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Tennis Injury: Analysis and Preventions Actions among National Junior Tennis Athlete

[1]Didik Rilastiyo Budi, [2]Boby Agustan, [3]Arfin Deri Listiandi, [4]Rohman Hidayat, [5]Rifqi Festiawan, [6]*Yulingga Nanda Hanief, [7]Wildan Qohhar, [8]Anang Setiawan, [9]Lutfi Nur

***ABSTRACT**--This study aimed to analyze the level of injury happens among national junior tennis athlete, so that the injury preventive actions can be conducted by recommending exercise programs, number of matches as well as the recovery process. Research methodology applied was Ex-spostfacto study with research approach through observation and interview. Further, the research instruments referred to Joshua et. al (2015) and Kekelesi et. al. (2020) which classifies the tennis injuries into some parts such as shoulder, hand and wrist, elbow, back, hip, thighbone, and ankle as well. Sample of the research used was all the national junior tennis athletes with the age range of 12-18 years old who joined National Tennis Tournament "Totalindo" in total 117 athletes with 73 male, and 44 for female athletes. The analysis and processing of data applied was Ms. Excel application for finding the profiles and the type of injury that whole junior athletes suffered from. Research result proved that the record of injury level happens among national junior tennis athletes in the age range 12-18 was high because there were 156 injury cases from 117 total sample used. In detail, 89 injury cases happened to male athletes and 67 cases to the female. In order to decrease the risk for experiencing the injury, so fundamental movement and multilateral training are highly recommended for junior athletes with age range 12-14 during the training programs. Meanwhile, for those in age range 16-18 can be applied such a proper programs dealing with physical training, techniques, strategies, mentality, and also the recovery programs can boost the athletes to grab more achievements.*

***Keywords**--*Tennis Injury, Analysis, Preventions, Junior Athlete

I. INTRODUCTION

Tennis is related to fast playing, high intensity and also good stamina needed [21]. It is because tennis takes such long duration, but limited break time. As its difference from other sports, every single match in tennis is not restricted by playing duration and it probably stands for several hours [1]. Tennis matches are conducted in high intensity, fairly short duration of break (60-90 seconds) and in some cases, matches are conducted for more than

[1] *Physical Education Program, Faculty of Health Sciences, Jenderal Soedirman University, Indonesia, didik.rilastiyo.budi@unsoed.ac.id*
[2] *Physical Education Program, Teaching and Educational College (STKIP) Muhammadiyah Kuningan, Indonesia, bobyagustan@upmk.ac.id*
[3] *Physical Education Program, Faculty of Health Sciences, Jenderal Soedirman University, Indonesia, arfinderilistiandi@gmail.com*
[4] *Physical Education Program, Faculty of Health Sciences, Jenderal Soedirman University, Indonesia, hidayatrohman100789@gmai.com*
[5] *Physical Education Program, Faculty of Health Sciences, Jenderal Soedirman University, Indonesia, rifqi.festiawan@unsoed.ac.id*
[6] **Physical Education Program, Universitas Nusantara PGRI Kediri, Indonesia, yulingganandahanief@gmail.com*
[7] *Physical Education Program, Teaching and Educational College (STKIP) Situs Banten,Indonesia, wildan.qohhar@stkipsitusbanten.ac.id*
[8] *Physical Education Program, Teaching and Educational College (STKIP) NU Indramayu, Indonesia, anangsetiawan@stkipnu.ac.id*
[9] *Indonesian University of Education, Tasikmalaya Campus, Indonesia, lutfinur@upi.edu*

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5 hours [2]. According to this opinion, it can be said that tennis players must have good physical stamina and condition [22].

The physical condition of a tennis player has certain characteristics, which are adjusted to the tennis game itself. Kovac in [3] explained that the physical components of tennis players consist of speed, agility, strength and endurance. Moreover, physical conditions that strongly possessed by tennis players are: cardiorespiratory endurance, muscular endurance, strength, agility, flexibility, speed and power [4]. Physical condition of an athlete takes such an important factor in the game of tennis, tennis players with an equal technical skills, it will benefit players with better physical conditions. The results of previous studies showed that good physical condition bring such a positive effect on the performance of junior athletes in performing various technical skills during the matches [5].

Beside physical conditions, tennis players also strongly required to be able to perform various skills in playing tennis in order to support the game. The requirements of tennis games are a combination of both aerobic and anaerobic activities in which there are various kinds of stroke techniques [6]. Furthermore, [7]explained that the basic technique of tennis consists of (a) service, (b) forehand and backhand groundstrokes, (c) volley, (d) lob and (e) smash. Various techniques in tennis can be well done if the players do such appropriate training programs.

Implementing an exercise program not only elevates the technical aspects of the game, but can also improve the physical power of the athletes. Appropriate training techniques totally required to help the junior athletes to be success in mastering the tennis playing technique [8]. Previous studies claimed that the proper training methods can lead to significant improvement skills in the type of Close Skills sports such as tennis [9]. So it is totally important for a tennis coach to provide such kind of moderate training portion that is neither too light nor too heavy, especially for junior athletes who can find a negative effect on the training process.

Such an unwell managed of training programs implementation comes as the problem occur in the training process, especially for junior athletes in the age range 12-18 years. As the result, trainings are ineffective even it causes the risk of injury to athletes because of high level of training burdens. Research data shows that injuries happen among tennis athletes occur because of the high training pressure as well as the unrestricted match schedule [10]. Junior tennis athletes experiencing injuries do heavier training (overtraining) within a week and do more matches in a year than athletes who are not [11]. A strict training program and a very intensive mathes schedule lead junior tennis athletes to be prone to injuries and can hamper the athlete's career on the next period.

The results showed that the prevalence of injury in tennis athletes occurred in the lower body by 67% consisting of ankle and thigh injuries, 49% upper body consisting of shoulder and elbow injuries, and 21% of back injuries [6]. Overtime tennis activities causes excessive muscle fatigue and lack of skill in playing techniques is one of the factors causing injury to the upper body such as the scapula and shoulder [12]. Based on the results of research that has been done, injuries that occur in junior tennis athletes dominated by upper body injuries, middle and that caused by the burden of training and the number of matches excess.

Indonesia has a number of really talented junior tennis athletes gaining awards by winning such international competitions. Regarding the number of junior tennis athletes in Indonesia based on data from PP PELTI in May 2020 who were actively involved in various national and international championships from the age of 10-18 there were 1,424 male junior athletes and 730 female junior athletes, with a total of 2,154 athletes juniors who are scattered in various regions in Indonesia (PP PELTI, 2020). According to the data, it can be stated that Indonesia has very good potential because of the number of highly talented athletes owned.

However, with a very large number of junior players, this does not happen at the senior level, because the number of junior athletes who can achieve at the senior level in the national or international level is not that large. Based on data from PP PELTI (2020) there were 147 senior male athletes and 92 female senior athletes with a total of 239 athletes or only 28.11% based on the comparison of the number of athletes aged 16-18 years. The data shows that junior athletes are not capable enough to maintain and even improve their physical condition and performance from junior to senior level.

The high level of injury among junior tennis athletes in Indonesia was one factor that has led to a decreasing number of talented junior athletes who can compete and excel at national and even international scales. The research data showed that 55 tennis athletes in DKI Jakarta Province, there were 24 athletes (43.64%) injured and 27 athletes (49.07%) were athletes who had suffered minor injuries [13]. Based on these data it is necessary to have a more in-depth study of the factors that cause injuries to tennis athletes, especially at the junior level.

Research on sports injuries in Indonesia has been widely carried out in various sports, but in tennis, researches focus on sports injuries experienced by junior tennis athletes is still very rarely conducted. If there is research on injuries among tennis athletes, it was still limited to senior national athletes or certain regional athletes. So far, no one has studied the identification of sports injuries in junior tennis athletes at National matches. Besides, research on tennis athlete injuries is also still limited to the identification of injuries in one part of the body, such as tennis elbow, hamstring, shoulder or injuries around the back. So, the entire data have not been obtained whether junior tennis athletes in Indonesia are vulnerable to injury or in good condition.

Based on facts and research data, it is important to analyze and identify the factors as well as the types of injuries experienced by Indonesian national tennis athletes so that solutions can be found to minimize the occurrence of injuries to junior athletes. This research was important because potential junior athletes must be prioritized in terms of training, competition and recovery programs so the risks of injury hampering the achievement of senior level can be avoided. The purpose of this study was to examine and identify the level of sports injuries suffered by Indonesian national junior tennis athletes, as well as find out solutions to prevent injuries.

II. METHOD

This research applied the ex-postfacto descriptive method. [14] explains that ex post facto research is a type of research conducted to study an event that has occurred and then analyzed the factors that cause the event. The research approach used both observation and interview techniques [15]). Observation carried out by directly observing if there are athletes who suffered injuries during the match, while the interview technique is done by asking athletes directly about the types of injuries that have been experienced during training and competing in tennis, whether it was minor, moderate or severe injuries.

The observation and interview research instrument used refers to [6], [12] which classifies tennis injuries occurring on the shoulders, hands and wrists, elbows, stomach and groin, back, hips, thighs, and ankles, these types of injuries were used as topics for interviews and guidelines for observing sports injuries in junior tennis athletes. The population in this study was all tennis athletes who took part in the "Totalindo" National Tennis Championship in Purwokerto which was held in September 2018, while the sample was all male and female junior tennis athletes from the Age Group (KU) 12-18 years who took part in the Championship. "Totalindo" National Tennis Court with 73 male athletes and 44 female

athletes so that the total research sample used is 117 national junior tennis athletes, the samples were obtained using purposive sampling techniques which are detailed in table 1 as stated below

Table 1: Number of Junior Tennis Athlete Samples

Age Range	Male	Female	Total
Age 12 y.o.	23	13	36
Age 14 y.o.	23	14	37
Age 16 y.o.	15	9	24
Age 18 y.o.	12	8	20
Total	73	44	117

Analysis and processing of data applied on this research was the Ms.Excel application worked to determine the whole profile and type of injury that occurs in junior tennis athletes and in each age group both male and female athletes, so that can be concluded about the type and level of injury experienced by national junior tennis athletes as well as the provides high recommended training program to prevent injury.

III. RESULT

The results of research on the number of national junior tennis athletes experiencing injuries during training and the overall competition of the age group 12-18 years, both male and female athletes can be seen in table 2 below:

Table 2: Profile of Injury Prevalence Experienced by Junior Tennis Athletes Age Group 12-18 Years

Injuries Case	Total
Male Athletes	89
Female Athletes	67
Total	156

Based on the data explained in the previous discussion, it was shown that injury cases occur in national junior tennis athletes with age range of 12-18 years were at a high rate with 89 injuries for the male athletes and 67 cases for female athletes with a total of 156 injury cases suffered by national junior tennis athletes. Below is a profile of the types of sports injuries suffered by junior tennis athletes aged 12-18 years, seen in table 3 and figure 1 below

Table 3: Types of Injuries in Junior Tennis Athletes

Type of Injuries	Age 12	Age 14	Age 16	Age 18	Total
Shoulder	7	8	5	5	25
Elbow	10	3	3	4	20
Arm	9	7	6	3	25
Back	2	3	4	4	13

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Knee	2	4	3	6	15
Hamstring	5	9	9	8	31
Ankle	5	10	5	7	27
Total	40	44	35	37	156

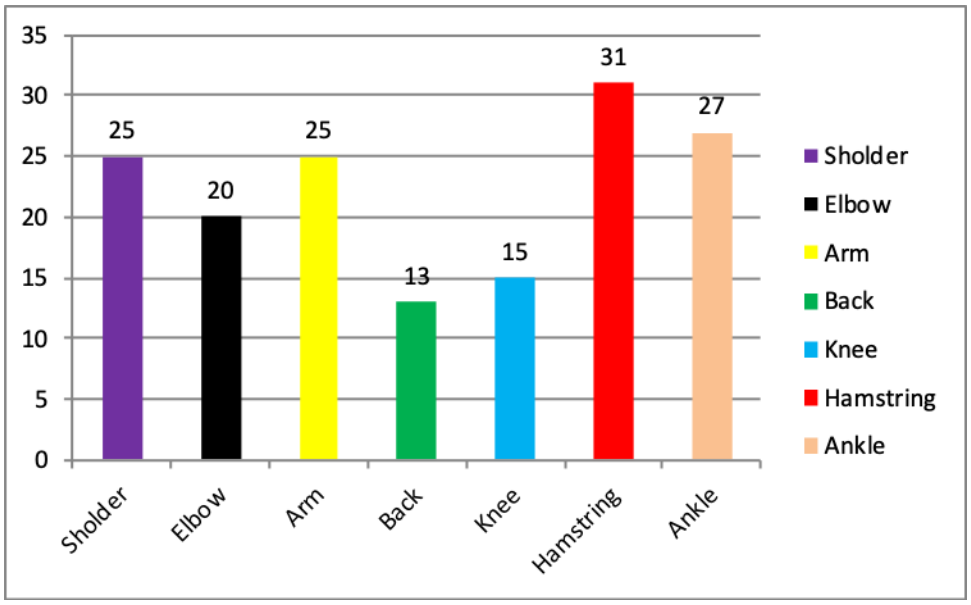

Figure 1: Types of Injuries in Junior Tennis Athletes

Based on data shown in table 3 and figure 1 it can be concluded that in junior tennis athletes age 12 years there were 40 cases of injury, 14 years 44 cases of injury, 16 years 35 cases of injury and 18 years 37 cases of injury. Whereas for this type of injury there were 25 (16.03%) cases of shoulder injuries, 20 (12.82%) elbow injuries, 25 (16.03%) hand injuries, 13 (8.33%) back injuries, 15 (9.62%) knee injuries, 31 (19.87) thigh injuries (hamstring) and 27 (17.31%) ankle injuries.

Next, the data profile of the history of sports injuries ever experienced by national junior tennis athletes in the age group of 12 years during training or competition can be seen in table 4 and figure 2 below.

Table 4: Profile of injury prevalence experienced by junior tennis athletes of 12 years old

Type of Injuries	Male	Female	Total
Shoulder	5	2	7
Elbow	7	3	10
Arm	6	3	9
Back	1	1	2
Knee	2	-	2
Hamstring	4	1	5
Ankle	4	1	5
Total	29	11	40

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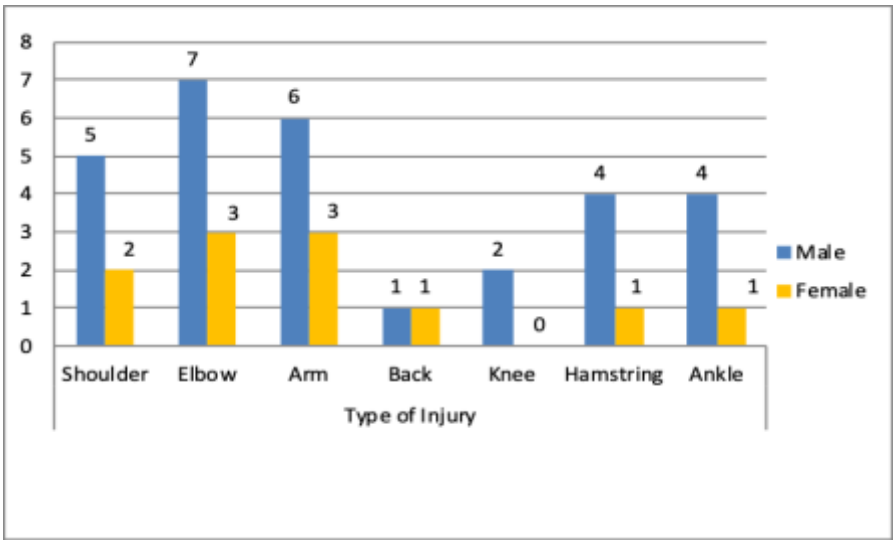

Figure 2: Injury Prevention Profile Experienced by Junior Tennis Athletes Age Group 12

Based on the data in table 4 and figure 2 it can be seen that the number of injuries among age 12 years athletes explained the number of shoulder injuries of 7 athletes (17.5%), elbows cases 10 athletes (25%), hands 9 athletes (22.5%), retainer 2 athletes (5%), knee 2 athletes (5%), thigh (hamstring) 5 athletes (12.5%) and ankles (ankle) 5 athletes (12.5%). In 12-year-old tennis athletes there were 40 sports injury cases in total, so that this figure showed that at the age of 12 there were quite high injury cases with the highest number of injury cases on the elbows and wrists.

A profile of the history of sports injuries in 14 year old junior field tennis athletes can be seen in table 5 and figure 3 belowTabel 5.

Table 5: njury Prevention Profile Experienced by Junior Tennis Athletes Age Group 14

Type of Injuries	Male	Female	Total
Shoulder	5	3	8
Elbow	2	1	3
Arm	5	2	7
Back	2	1	3
Knee	3	1	4
Hamstring	4	5	9
Ankle	6	4	10
Total	27	17	44

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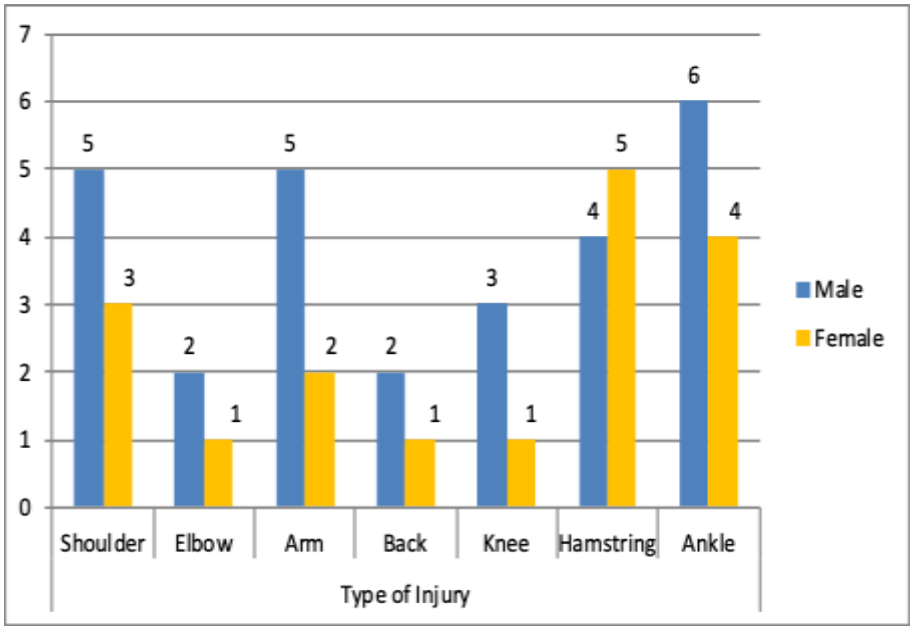

Figure 3: Injury Prevention Profile Experienced by Junior Tennis Athletes Age Group 14

Based on the data provided in Table 5 and Figure 3, it can be seen that the number of injuries among tennis athletes in the 14-year-old age group showed the number of shoulder injuries of 8 athletes (18.18%), Elbows cases 3 athletes (6.82%) , Hands of 7 athletes (15.91%), Backs of 3 athletes (6.82%), Knee 4 athletes (9.09%), Thighs (hamstring) 9 athletes (20.45%) and Ankle 10 athletes (22.73%). In 14-year-old tennis athletes, there were 44 cases of sports injuries, so that the figures showed high injury cases with the highest number of injuries occurring in the shoulders, hands, thighs (hamstring) and ankles. Data on the history of sports injuries in 16-year-old junior tennis athletes in detail can be seen in table 6 and figure 4 below

Table 6: Profile of injury prevalence experienced by 16-year-old Junior Tennis Athlete

Type of Injuries	Male	Female	Total
Shoulder	3	2	5
Elbow	1	2	3
Arm	3	3	6
Back	1	3	4
Knee	2	1	3
Hamstring	4	5	9
Ankle	3	2	5
Total	17	18	35

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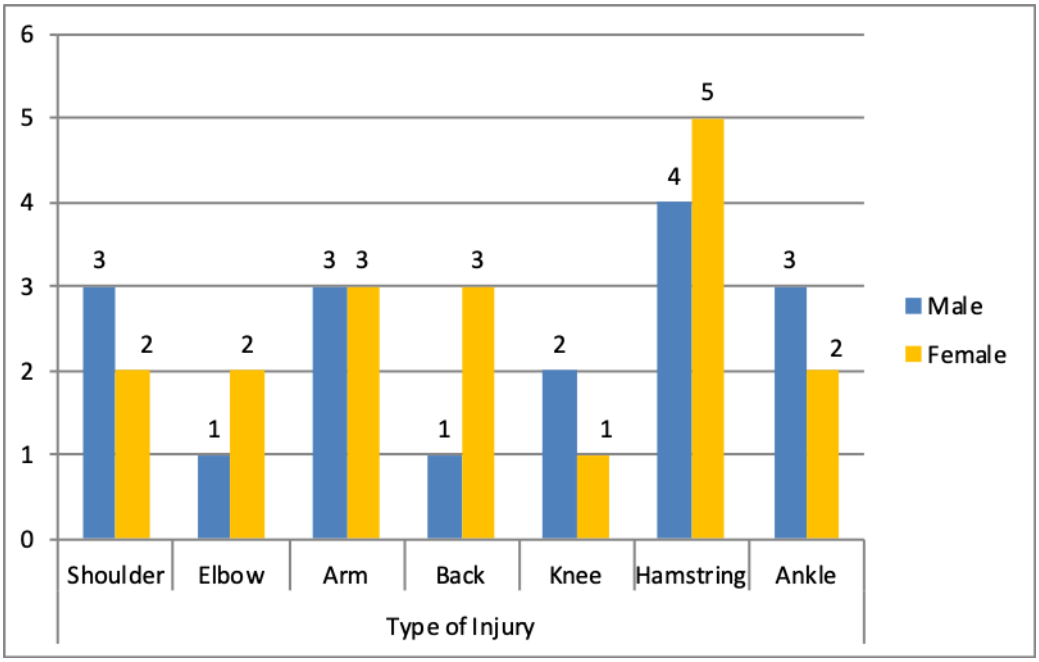

Figure 4: Injury Prevention Profile Experienced by Junior Tennis Athletes Age Group 16

Based on the data in table 6 and figure 4, it can be seen that the number of injuries in age 16 years athletes declared that the number of shoulder injuries of 5 athletes (14.29%), Elbows 3 athletes (8.57%), Hands 6 athletes (17.14%), Retained 4 athletes (11.43%), Knee 3 athletes (8.57%), Thighs (hamstring) 9 athletes (25.71%) and Ankle 5 athletes (14.29%). In 16-year-old tennis athletes there were 35 sports injury cases overall, with the highest number of injuries occurring on the shoulders, hands, thighs (hamstring) and ankles. Data on the history of sports injuries in 18 year old junior tennis athletes in detail can be seen in table 7 and figure 5 below

Table 7: Prevalence Profile of Injuries Experienced by Junior Tennis Athletes Age Group of 18 Years

Type of Injuries	Male	Female	Total
Shoulder	2	3	5
Elbow	2	2	4
Arm	1	2	3
Back	1	3	4
Knee	4	2	6
Hamstring	3	5	8
Ankle	3	4	7
Total	16	21	37

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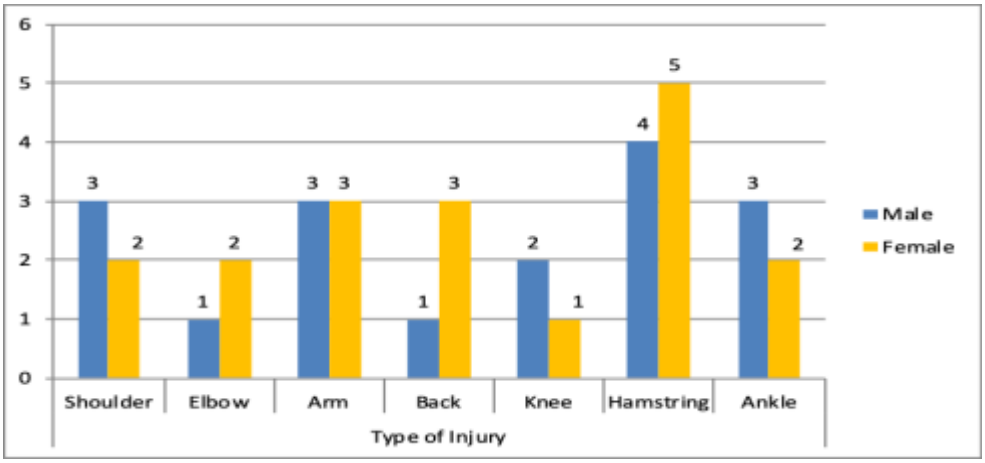

Figure 5: Injury Prevention Profile Experienced by Junior Tennis Athletes Age Group 18

Based on the data shown in table 7 and figure 5, it can be seen that the number of injuries in age range 18-year tennis athletes explained that the number of shoulder injuries of 5 athletes (13.21%), Elbows 4 athletes (10.18%), Hands of 3 athletes (8.11%), Backs 4 athletes (10.81%), Knee 6 athletes (18.22%), Thighs (hamstring) 8 athletes (21.62%) and Ankle 7 athletes (18.92%). In 18-year-old tennis athletes there were 37 cases of sports injuries, with the highest number of injuries occurring in the knees, thighs (hamstring) and ankles.

IV. DISCUSSION

The results of the research showed that the history of sports injury experienced by national junior tennis athletes at the age of 12-18 years old was in the high category because there were 156 cases of injuries from a total of 117 study samples, with 89 cases of injury happened among male athletes and 67 cases of injury for the female one. The results of previous studies showed that male athletes had a higher case of injury than female athletes during a year of tennis matches [16]. The result of the study was in line with the results of this research conducted.

The high prevalence of sports injury in national junior tennis athletes, ranging from mild, moderate to severe injuries explained that there were serious problems in the pattern of coaching the young tennis athletes in Indonesia, starting from identification of athlete talents, implementation of training programs and frequency of matches as well. The results of previous studies indicated that the level of injury experienced by tennis athletes was influenced by inappropriate training programs [13].

Implementation of an appropriate training program and adjusted to the age period of the junior athletes becomes very important thing to be well-considered by the coach, it is expected that athletes are not given specific branching training at an early age. Prospective athletes must pass through the stages of learning multilateral motion before the specialist is determined by the sport. Multilateral development stage is given to children aged 6-15 years with the aim of developing a variety of movements and skills, as well as preventing children from the risk of injury [17]. The stages of training based on the age level must be given such more depth attention. [18] explained that in tennis, the initial stage of children starting to practice is 7-8 years old, the 11-13 year specialization stage and the top achievement stage is in 17-27 years. If this stage can be carried out in a training program then the high risk of injury to junior tennis athletes can be avoided.

Based on the research findings, it was stated that the highest injury cases occur in athletes aged 12 and 14 years. In tennis, injuries happened in 12-year-old tennis athletes were dominated by cases of shoulder, elbow and hand

injuries. In this case, it can be possibly happened because at the age of 12, both male and female athletes are not strong enough to perform various types of stroke techniques in tennis with a fairly heavy racket load. The results of previous studies indicated that the use of rackets with a larger size and weight raises the risk of injury to tennis athletes [6]. Furthermore, [12] stated that the results of the study indicate that the type of racket, grip (racket) and inertia (inertia) of the racket are external factors that influence the occurrence of injury. So, to overcome these problems, tennis athletes aged 12 years can use a lighter type of racket that was adjusted to the age level.

Next, in age range of 14-year age was dominated by injuries to the hands, shoulders, thighs (hamstring) and ankles (ankle), with the highest cases occurring in lower body extremities that was the thigh (hamstring) and ankle. These results were in line with previous research that junior tennis athletes aged 11-14 years were known to have a history of injury to the lower extremities [19]. This is because at the age of 14 years, athletes have begun to enter the competition phase to win champions who demand athletes to be able to carry out various explosive movements in a high enough intensity.

In the group of athletes aged 16 and 18 years showed the level of injury that is almost the same as the age of 14 years, with the most cases of injuries occurring on the hands, thighs (hamstring) and ankles. The results of previous studies mentioned the level of injury at the age of 15-18 years occurred most in the lower limb (51%) followed by the upper limb (24%) and back (24%) [11]. This declared that the age of 16 and 18 years is a period where an athlete starts competing in obtaining achievements with the type of training and comparing high intensity and more complex, because at this age the top achievement of a tennis athlete begins [18].

If the athletes did not have an adequate good fundamental movement base, varied moving experience and the right stages of training, the athlete can suffer from an injury that restrict the achievement. [17] explained that athletes who specialize too early will obtain pretension at the age of 15-16 years and will decline at the age of 18 because of the high injury factor. While athletes with the right stages, starting from multilateral training, specifications and high performance can achieve at the age of 18 years or more in quite a long time because of avoiding the risk of injury.

Moreover, another factor that can hinder the achievements of junior athletes was the lack of warm up training. In some cases, warm-up training was considered as an unimportant part in supporting performance and keeping athletes from injury. Players who regularly do stretching exercises generally suffer less injury than players who do not [16]. According to the data, stretching exercises takes one important elements that can reduce the risk of injury in junior tennis athletes. Structural training can be done statically, dynamically or PNF. PNF training is an effective way for tennis players to prevent and recover injuries [6].

Based on data and the results of previous studies, having such a proper program for junior athletes to avoid the risk of injury in tennis is strongly needed. Strengthening training programs performed with special movements for tennis can play a key role in preventing general injuries to tennis players [20]. So that the implementation of an appropriate training program, a good recovery process and supported by limiting the number of matches in junior athletes can play an important role in reducing the risk of injury to athletes, so that athletes can maintain and even improve their achievements at senior level for longer time.

V. CONCLUSIONS

Based on the research result and discussion explained that the level of injury prevalence in national junior tennis athletes was in the quite high category, especially in the 12-14 years age group. The high number of

injuries that occurred in potential junior athletes at the age of 12-18 years caused the number of tennis athletes at senior level with the talent and skill to play tennis well and have a very good aspects in terms of physical, tactical and mental techniques were very few in number. To prevent junior tennis athletes from suffering a large number of injuries, special attention was extremely needed in the process of fostering the achievements of junior athletes. It was expected that such and high pressured training burdens can be avoided by the coach, a very tight number of matches and the weak recovery programs can be omitted too. As the result, the risk of injury among athletes due to physical fatigue can be decreased. Stretching program was also an important component that was often forgotten by athletes, causing an even greater risk of injury. Training programs for junior athletes aged 12-14 years was highly recommended to prioritize fundamental movement and multilateral training methods, while for ages 16-18 years can be given the right program in terms of physical, technical, tactical, mental and recovery training that can help athletes gain more achievements at the national and even international scale.

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REFERENCES

1. M. C. Fu, T. S. Ellenbecker, P. A. Renstrom, G. S. Windler, and D. M. Dines, “Epidemiology of injuries in tennis players,” Current Reviews in Musculoskeletal Medicine, vol. 11, no. 1. Humana Press Inc., pp. 1–5, 01-Mar-2018, doi: 10.1007/s12178-018-9452-9.
2. J. A. Kurtz, J. Grazer, B. Alban, and M. Martino, “Ability for tennis specific variables and agility for determining the Universal Tennis Ranking (UTR),” vol. 41, no. 2, pp. 1–16, 2019.
3. N. S. Kolman, T. Kramer, M. T. Elferink-Gemser, B. C. H. Huijgen, and C. Visscher, “Technical and tactical skills related to performance levels in tennis: A systematic review,” J. Sports Sci., vol. 37, no. 1, pp. 108–121, Jan. 2019, doi: 10.1080/02640414.2018.1483699.
4. A. R. Riza, “Perbedaan Pengaruh Latihan Cross Court Dan Latihan Down The Line Return To Center Mark Terhadap Kelincahan Dan Kemampuan Groundstroke Dalam Permainan Tenis Lapangan Pada Siswa Sekolah Tenis Progress Unimed,” J. ILMU KEOLAHRAGAAN, vol. 17, no. 1, pp. 30–36, Jun. 2018, doi: 10.24114/JIK.V17I1.9961.
5. A. Ulbricht, J. Fernandez-Fernandez, A. Mendez-Villanueva, and A. Ferrauti, “Impact of Fitness Characteristics on Tennis Performance in Elite Junior Tennis Players,” J. Strength Cond. Res., vol. 30, no. 4, pp. 989–998, Apr. 2016, doi: 10.1519/JSC.0000000000001267.
6. J. S. Dines et al., “Tennis injuries: Epidemiology, pathophysiology, and treatment,” Journal of the American Academy of Orthopaedic Surgeons, vol. 23, no. 3. Lippincott Williams and Wilkins, pp. 181–189, 26-Mar-2015, doi: 10.5435/JAAOS-D-13-00148.
7. D. R. Budi, R. Hidayat, and A. R. Febriani, “The Application of Tactical Approaches in Learning Handballs,” JUARA J. Olahraga, vol. 4, no. 2, p. 131, Jul. 2019, doi: 10.33222/juara.v4i2.534.
8. D. R. Budi, M. Syafei, M. N. H. Kusuma, T. Suhartoyo, R. Hidayat, and A. D. Listiandi, “The

significance of exercise method on forehand and backhand groundstroke skills improvement in tennis," J. Sport. J. Penelit. Pembelajaran, vol. 6, no. 1, pp. 132–144, Apr. 2020, doi: 10.29407/js_unpgri.v6i1.13920.

9. Sahan A, Erman KA, and Ertekin E, "The effect of a variable practice method on tennis groundstroke learning of adult beginners," ITF Coach. Sport Sci. Rev., vol. 74, no. 26, 2018.
10. B. M. Pluim, "The evolution and impact of science in tennis: Eight advances for performance and health," British Journal of Sports Medicine, vol. 48, no. SUPPL. 1. BMJ Publishing Group, pp. i3–i5, 01-Apr-2014, doi: 10.1136/bjsports-2014-093434.
11. N. Hjelm, S. Werner, and P. Renstrom, "Injury risk factors in junior tennis players: a prospective 2-year study," Scand. J. Med. Sci. Sports, vol. 22, no. 1, pp. 40–48, Feb. 2012, doi: 10.1111/j.1600-0838.2010.01129.x.
12. A. Kekelekis, P. T. Nikolaidis, I. S. Moore, T. Rosemann, and B. Knechtle, "Risk factors for upper limb injury in tennis players: A systematic review," International Journal of Environmental Research and Public Health, vol. 17, no. 8. MDPI AG, 02-Apr-2020, doi: 10.3390/ijerph17082744.
13. J. Junaidi, "Cedera Olahraga Pada Atlet Provinsi Dki Jakarta (Pengaruh Pemahaman Pelatih, Sarana – Prasarana Olahraga Dan Metode Latihan Terhadap Terjadinya Cedera Olahraga)," GLADI J. ILMU KEOLAHRAGAAN, vol. 7, no. 2, p. 746, May 2017, doi: 10.21009/gjik.072.02.
14. Sugiyono, Metode Penelitian Kualitatif, Kuantitatif, dan R and D. Bandung: Alfabeta., 2016.
15. N. I. Saputri, "Survei Pembinaan Olahraga Tenis Usia Dini Sekolah Tenis New Armada Kabupaten Magelang," Act. - J. Phys. Educ. Sport. Heal. Recreat., vol. 2, no. 11, Nov. 2013, doi: 10.15294/active.v2i11.2467.
16. H. F. Oosterhoff et al., "Risk factors for musculoskeletal injuries in elite junior tennis players: a systematic review," J. Sports Sci., vol. 37, no. 2, pp. 131–137, Jan. 2019, doi: 10.1080/02640414.2018.1485620.
17. 1D. P. Irianto, Dasar-dasar latihan olahraga untuk menjadi atlet juara. Yogyakarta: Pohon Cahaya, 2018.
18. Harsono, Kepelatihan Olahraga : Teori dan Metodologi. Bandung: Remaja Rosdakarya Offset, 2017.
19. J. van Mechelen, J. Nauta, B. Pluim, and E. Verhagen, "RISK FACTORS FOR INJURIES IN ELITE YOUTH TENNIS PLAYERS," Br. J. Sports Med., vol. 51, no. 4, pp. 402.3-403, Feb. 2017, doi: 10.1136/bjsports-2016-097372.301.
20. T. S. Ellenbecker, B. Pluim, S. Vivier, and C. Sniteman, "Common injuries in tennis players: Exercises to address muscular imbalances and reduce injury risk," Strength Cond. J., vol. 31, no. 4, pp. 50–58, Aug. 2009, doi: 10.1519/SSC.0b013e3181af71cb.
21. Budi, D. R., M. Syafei, M. N. H. Kusuma, T. Suhartoyo, R. Hidayat, and A. D. Listiandi. "The Significance of Exercise Method on Forehand and Backhand Groundstroke Skills Improvement in Tennis". Jurnal SPORTIF : Jurnal Penelitian Pembelajaran, Vol. 6, no. 1, Apr. 2020, pp. 132-44, doi:10.29407/js_unpgri.v6i1.13920.
22. Jatra, R., and D. D. Fernando. "The Understanding of Court Tennis Rules for Participants of Licensing Tennis Umpire Training". Jurnal SPORTIF : Jurnal Penelitian Pembelajaran, Vol. 5, no. 1, May 2019, pp. 70-79, doi:10.29407/js_unpgri.v5i1.12754.