications for the total number of authors of a country is an indicator of high level of change variance in medal number (55%). In other words, while the number of authors can explain the 55% medal number change, the rest 45% can be predicted by other factors such as GDP, education, age to start doing sports and building sports facilities. Parallel with the current study findings, another research exploring the relationship between the number of scholarly papers in sports and exercise psychology and Olympic success reported that the number of authors with quality publications explained the number of Olympic medals by 42 and 57% (İmamoğlu, 2016).

If we consider the studies in literature and the findings of this study, it could be inferred that an increase in quality research in sport science is of a positive contribution to success in Olympic Games. It could be stated that various gains applied for writing quality publications, such as research pattern, experiment methods, instruments, training methods, sharing the experiences and using the obtained findings in athlete development also contributed to the athletes and Olympic success of that country.

Although not all of the articles published in the sports science field are not for developing the athletic performance, it is possible to hypothesis that studies in this field play a positive role on sportive development and cultural accumulation. Quality research of the countries in sport science statistically increases the possibility of winning an Olympic medal of that country. In recent years, awareness and interest towards Olympic Games and have risen in the public and civil institutions in Turkey, and a dynamism in related academic studies has been observed. Majority of these studies focuses on topics such as positive behaviors that Olympics bring for individuals and society; Olympism thought and economic gains of the countries with Olympics (Güçlü, 2001; Şahin and Erden, 2017). According to previous studies and results of the current one, it can be assumed that a higher level of GDP per capita and quality studies in sport science plays a useful role on increasing the number of Olympic medals.

In the light of study results, it is critical to expand the number of quality studies in sport science faculties to reinforce a long-term Olympic success. In this process, it is predicted that more financial support to sport science faculties as well as academic incentive and funds to sport science faculties and sport scientists by the Ministry of National Education, the Ministry of Youth and Sports, the Ministry of Culture and Tourism and the Ministry of Internal Affairs will make a great contribution to the Olympic success of Turkey. Additionally, sharing domestic and international quality research findings by the researchers more effectively with sports federations and Olympic preparation centers is thought to contribute to Olympic athlete development in Turkey.

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