

## QUANTITATIVE ANALYSIS OF MEN'S EHF EURO 2020, SWEDEN-AUSTRIA-NORWAY

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**Abstract.** *The purpose of the present research is to investigate the performance of the teams participating in Men's EHF Euro 2020 hosted by Sweden, Austria and Norway, using the statistical data recorded during the competition. Twenty-four European teams took part in the event. It is for the first time in the history of handball that a special smart ball has been used to provide a lot of new details in real time. A total number of 5779 shots were taken during the competition and 3532 goals were scored. The average efficiency at this event had a value of 60%. The average number of scored goals per game was 26.5. Only 12% of the total number of goals were scored in the first phase of the offence. A total number of 93067 passes were counted during the competition, with an average of 718 passes per game. Of these, 1760 assists were counted throughout the competition, with an average of 13 assists per team in each played game. The players used by the 24 participating teams ran a total distance of 3845.5. An average distance of 29.7 km was run per game. The Norwegian player Sander Sagosen was the top scorer of the competition, with 65 goals. The fastest shot was recorded by Filip Taleski from North Macedonia, with a speed of 141 km/h. The highest jump, 75 cm, was recorded by Miquel Martins from Portugal. The paper also highlights the differences between teams regarding all the mentioned variables.*

**Keywords:** *handball, men, statistic.*

### Introduction

The analysis of sport performance has been used since the end of the 19<sup>th</sup> century for various purposes. According to Calmet et al. (2019), the works of specialists allow qualitative analysis (interpretation of the action) and quantitative analysis (distance, velocity, time and power).

Statistics and video analysis in rugby have shown differences between winning and losing teams (Van Rooyen, 2012), using variables such as recovered balls, frequency and earned points by invading the rivals' 22-m zone, kicking effectiveness. Concerning the same topic, Vaz, Hendricks and Kraak (2019) conclude that further establishment of these variables and their influence on performance may be used to assess team performance and plan more effective tactical approaches to competition.

All kinds of statistics are possible with the help of technology, which is renewing and evolving rapidly, bringing useful information to all areas, including the field of sport.

Cronin et al. (2017) raised the question whether new technology could be a problem for coaches. At the end of their research, one of the conclusions was that "we do not see the development of technological devices as a problem for coaches. On the contrary, we argue that technology itself is not a problem and can add much value to the experiences of both coaches and athletes". Moreover, Collins, Carson and Cruickshnak (2015) support this idea

stating that technology can encourage a more rational, objective and quantified view of human performance.

Technology has made its presence felt in the field of soccer as well, its advantages being emphasized by Groom, Cushion and Nelson (2011): technology is increasingly recognized and universally used with the intention of enhancing the coaching process.

In volleyball, video analysis was used to improve the performance of young athletes. Parisi and Raiola (2014) highlighted the differences between two teams with different average age. They have concluded that video analysis is particularly useful in the growth stage, and then in youth teams to increase the learning of motor skills and technical training.

In recent years, statistical and video analyses have also aroused interest among handball researchers. Smits et al. (2011) gathered qualitative analysis at the final tournament of women's U19, while Bilge (2013) accounted statistical analysis from all three major handball competitions, namely European Championship, World Championship and Olympic Games.

The relationship between field performance in handball, age and anthropometric parameters was a topic of debate for Hammami et al. (2019), whose main purpose was to determine which anthropometric and maturity variables had the greatest relative importance in fitness for this sport.

Because major international handball events are powerful indicators (Vărzaru, Tudor, & Mujea, 2018), we have researched over time the current state of the various variables in handball. Both defense and offence performances of the Romanian Women's National Team were analyzed at the EHF Euro 2014 (Vărzaru & Cojocaru, 2016). Cumulative statistical data about player performance were collected and analyzed after a Champions League Final Four for women (Vărzaru, 2015). The somatic characteristics of wing players were established by observing the female players of the Romanian League (Cojocaru et al., 2015), 6-m throws were studied referring to female players who performed at the 2015 World Championship (Vărzaru & Igorov, 2016), while the statistical model of the wing player was outlined based on the wings participating in the 2012 European Championship (Vărzaru & Igorov, 2012).

The *purpose* of the present paper is to investigate the performance of the teams participating in Men's EHF Euro 2020 held in Sweden, Austria and Norway. The European Handball Federation has decided that, starting with this competition, the number of participating teams should be increased from 16 to 24. It is one of the measures taken by the European Federation with the intention of promoting handball in a larger number of countries, considering that the final tournament is a highly requested event by televisions, its organization being a real show.

Another measure taken to increase the attractiveness of handball and help coaches and staff that seek to better prepare their strategies was to provide more details than ever about the performance achieved by athletes during the games played at this competition.

Using a smart ball with a built-in chip that tracks and distributes data in real time, spectators and not only could benefit from insights into ball speed, shot detection, shot position or ball position into the goal. Technologization of the competition did not stop here. Details regarding the highest jump, the number of passes or the number of kilometers run during each game were provided. The details provided with the help of technology are not only important for increasing attractiveness among spectators, but also for helping those

directly involved – coaches and players to use this kind of data when analyzing their own performance or that of the opponents.

## Methodology

Men's EHF Euro 2020 was played between 10 and 26 January. Twenty-four teams participated in the event and another novelty regarding its organization was the number of countries hosting the competition together. If, until recently, the tendency was to offer a couple of countries the chance to organize this type of tournament, in 2020, three nations have won the bid for organizing the European Championship. Together with Sweden, Austria and Norway as organizing countries, the other 21 teams were distributed in 6 preliminary groups of 4 teams each. Great and spectacular handball was seen in the 6 hosting halls: Sweden chose Gothenburg's Scandinavium, Malmo Arena and Tele 2 Arena for two preliminary round groups, one main round group and the final weekend, Austria hosted two preliminary round groups, one main round group in Stadhalle Graz, while in Norway two preliminary round groups were played in Trondheim Spektrum hall. Tele 2 Arena in Stockholm has a capacity of over 20,000 seats for spectators and hosted the finals of the tournament.

The details about the 24 teams participating in the tournament were collected by observing and analyzing the official website of EHF Euro 2020. The collected data were later interpreted using mathematical indicators such as sum, average, minimum, maximum, but also graphical representation to provide a better image of each detail observed through this research.

Table 1. *Somatic characteristics of the teams participating in Men's EHF Euro 2020*

Country	Age avg	Height avg	Weight avg
SPA	31.2	193	95
CRO	27.3	194	98
NOR	25.9	191	92
SLO	26.3	193	96
POR	27.1	192	98
GER	27.4	194	96
SWE	26.8	191	95
ISL	27.8	191	92
HUN	24.8	194	95
BLR	28	194	93
AUT	27.6	192	95
CZE	28.7	193	91
BIH	30.1	194	99
LAT	30.5	191	93
FRA	27.6	193	97
RUS	28.7	193	91
SRB	26.8	192	94
UKR	27.7	195	100
MKD	27.5	192	92
SUI	27.3	192	92
DEN	29.8	192	96
MNE	27.4	192	93
POL	24.7	193	92

NED	27.3	191	90
Average	27.7	193	94
Min	24.7	191	90
Max	31.2	195	100

The mean age of the teams qualified for the mentioned final tournament was 27.7 years. The youngest team present in the competition was Poland, with an average age of 24.7 years, closely followed by Hungary, whose players had an average age of 24.8 years. At the opposite pole, we found Spain, with the most experienced team, whose average age was 31.2 years. Two more teams exceeded 30 in terms of age: Bosnia Herzegovina and Latvia. Eleven teams participated in the competition with teams whose average age was 27 years.

When talking about height, no big difference was between the 24 teams. The tallest team was Ukraine, with an average of 195 cm, while the smallest value was recorded for 5 teams: Netherlands, Latvia, Island, Sweden and Norway (191 cm). The mean height at this European Championship had a value of 193 cm. Six teams recorded the mean height value: Poland, Russia, France, Czech Republic, Slovenia and Spain.

The average weight of the teams fluctuated between 90 kg, a value recorded for Netherlands, and 100 kg, a value recorded for Ukraine. The mean weight at Men's EHF Euro 2020 was 94 kg. There was only one team to reach this value, namely Serbia.

## Results

A total number of 5779 shots were recorded throughout the competition, of which 3532 goals were scored. Table 2 highlights the efficiency of each team. The highest value was recorded by Spain (68%), followed by Germany, with 66%, while the lowest value was counted for Poland (54%), closely followed by Montenegro, Switzerland and Serbia, teams whose mean scoring efficiency was 55%. The average in the tournament had a value of 60% and was recorded by Czech Republic.

Table 2. Team scoring efficiency during Men's EHF EURO 2020

Country	No. of games	Goals	Shots	Efficiency
SPA	9	278	411	68
CRO	9	227	383	59
NOR	9	273	434	63
SLO	9	245	390	63
POR	8	228	350	65
GER	8	232	349	66
SWE	7	182	309	59
ISL	7	191	323	59
HUN	7	176	306	58
BLR	7	209	336	62
AUT	7	205	322	64
CZE	7	172	286	60
BIH	3	73	128	57
LAT	3	73	120	61
FRA	3	82	135	61
RUS	3	76	136	56
SRB	3	72	130	55
UKR	3	74	124	60
MKD	3	79	138	57

SUI	3	77	141	55
DEN	3	85	130	65
MNE	3	70	128	55
POL	3	73	134	54
NED	3	80	136	59
Total		3532	5779	60

Figure 1 shows the average number of goals scored per game by each country. The team with the best offense was Spain, with 31 goals scored per game, closely followed by Norway and Belarus (30). Slovenia, Germany and Austria were the teams that scored 29 goals per game. The countries with the lowest number of scored goals per game were Montenegro, with 23, and Poland, Serbia, Latvia and Bosnia Herzegovina, each with an average of 24 goals scored per game.

Out of the 4 teams that played 9 games until the end of the competition, Spain was the team with the biggest number of goals scored in the tournament (278). The mean value of goals scored by the teams that made it through the end of the competition was 28.4 per game. For the teams with the lowest number of games played in the competition, the mean value of scored goals was 25.4 per game. Six other teams played 7 games in the EHF EURO 2020. In this case, the mean value recorded for goals per game was 27.



Figure 1. Average number of goals scored by each team during Men's EHF Euro 2020

When observing the fast phases of the offense, we could see that 419 out of the 3532 goals were scored on fast break, meaning only 12% of total. The explanation for this low number might be the competitive system, with games played by teams sometimes after less than 24 hours, which means a lot of fatigue accumulated by players, especially those who have reached the last phase of the competition and ended playing 9 games within 14 days. Figure 2 shows the average number of goals scored on fast break per game by each participating team. France was the team who scored most in the first phase of the offense, but it should be taken into consideration that this team had been early eliminated from the competition, after only 3 games played, so there was no time for getting tired and slowing down the pace in their playing strategy. Among the teams who played most of the games during the competition, Spain is leading in the fast break top, with an average of 5.3 goals per game scored in the first offense phase.



Figure 2. Average number of goals scored by each team during Men's EHF Euro 2020 on fast break

The goals were scored following the strategy of each team for the offense phase, the playing concept being established according to the particularities of each team, the handball school of origin. Thus, for the construction of offense phases, there are differences regarding the number of passes used by each team to build their concrete shooting situations. The figure below highlights the average number of passes counted per game for each team. Bosnia Herzegovina is the team with the highest number of passes, with 905 more than the following team, Poland, with 822. One more team succeeded to pass the ball with an average value bigger than 800 and that was Netherlands. Twelve other teams passed the ball around 700 times per game, while the lowest number of passes was recorded for Denmark, with an average of 468 passes per game.



Figure 3. Average number of passes per game for each team during Men's EHF Euro 2020

It is for the first time in history of handball competitions that details about the running distance have been recorded throughout the competition. Overall, 3845.5 km were run by the players of the 24 participating teams. The differences between teams were big, as the number

of games played by each team ranged between 3 games for the teams that left early the competition and 7, 8 or 9 games for the teams who reached the final stages of the competition. The figure below reveals the average number of kilometers run per game by each team. As seen in Figure 4, two teams had a running distance over 32 kilometers per game: Switzerland, with an average of 32.6 km, and Poland, with 32.1 km. Another 5 teams ran over 31 kilometers per game: Spain, Germany, Island, Austria and Netherlands. At the opposite pole, the team who ran the lowest number of kilometers per game were Serbia, with 24.9 kilometers, followed by Montenegro, with 26.3 km, and Slovenia, with 26.6 km.

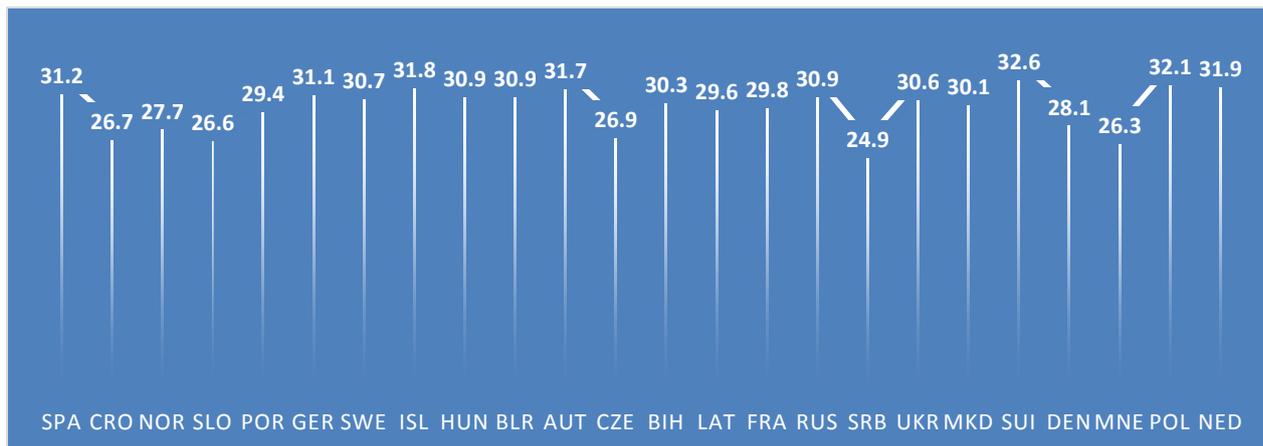


Figure 4. Average running distance for each team during Men's EHF Euro 2020

The teams competing in EHF Euro 2020 showed refined playing concepts designed according to the particularities of their own players. In each team, it could be observed key players who were leaders for each phase of the game, but also players with impressive physical qualities, counted in the statistics provided by the organizers in details like fastest shot or highest jump.



Figure 5. Fastest shot and highest jump for each team at EHF Euro 2020

When talking about the highest jump, Figure 5 shows that there were important differences between the players of the teams. The recorded values were between a minimum

of 67 cm for the Latvian team and a maximum of 75 cm for the Portuguese team. A number of 13 other players succeeded to jump close to the highest value, with only one centimeter less than the maximum.

Regarding the fastest shot, powerful players at the 9-m line could be found in each team. These players managed to throw the ball into the net with a speed between 131 km/h and 141 km/h. Filip Taleski from North Makedonia had the fastest shot in the tournament, followed by a player from Czech Republic, with the fastest shot, namely 140 km/h. The least powerful shot in this top was recorded for players from France and Serbia, with 131km/h.

The last analyzed details regarding the performance of the 24 teams participating in the EHF Euro 2020 refer to the number of assists and technical faults. Of the total number of 93067 passes, 1760 passes were the last ones from which a player scored a goal. The figure below reveals the average number of assists per game counted for each team. It can be seen that North Makedonia and Austria are leading the top with 19.7, respectively 19.3 assists per game. Montenegro and Serbia, with 6 and 7.7 assists per game, are the teams with the lowest recorded value.

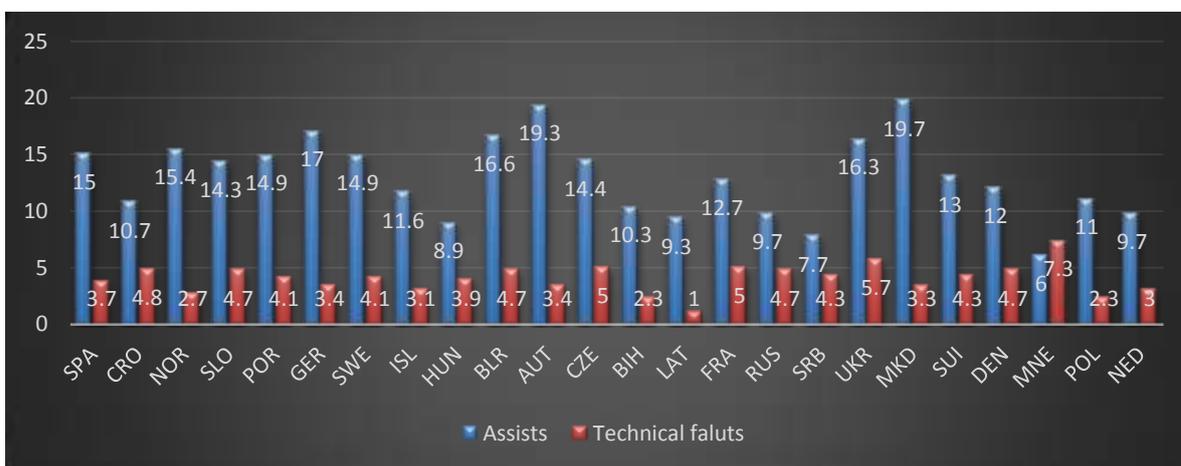


Figure 6. Average number of assists and technical faults per game for each team at EHF Euro 2020

In Figure 6, it can also be observed the average number of technical faults made per game by each team. From the statistics, we can conclude that this kind of mistake has been kept at a low level. The maximum number of technical faults per game had a value of 7.3 for the team of Montenegro, and the minimum number of technical faults per game had a value of 1 for the team of Latvia.

## Conclusion

At Men’s EHF Euro 2020 held in Sweden-Norway-Austria, a number of 24 teams competed against each other in a tournament that lasted 2 weeks. A total number of 3532 goals out of 5779 taken shots were scored in the 71 played games. The efficiency counted at the end of the competition had an average value of 60%. Spain was the most effective team,

with 68%, followed by Germany, with 66%, while the lowest value was counted for Poland (54%).

The number of goals scored per game was 26.5. The team with the best offense was Spain, with 31 scored goals per game, closely followed by Norway and Belarus, both with 30 goals per game.

There are differences regarding the number of passes used by each team to build their concrete shooting situations and to score. Bosnia Herzegovina is the team with the highest number of passes, 905, followed by Poland, with 822, and Netherlands, with 812. The remaining 21 teams recorded values below 800 passes. The lowest number of passes was recorded for the team of Denmark, with an average of 468 passes per game.

A total of 1760 passes were the final ones from which a player scored a goal. The average of assists counted per game during the European Championship had a value of 12.9. North Makedonia and Austria are leading the top with 19.7, respectively 19.3 assists per game. Montenegro and Serbia, with 6 and 7.7 assists per game, are the teams with the lowest recorded value.

The number of technical faults was kept at a low level in this tournament, with an average of 3.9 per game. The highest rate of mistakes was counted for Montenegro (7.3), and the minimum number of technical faults per game had a value of 1 for Latvia.

There was also a lot of running, the effort provided by players being counted at 3845.5 km ran throughout the event, with an average of 29.7 km per game. Two teams had a running distance over 32 km per game: Switzerland, with an average of 32.6 km, and Poland, with 32.1 km, while the teams who ran the lowest number of kilometers per game were Serbia, with 24,9 km, followed by Montenegro, with 26.3 km. These values prove that handball is a very dynamic sport involving a lot of movement.

The Norwegian player Sander Sagosen was the top scorer of the competition, with 65 goals. The fastest shot was recorded for Filip Taleski from North Makedonia, who succeeded to throw the ball into the net with a speed of 141 km/h. The highest jump, 75 cm, was recorded for Miquel Martins from Portugal. Domagoj Duvniak, from the Croatian team, was designated the most valuable player of the competition. The Swedish Jim Gottfriedsson passed the ball more time than any other player, with 1414 passes. The quickest player, Jerry Tollbring, who reached 32 km/h, was also from Sweden. The athlete who played most of the time during this event was Kristjan Bjornsen, with 7 hours and 46 minutes recorded on the field.

With the help of statistical analysis, performance in handball can be assessed in order to develop an understanding of individual and collective actions, and thus to support coaches and players on their way towards achieving optimal results. The best results will always stand for those who will not only perform at the highest level on the field, but also for those who will prepare the competition before its start by observing, through statistical and video analyses, the opponents' behavior, individual and collective trends, strengths and weaknesses.

Another great handball competition has come to an end. As any other event of the kind, the studied competition highlighted some characteristics of current handball. The dynamism of our sport was revealed by the circulation of the ball (718 passes every 60 minutes) and the circulation of players (29.7 km run per game). The speed of the players also supports the mentioned characteristic (32 km/h was reached by the fastest player). Making the best

decisions under a lot of pressure, but also at the highest speed, is another important characteristic that makes the game of handball so attractive. The low number of mistakes (3.9 per game) and the above-average scoring efficiency (60%) show that this characteristic has been fully exploited.

The details revealed even after the end of the competition highlight the spread and success of handball worldwide and have made the European Handball Federation conclude that the mentioned event is the biggest in the EHF history: a record number of 500,000 fans watched the action live inside the 6 arenas, social media channels of EHF EURO grew by 27%, online video views reached 12 million, 20,000 people voted for All-Star Team. The competition was screened by almost 90 broadcasters, while approximately 1 million fans accessed EHF TV, half of those watching the games live on the mentioned platform. Croatia's miraculous comeback against Germany was watched by 7.4 million fans.

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