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RESEARCH ARTICLE

Examining the Relative Age Effect of Elite Paralympic Athletes

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Abstract
Although there are many studies on the Paralympic Games and athletes, which are an international organization, there are not enough studies in the literature on the "relative age effect" in Paralympic athletes. The research is the first study to examine the successful Paralympic athletes in terms of "relative age effect", especially in this respect. The aim of this research is to examine the effects of the relative age effect of the successful paralympic athletes. The model of the research was determined as "Basic Qualitative Research" and the data collection technique in the research was determined as "Document Analysis". The analysis of the data in the research was made according to the Miles and Huberman model. The universe of the research consisted of athletes who participated in the Paralympic Games between 1960 and 2022. The sample of the study consisted of 30 elite athletes, including the athletes who won the most gold medals in the Paralympic Games. The sampling method of the research is density sampling based on heuristic approach. As a result, it was understood that for the successful Paralympic athletes, the number of athletes born in the first six months of the election year is higher than those born in the last six months. Thus, it has been concluded that the elite Paralympic athletes with medals in the Paralympic Games are affected by the relative age effect.

Keywords
Paralympic, Olympic, National, Athlete, Relative Age Effect

INTRODUCTION

Sport; It is the whole of the activities that individuals carry out so that they can continue their lives more comfortably by feeling good physically, mentally and spiritually. At the same time, sports are also important for people who face many obstacles in their lives. Because, thanks to sports, although the obstacles are removed, it can provide more pleasure and satisfaction in life (Özkan et al., 2013). Sports have a special place especially for disabled individuals who have lost their physical, mental and spiritual abilities from birth or later to various degrees (Akınoğlu et al., 2016). Disabled individuals tend to participate in sports activities or different sports branches specially organized for them in order to eliminate the negative situations they experience in life and to turn negative issues into a positive direction (Yıldız et al., 2016). In this way, disabled individuals can participate in various competitions by completing the training processes of the sports branches specially arranged for them, and can experience the feelings of success and failure in these competitions. With this process, disabled individuals can define themselves as athletes (Sarıgöz et al., 2017; Youngson et al., 2023). Paralympic Games are one of the most important

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organizations that enable people with disabilities to compete fairly and equally. The Paralympic Games is an event that takes place two weeks after the Olympic games. It was first held in 1960 after the Rome Olympics. Since then, it has been held once every four years (Tow et al., 2020; Yardimci & Kulunkoglu, 2022). When the literature in the field of Paralympics is examined, there are many studies especially on paralympic athletes. Some of these studies are: Swartz et al. (2019) conducted a study on the mental health symptoms and disorders of paralympic athletes. In another research; Fagher et al. (2016) examined paralympic athletes' perceptions of their sports-related injury experiences, risk factors, and protection opportunities. In another study; Banack et al. (2011) aimed to reveal the coach autonomy support, basic needs satisfaction and intrinsic motivation of paralympic athletes. In another research; Alexander et al. (2020) tried to determine the views of female paralympic athletes on effective and ineffective coaching practices. In another study, Madden et al. (2017) investigated the evaluation of dietary intake and supplement use in paralympic athletes. Despite these studies, no research has been found that examines the relative age effect of paralympic athletes. The relative age effect refers to the asymmetry in the distribution of birth dates, which favors players born prematurely in the election year and discriminates against those born later in the year (Helsen et al., 1998). Grouping of athletes according to age groups is very common in sports. January is globally considered the start of the election year. In particular, categories in team sports correspond to annual or biennial competition cycles in which the athlete is included in competition groups according to his chronological age and a predetermined end date. (Gil et al., 2020). Therefore, it is seen that older athletes have more opportunities to reach a higher sports level in terms of selection and competition performance than their other younger peers (Till et al., 2010). When the literature on the relative age effect is examined, there are many studies. Some of these studies are: Barnsley and Thompson (1988) examined the relative age effect of hockey players in their study. They concluded that the players born in the first months of the year are stronger, faster and have better coordination skills than the players born at the end of the year, but they are more successful. In another study, Simmons and Paull (2001) found that none of the 59 players selected for Sweden's under-17 football team were born in the last two months of the year. They also revealed that 25 players out of 59 players were born in the first 2 months of the year. In another study, Salinero et al. (2013) investigated the relative age effect of the player group consisting of 2763 players from the UK, Germany, Italy, France and Spain leagues. At the end of the study; They stated that the relative age effect is effective in these leagues. In line with this information, the aim of our study is to compare the relative age effect of 30 elite athletes who have won the most medals in the Paralympic games and who have won medals as competitors in both the Olympic and Paralympic games.

MATERIALS AND METHODS

This study was performed by adhering to the Helsinki Declaration. Ethical approval of the study was obtained from İstanbul Topkapi University Ethics Committee at the board meeting dated 20.03.2023 and numbered 2023/03 E-49846378-302.14.1-2300002932.

Model of the Research

The method of the research was determined as "Basic Qualitative Research" and the data collection technique in the research was determined as "Document Analysis". In the analysis of the data in the research, the Miles and Huberman model, which is a descriptive analysis form, was used.

Research Design

Qualitative data analysis; It is a collection of activities in which the data that can be obtained by different data collection methods and techniques such as document review, observation and interview are organized, categorized, themes are discovered, and ultimately this whole process is transferred to the report. In this study, document analysis technique was used in qualitative data analysis. Qualitative data analysis based on an interpretative philosophy is usually the data set studied; It is a combination of rough analysis (review, concentration, summarizing) with detailed analysis (detailing categories, hermenutic interpretation, describing data). The aim here is to produce common explanations by describing various data, describing in detail or comparing different data (Creswell, 2003; Flick, 2013). In qualitative studies, the analysis process mainly

involves understanding the essence of large amounts of data by reducing the volume of raw data, identifying important patterns, and creating a logical chain of evidence for the researched phenomenon by extracting meaning from the data (Patton, 2014). In this context, the Miles and Huberman model qualitative data analysis is essentially carried out in three steps: The first step is data reduction. Data reduction; It is the selection, examination, simplification, summary and transformation of the data obtained at the end of the research. In the second stage, data is displayed. Data representation; is to create an organized version of the collected data to reveal the results. The third stage is inference/validation. deduction/validation; It is testing the results in terms of validity, along with revealing causal relationships, patterns and possible structures between events and objects (Miles & Huberman, 2016). The reality, which is uncertain at the beginning of the research process and remains hidden in the data, is discovered and brought to light in the final stage.

Universe and Sample

The universe of the research consisted of athletes who participated in the Paralympic Games between 1960 and 2022. The sample of the research consisted of the athletes who won the most gold medals in the Paralympic games and the athletes who showed outstanding success in both the Olympic and Paralympic games. Density sampling was used in the sampling method of the study. Density sampling used in a qualitative research includes the best or most informative examples of the investigated phenomenon rather than extreme or unusual situations (Morgan & Morgan, 2008). Among the qualitative research methods, heuristic-based research generally uses density sampling (Mays & Pope, 2000). The phenomena studied in heuristic studies need not be extraordinary, pathological, or contradictory. Instead, it is essential that they contain intense information and have samples that can reach different and new information over time (Strauss & Corbin, 2015). The heuristic approach aims to discover and make sense of the nature of the studied event or phenomenon through self-experiences and the researcher's subjective explanations (Denzin & Lincoln, 2008). It enables the researcher to clearly express and make sense of the creative thought that exists within him. The heuristic approach is the only research approach that enables human experiences to establish subjective and creative connections between the researcher and the researched phenomenon (taking into account the researcher's tacit knowledge) (West, 2001).

Data Collection Tools

For the research, websites such as the official website of the International Paralympic Committee "www.paralympic.org" and the official website of the International Olympic Committee "www.olympics.com", where detailed information about Paralympic and Olympic athletes are available. It is aimed to reach the necessary documents by examining e-content documents containing athlete data. In addition, validity-reliability in qualitative studies is handled differently from quantitative studies (Yıldırım & Şimşek, 2013). In terms of the reliability of the study, the "triangulation" technique, perhaps the most well-known and applied strategy, was used to increase its internal validity. Triangulation is the comparison of results from two or more data sources. In this way, the weaknesses of one of the methods can be compensated with the strengths of the other method (Streubert & Carpenter, 2011). In this study, documents from two different databases were compared and examined.

The Analyses of the Data

In this research, it is aimed to form a basis for data analysis with the theory known as 'Embedded Theory'. This type of analysis was developed by Glaser and Strauss (2006). Embedded theory is used both as a research strategy and as a data analysis method. Today, it is called the most impressive paradigm for qualitative research method (Ilgar & Ilgar, 2013). In embedded theory, data collection and data analysis are directly related to each other. Each collected data is directly compared with the next data, and in this way the comparison is continued until the most accurate data is reached. The embedded theory method consists of systematic but flexible guidelines developed for collecting and analyzing qualitative data with the aim of constructing theories embedded in and sourced from data (Charmaz, 2006). Data analysis in embedded theory is a well-defined process that begins with basic descriptions, continues with conceptual arrangement, and leads to theorization (Patton, 2002). Embedded theory has turned into an excuse presented to the scientific world for the qualitative approach by ensuring that qualitative

research is evaluated according to quantitative standards (Atkinson, 1997).

RESULTS

The aim of many athletes participating in sports competitions is to win. However, participating in the Paralympic Games or being able to compete in sports is a great source of pride for Paralympic athletes. It is clear that athletes from certain branches have an advantage. In Paralympic Games, there may be a chance to achieve more success, especially in individual competitions rather than team sports. For example, there are more swimming medals than a team sport such as wheelchair basketball. In addition, as the number of competitions awarded with medals in the Paralympic Games increases over time, there will be differences in participation and success in the games from different branches. In this research, a list was created among the most successful and most medal-winning athletes in the history of the Paralympic Games and ranked according to their medal winning status. In addition, competition in both the Olympic Games and the Paralympic Games. In this way, the effect of the "relative age effect" phenomenon of the elite Paralympic athletes was examined.

Table 1. Top Paralympic gold medal winner athletes

Athlete	Country	Gender	Sport	Born Date
Trischa Zorn	USA	F	Swimming	June 1, 1964
Béatrice Hess	France	F	Swimming	November 10, 1961
Michael Edgson	Canada	M	Swimming	May 6, 1969
Sarah Storey	Great Britain	F	Swimming, Cycling	October 26, 1977
Jonas Jacobsson	Sweden	M	Shooting	June 22, 1965
Jessica Long	USA	F	Swimming	February 29, 1992
Roberto Marson	Italy	M	Athletics, Fencing	June 29, 1944
Mike Kenny	Great Britain	M	Swimming	January 30, 1945
Mayumi Narita	Japan	F	Swimming	August 27, 1970
Heinz Frei	Switzerland	M	Athletics, Cycling	January 28, 1958
Daniel Dias	Brazil	M	Swimming	May 24, 1988
Franz Nietlispach	Switzerland	M	Athletics	April 2, 1958
Chantal Petitclerc	Canada	F	Athletics	December 15, 1969
Erin Popovich	USA	F	Swimming	June 29, 1985
Claudia Hengst	Germany	F	Swimming	September 3, 1969

*Source: Retriewed from https://www.paralympic.org and https://www.topendsports.com/, March 23, 2023.

Table 1 shows the list of athletes who have won the most gold medals in total in the Paralympic Games. The swimmers and track and field athletes in the table have numerical superiority as they have more medals compared to team game athletes. It is seen that there are athletes with medals in different branches of athletics, as well as in cycling, shooting and fencing sports, in the list where the athletes who have excelled in swimming are predominant.

According to the table,

- Of the 15 athletes from different continents and countries, 8 are women and 7 are men,
- 7 out of 8 female athletes are swimming athletes,
- Only 3 of the 7 male athletes are in swimming,
- 5 out of 7 male athletes represent European continent countries,
- All of the medalists in more than one sport are from European Continental countries,
- 3 out of 4 athletes who have won medals in more than 1 sport are men.

The main focus of this stage is the evaluation of the most successful Paralympic athletes according to their date of birth in terms of “Relative age effect”.

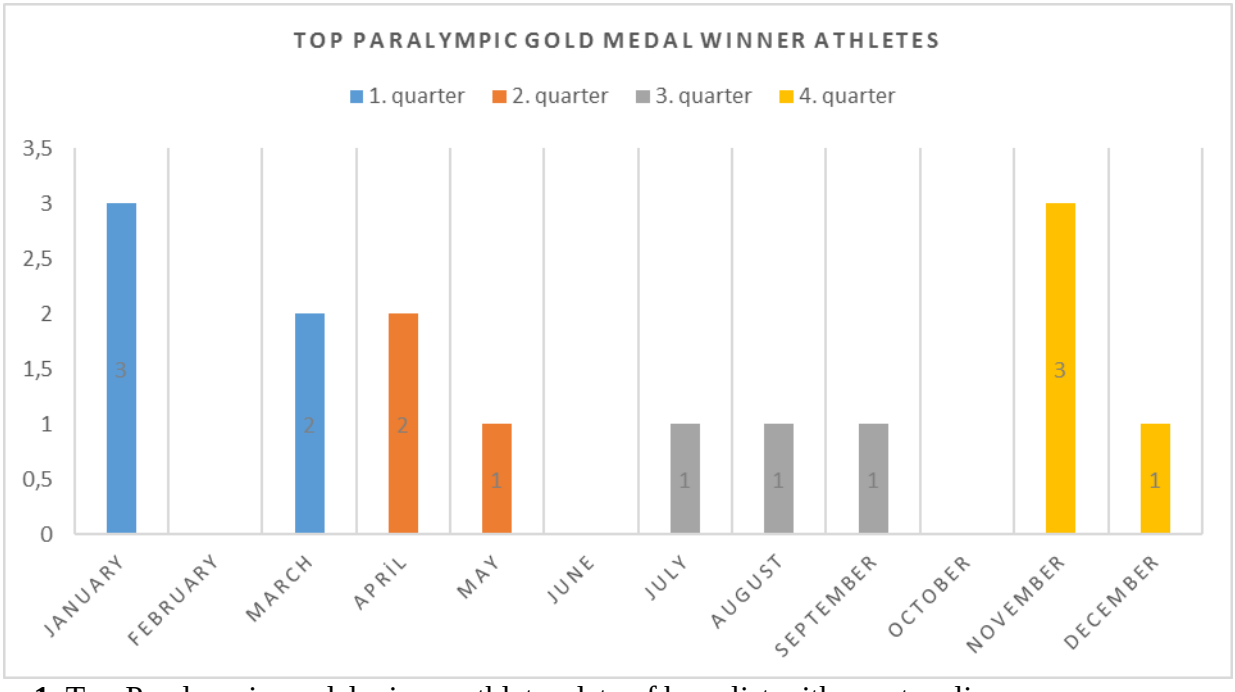

Figure 1. Top Paralympic medal winner athletes date of born list with quarter slice

In the Fig. 1, it is seen that the 15 elite athletes who won the most gold medals in the Paralympic Games are grouped according to their birth months, with the election year divided into quarters. In the chart where there are at least 3 athletes in each quarter, the athletes born in the 1st quarter have the highest number. The number of athletes born in the 1st and 2nd quarters is higher than those born in the 3rd and 4th quarters. Therefore, it is seen that the athletes born in the first half of the election year are more than the athletes born in the last part of the year, in direct proportion to the "relative age effect".

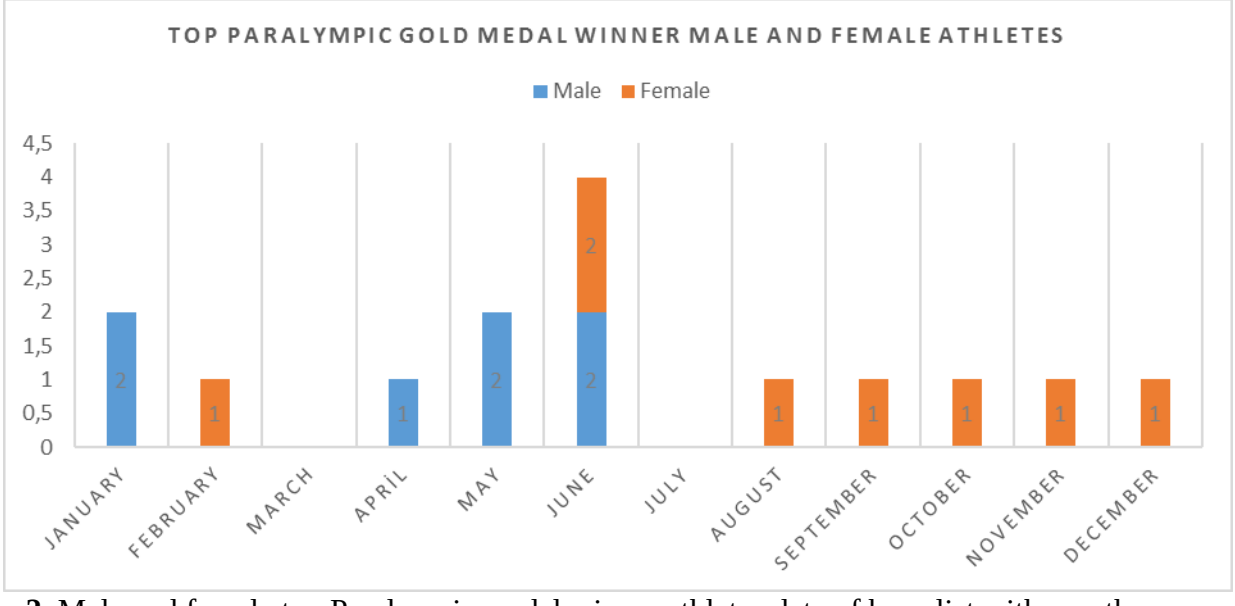

Figure 2. Male and female top Paralympic medal winner athletes date of born list with months

In the Fig. 2, all 7 male athletes who won the most gold medals in the Paralympics were born in the first months of the year. Although 3 of 8 female athletes were born in the first half of the election year, 5 female athletes are seen as born in the last months of the year. For the elite athletes with the highest number of gold medals in the Paralympic Games, those born in the first period of the year for men and those born towards the end of the election year for women dominate.

Competed and Medal Winner Athletes in the Both of Olympic and Paralympic Games

It is known that even before the Paralympic Games started in 1960, there were athletes with disabilities competing in the Olympics. Although some of the Olympic athletes became disabled as a result of an accident or illness in different parts of their lives, they returned to elite sports with the Paralympic Games. Paralympic Games are very important for disabled athletes in terms of being able to compete with each other and highlight their sportive aspects.

It is planned to look at the "relative age effect" according to the birth dates of the athletes by choosing 15 athletes who have succeeded in competing and winning medals in the Olympic and Paralympic Games. It is important to examine the relative age effect, especially when it is considered that athletes with Olympic Games experience have started to compete in sports from very young age groups, have reached national sportsmanship, and outstripped many of their peers in their own category.

Table 2. Competed and successful athletes in both olympic and paralympic games

Athlete	Country	Gender	Sport	Born Date
Neroli Fairhall	New Zelland	F	Archery	26 August 1944
Marla Runyan	United States	F	Track and Field	January 4, 1969
Natalie Du Toit	South Africa	F	Swimming	January 29, 1984
Paola Fantato	Italy	F	Archery	September 14, 1959
Sonia Vettenburg	Belgium	F	Shooting	November 12, 1954
Assunta Legnante	Italy	F	Shot Put, Discus Throw	May 14, 1978
Natalia Partyka	Poland	F	Table Tennis	July 27, 1989
Oscar Pistorius	South Africa	M	Running	November 22, 1986
Pepo Puch	Austria	M	Equestrian	January 10, 1966
Zahra Nemati	Iran	F	Archery	April 30, 1985
Melissa Tapper	Australia	F	Table Tennis	March 1, 1990
Sandra Paovic	Crotia	F	Table Tennis	April 15, 1983
Pal Szekeres	Hungary	M	Fencing	September 22, 1964
Ilke Wyludda	Germany	F	Discus Throw	March 28, 1969
Orazio Fagone	Italy	M	Short Track Speed Skating	November 13, 1968

*Source: Retrieved from https://www.olympics.com and https://www.paralympics.org, March 23, 2023.

Table 2 shows the elite athletes who have competed in both the Olympic and Paralympic Games and have been successful. It is seen that the Olympic athletes in the table compete in more diverse sports branches than the athletes who compete only in the Paralympic Games. In the table, 11 of the 15 elite athletes from different continents and countries are men and 4 are women.

In the Fig. 3, it is seen that the 15 elite athletes who competed in the Olympic Games and won medals in the Paralympic Games are grouped according to their birth months, with the election year divided into quarters. In the chart where there are at least 3 athletes in each quarter, the athletes born in the 1st quarter have the highest number. The number of athletes born in the 1st and 2nd quarters is higher than those born in the 3rd and 4th quarters. Therefore, athletes born in the first half of the election year are seen to be more than athletes born in the last part of the year, in direct proportion to the "relative age effect".

The Fig. 4 shows in which successful athletes who competed in the Olympic and Paralympic Games are evaluated in terms of gender according to the relative age effect. 8 out of 11 female athletes were born in the first months of the election year. 3 of 4 male athletes are seen as born in the last months of the year. It is understood that successful male athletes competing in both the Olympic Games and the Paralympic Games were born mainly in the last part of the year, while female athletes were born in the first half of the election year.

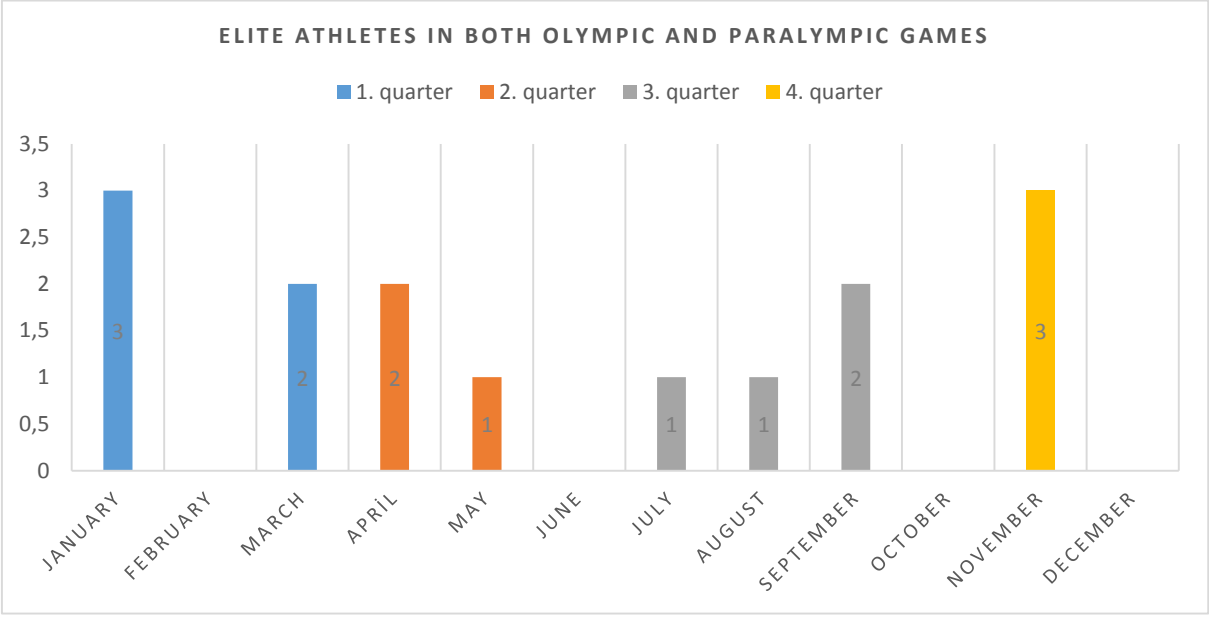

Figure 3. Competed elite athletes in both olympic and paralympic games date of born with quarter slice

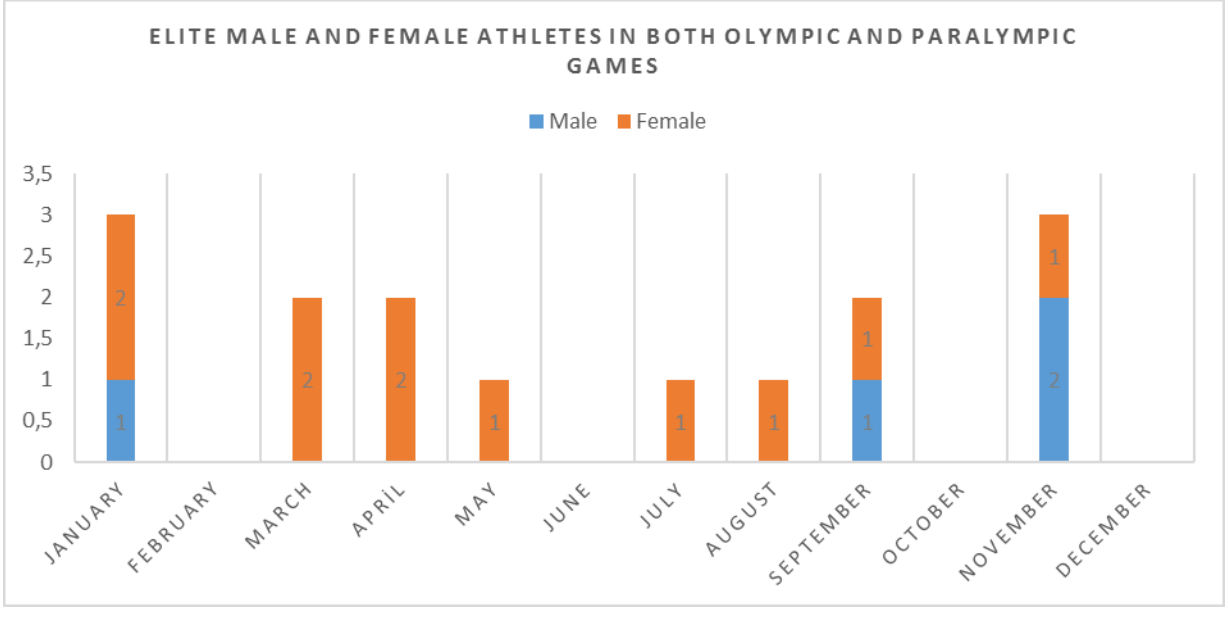

Figure 4. Competed male and female elite athletes in both olympic and paralympic games date of born list with months

As can be seen in the Fig. 5, when the 30 elite athletes who have excelled in the Paralympics are examined without gender discrimination, it is understood that there are more athletes born in the first months of the election year than those born in the last months of the election year. Thus, successful paralympic athletes are affected by the relative age effect.

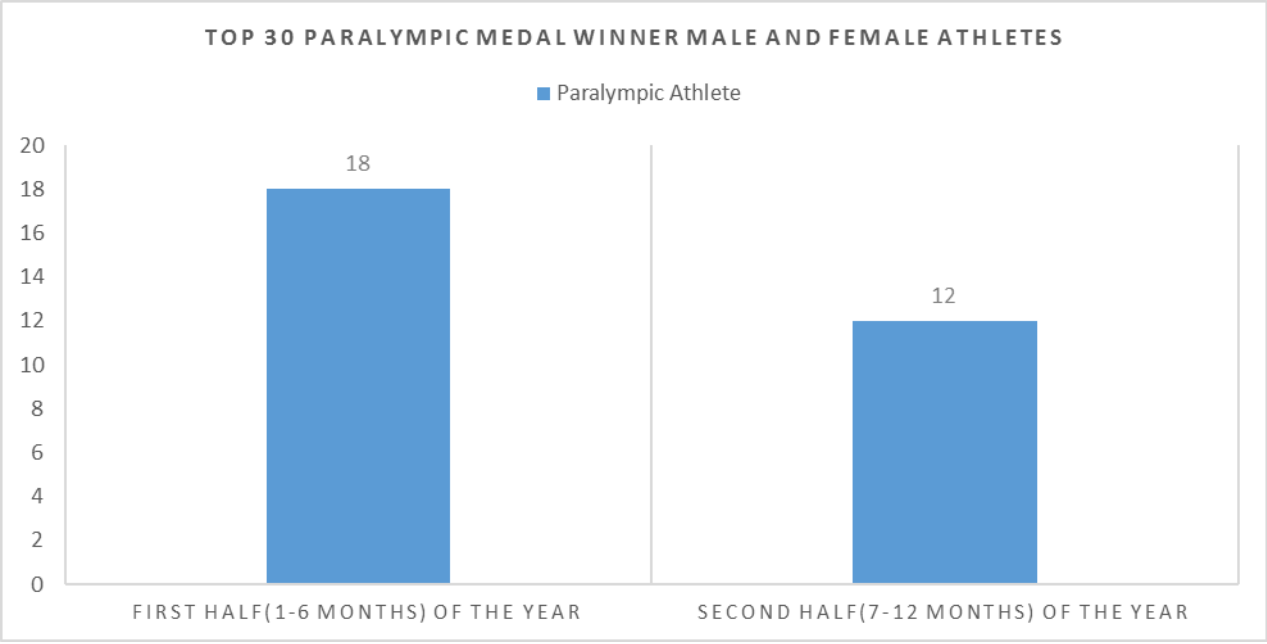

Figure 5. Top 30 medal winner paralympic athletes "relative age effect" graph

DISCUSSION

For nearly 50 years, many studies have investigated the relative age effect in the sports setting. Comparing the birth dates between junior and senior athletes in sports such as baseball, ice hockey, netball, rugby, football and tennis revealed skewed birth date distributions that favor individuals born prematurely in the election year (Musch and Grondin, 2001). In a study conducted for ice hockey, one of the aforementioned team sports; Bezuglov et al. (2020) examined the relative age effect of players playing in the Russian elite hockey league. In conclusion; They found that the teams in the Russian elite hockey league mostly included the athletes born in the first half of the year in their squads. Therefore, it can be said that teams and coaches shape their squads according to the relative age effects of the players. In another study; Rubia et al. (2020) investigated the relationship between the relative age effect and performance of the athletes participating in the World Handball Championships. As a result of the study; They found that there is a relative age effect between both male and female athletes in the U-19 and U-21 categories. However, they found that the athletes born in the first six months of the year took more time in the game and these players performed better than the athletes born in the other six months of the year. Similarly, in our study, it was seen in Table 1 that the majority of the paralympic athletes who won the most medals were born in the first six months of the year. In addition, Rubia et al. (2020) stated that the relative age effect of both male and female players is a criterion to be considered in order to select players for international competitions or competitions.

In another study; Lorenzo-Calvo et al. (2021) examined the effect of relative age on people involved in swimming. As a result of the study; It has been revealed that male swimmers are more affected by the relative age effect than female swimmers. In this study, it was observed that all male swimmers who won medals in the Paralympic Games were affected by the relative age effect. Among female swimmers, the number of athletes born in both halves of the election year remained the same.

In another study; De Larochelambert et al. (2022) investigated the relative age effect of athletes interested in the French mountain skiing discipline. As a result of this study; They found that both female and male athletes were born in the first six months of the year more and they performed better than the athletes born in the other six months of the year. Similarly, in our study, successful Paralympic athletes, for both female and male athletes, were more likely to be born in the first six months of the year and were more numerous than those born in the other six months of the year.

Zháněl et al. (2022) conducted a study examining the relative age effect of the top 100 elite female tennis players between 2007 and 2016. In the study; They found that more than half of 100

tennis players were born in the first six months of the year. In particular, they stated that there was a moderate relative age effect among the top 10 players. In our study, it was seen that more than half of the best Paralympic female athletes were born in the first six months of the year.

As a result, it was seen that the athletes who won the most medals in the Paralympic games and were born in the first half of the election year were more than the athletes born in the last part of the year, in direct proportion to the "relative age effect". For the elite athletes with the highest number of medals in the Paralympic Games, those born in the first period of the year for men and those born towards the end of the election year for women dominate.

It has been observed that the athletes competing in both the Olympic Games and the Paralympic Games and winning medals are also affected by the "relative age effect". It is understood that successful male athletes competing in both the Olympic Games and the Paralympic Games were born mainly in the last part of the year, while female athletes were born in the first half of the election year.

When the two groups of paralympic athletes observed in the study are examined together, it is understood that the athletes born in the first months of the election year are more than the athletes born in the last months of the year. Thus, it is understood that elite Paralympic athletes are affected by the relative age effect.

Author Contributions

Study Design: BB; Data Collection: BB, AC; Analysis: BB; Manuscript Preparation: BB, AC.

Ethical Approval

Ethics committee approval of the study was obtained by the decision of the ethics committee of Istanbul Topkapi University, dated 20.03.2023 and numbered 2023/03 E-49846378-302.14.1-2300002932 and our study was performed by adhering to the Helsinki Declaration.

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Conflict of Interest

The authors hereby declare that there was no conflict of interest in conducting this research.

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