Annex 4

Task 2 – Experts Interview

1. Introduction

Trampolines are one of the gymnastics disciplines included in the International Gymnastics Federation (FIG), since 1999. Before that, they were part of the International Trampoline Federation, founded in 1964 and now extinct, as the trampolines were integrated in FIG and became part of the Olympic program at the Sydney 2000 Olympic Games.

Trampoline gymnastics has 7748 gymnasts active at international level[1] (FIG), which compete in one of four categories: Individual Trampoline (TR), Synchronised Trampoline, Double Mini-trampoline (DMT) and Tumbling (TU). But have a much higher number of gymnasts, all over the world, in different performance levels.

Gymnasts bounce on trampolines between 3 and 10 meters in the air performing from 2 to 10 skills in sequence and without stops depending on the category. They perform complex movements (a number of flips and/or twists) without deviations at the highest point. In Double Mini-trampoline and Tumbling (track) they should have horizontal speed and the final element finishes on the softer landing mats that are stacked to absorb the impact.

These complex movements are learned on a step by step process, supported in basic skills and also in part method, where some skills and parts of them are linked together to learn a new one.

[1] https://www.gymnastics.sport/site/pages/about-population.php

There are also a number of satisfactory techniques to support the gymnast that may be used on a trampoline to ensure safety during attempts: the overhead belt system or bungee cords that support the athlete so that there is little to no impact on landing; hand spotting done at bed level to help part of the movement or landing; mat spotting done from one side of trampoline, introducing a mat over the bed before gymnast landing to soften the contact.

Any kind of mistake, misjudge take-off or landing, of beginners or experienced gymnasts, can lead to a fall over the apparatus or flying off the equipment and onto the mats below. It is also important to have in consideration, as a safety concern, the lost move syndrome (LMS) - when a gymnast does an extra skill without consciously planning it, which sometimes leads to uncontrolled falls.

These are the reasons to see trampolining as a very enthusiastic activity and also to understand that it depends on knowledge and safety requirements, where coaches have an important role to guarantee their presence.

Trampolining has also some benefits for practitioners (children, adults, disable, elderly) health benefits improving fitness (resistance, strength) dynamic balance and motor performance (Tay et al, 2019).

The main problem is the increasing number of people that have an opportunity to play on trampolines in domestic trampolines and trampoline parks, without knowledge, but also the increasing number of injuries reported on scientific publications and in the media.

To understand it and to find solutions to increase safety it is important to know the expert's opinion on this topic.

2. Methodology

2.1. Sample

We did an interview with 4 trampoline gym coaches, male, with an average age of 47 years, an average of 26 years of practice, with Grade IV Portugal and top FIG coaching graduation, training an average of 47 gymnasts, from 6 to 40, some of them with an elite level.

2.2. Procedures

We have done an one hour and a half online interview, supported by Zoom software, that allowed us to be in live contact and to record all the interviews (with coach's authorization).

The interview has 9 questions on trampoline gymnastics injuries, 6 questions on domestic trampolines safety and finally 9 questions on trampoline parks safety.

We perform a data qualitative analysis to understand the expert's point of view. Were checked the key words and major differences and similarities between answers to each question.

3. Results

The majority of the questions have four different answers but in most of them the experts have agreement points.

3.1. Gymnastic trampoline injuries

All interviewed trampoline gymnastic coaches state that the injuries are in small numbers, but half of them said it was in training and the other half said in competition. The relation between the injury and the apparatus where they took place is due to the most used in training or the category of competition. Related to basic training there are also some injuries on the floor and for more complex movements in the foam pit.

The injuries could be related to the bed or track take off, but the majority are on landings, occurring on the landing mats at the end of the exercise.

According to the coaches, young gymnasts (14-15 years old) are more likely to be injured because they have greater risk in jumping and because they start to have greater autonomy. In an initial phase, with the youngest, there is greater support from the coaches, to ensure safety in learning and in landings and because of that less injuries happen. All of them agree that the risk is related to the lack of experience which implies for initiated users the same support as the youngest have. Sometimes could be related to previous tiredness and the injury can occur in the beginning of training with simple jumps but more often with tiredness at the end.

They agree that the part of the body most affected is the ankle but three of them include also the low back and the knee. There is also one reference to the elbow. Low back could be a muscular or joint injury (overuse broken) and knee and ankle are joint injuries. There is one reference to hamstrings injury due to running for DMT[2] and elbow dislocation due TU[3] track impact. The most severe injuries are related with broken bones and knee damage (tendons, ligaments and menisci) which could imply surgery.

For the question which part of the equipment causes the injury, we got different answers but two of them agree on mat density for landing and also on frame for bad landings outside of the trampoline bed. We also have one reference for airbags and springs. As an example of any fatal or disabling accident, all mentioned the Portuguese male gymnast of TU, who in the warm-up, got lost after a round off, making a back somersault with a fall on the track with hyperextension of the neck, becoming quadriplegic. Two of them refer to a case of a Portuguese female gymnast on the trampoline, performing front somersault and ¾, who at an uncontrolled landing, has a cervical dislocation and becomes quadriplegic (there is a possibility that this happened during the take-off in the beginning of the movement). There are two more reported cases of triple jumps, lost skills on the trampoline (HIHOt[4]) finished

[2] Double Minitrampoline
[3] Tumbling
[4] Half in Half out Triffis

with an uncontrolled landing on the bed, with a neck hyperflexion that caused quadriplegia. We have one reference of another triple on TU with landing on foam pit that caused quadriplegia; The only fatal reported case is on TU, at landing after a Miller (double somersault with triple twist), the male gymnast cannot stop and continues with horizontal speed backwards, until he falls on his back on the floor and hits his head (he died in the hospital).

3.2. Domestic trampolines

Three of the coaches said it isn't safe to have a trampoline at home/garden unless users have technical knowledge. One said yes with control and lower risk jumps.

They identify as the biggest risk(s) in this type of trampoline/context the absence of knowledge of use. For each one there are other several risks: lack of enclosure; exposed springs; reproduction of the Greg Roe's[5] insane stunts presented on social media (YouTube); more than one user at same time; frontal landings with multiple somersaults; risk unaware; craziness level; trampoline quality (seated landing and contact with ground); injuries with cervical landings.

The major safety concerns for three experts are the enclosure and wide space around. Although they have different answers for the rules, some important topics are: jumping barefoot; jumping one at a time; technical knowledge; to prevent objects on the trampoline.

For two coaches what the jumps users can do is related with straight bouncing exercises and front and back landing without and with rotations. There is one that answers with hands and knees landing and another one with techniques in dependence on training or motor availability. Surprisingly one coach said users can do everything (the limit is in the notion of risk), because kids don't take many risks.

[5] https://www.trampolinecoaching.com

Two coaches think somersaults must be prohibited but there are other references to: more than one twist in straight jumps; front landing; double somersaults; more than doubles.

Three experts with different answers consider that there are some limitations regarding age and/or technical competence: little ones don't jump so high and have smaller imbalances, and for that reason possibly there is less risk, but younger than six shouldn't jump alone. 13-14y old are at more risk; activity lack of information/knowledge is a limitation factor although technical competence and body control evolves with practice. But there is one who considers that there are no age-related limitations.

3.3. Trampoline Parks

All experts went to a trampoline park and do not consider it a safe place. Only one considers it safe as long as there is a monitor and another one considers that if the user has experience it will be safer.

About the greatest risk half of the experts identify that in this type of parks are uncontrolled jumps due to lack of technical level, users without a sense of risk and untrained monitors. Although with only one answer there were also identified other risks such as: more than one jumper; apparent sense of security; users mixed with different experience/age; attempted reproduction by copying / imitation; lack of standards; foam pit.

Two of the experts have as major safety concern the small number of monitors per zone and staff training. Other examples are: to reduce the number of users, insufficient safety distance between trampolines and others, unsafe airbag, free jump zone with not have control, one jumper at a time; foam pit with 2 meters, ignorance of landing techniques in the foam pit, be careful when using extra material (boards, skis, ...), using spotting belts.

We have four different answers about what jumps users can do: from basic skills information, stop, sitting with hands on (including theoretical class) to doubles and risky airbag jumps for those who know how to jump. In an indirect way everyone agrees that it is necessary to have

body control and a basic experience to be able to do more difficult jumps, for example somersaults. There is also the idea that with the offer of learning situations many will be able to make somersaults safe.

For prohibited jumps there are also four different answers, but two coaches agree on front landing. In other possibilities we have from no prohibited jumps to somersaults or more and triple somersaults never.

We don't have an agreement in age related limitations because one said there are no limitations and others said there are (up to 7-8). We also have the possibility of participation up to 7 with parental supervision.

The majority of experts agree with the lack of staff/monitor qualified and all of them said they should have the gymnastic coaching first level course. Although some have mentioned that gymnasts, or ex-gymnasts, have some knowledge, others argue that they do not have the capacity to analyse the risk, the mechanical aspects of the movement, as well as the process of teaching techniques.

The final question was about what kind of monitoring should the monitors do and we have total agreement on a 10 min warm up with dynamic joint mobilization. There are different proposals to increase fun and could include music, choreographed movements, stretching and tonicity. Three experts said monitors should control the jumping time but with different opinions on how to do it (2 min or 3 to 5 min max; it depends on the user; tired kids leave). All experts agree that monitors must impose height limits but if one said that he had no idea how, the others said that those who have lack of balance should lower the height of the jump. They also agree that monitors must impose limitations on the jumps to perform depending on user ability. Some said that users shouldn't do front landings and somersaults. Half of the experts said that monitors should do safety support (hand spotting; mat spotting) and should teach how to perform. They can have learning stations designed with elevated mats to learn somersaults and they can do demonstrations of part of the movement, for teaching and as a good example. For three experts' monitors shouldn't incite more difficult jumps or demonstrate them. Two of them said that monitors could do a presentation at the end to

show some moves and to encourage users to return. Surprisingly one expert said that demonstration is good to show how they can reach other jumps.

As a final comment they say that trampoline parks are fun places, but they must be properly regulated, and legislated. They show some concern because well-framed and properly taught gymnastic trampolines are an asset and these parks can tarnish the sport's image.

It is important to invest in training, rules and use by levels (technical characteristics and progressions; trampolines with less rebound) with a good control made by the monitors including an availability assessment.

There was also an alert for the high risk and for the early news with a fatality 2 months ago in Bern, that is under investigation.

4. Discussion

Interviewed experts said that there are a small number of injuries and this can be supported by Kuisis et al (2011) with an incidence of injury 2.3 per 1000 hours of exposure to trampoline training which is lower than in other sports like running, soccer or tennis. This author also supports the idea of a greater risk for young gymnasts with the highest incidence of injury age related from 14 to 18 years.

Younger gymnasts have less injuries because they have more support from coaches and during this initial phase, they are getting strong support for higher jumps and faster rotations. Burt et al (2015) confirm this growth of gymnasts because when comparing female gymnasts (16-29 years old) with female sedentary volunteers, she found superior values in bone size, strength and density.

The part of the body most affected and presented by interviewed coaches is the ankle but there are also injuries in the knees which is in line with Grapton et al (2013) data, which indicate a greater number of injuries to the lower limbs. These kinds of injuries are related

with landings from great heights after twisting and rotating and sometimes due to an incomplete execution or a lack of muscular tone (Grapton et al, 2013).

For these experts the biggest risk in domestic trampolines is the absence of knowledge on how to use it. This is related to risk unawareness, but also the reproduction of stunts without knowing the proper technique, nor the learning process. In gymnastics training there are less injuries with young gymnasts because, in an initial phase, there is greater support from the coaches, to ensure safety in learning and in landing. In the domestic environment there is no coach, which implies a knowledge of the techniques to be performed and a lesser possibility of advancing to more complex and riskier movements. The allowed jumps are related with straight bouncing exercises, front and back landing without and with rotations, hands and knees landing, because these are the basic techniques which lead to a more controlled motor behaviour and support the learning of more complex skills.

Regarding the concerns associated with age, we can reinforce, as previously mentioned, that children jump less and have less imbalances and through regular practice they strengthen their lower limbs. The problem is the falls where they protect themselves with arms that may break in contact with the bed or on the floor. That is why body control and balance are essential to maintain verticality.

In trampoline parks the main risks identified by experts are uncontrolled jumps due to lack of technical level, users without a sense of risk and untrained monitors. The lack of technical level has the same relation, mentioned previously, with basic jumps and the knowledge of the techniques to be performed. In these parks the sense of risk is important as the environment gives a good feeling and sometimes a false sensation of safety. That is why some of the falls are more dangerous due to uncontrolled jumps. The foam pit or the airbag is a good example of this topic because it seems very safe but most of the users don't know how to use them. And just jumping without knowing the purpose of the skill is dangerous as it often results in uncontrolled movements. In analysing the mechanics of the movement it is important to consider the angular velocity associated with the rotation and a small angle of the trunk is sufficient to do a somersault. Unfortunately, the poorly executed or uncontrolled

movement will not have a full rotation on the transverse axis, which causes a headfirst landing with a high probability of cervical injury.

The age limitation is associated with the growth and development of the locomotor system. In training in gymnastics is an assumed contradiction, because gymnasts are better prepared with regular practice and the monitoring is constant and of quality.

The staff knowledge is associated with the ability to analyse situations in order to anticipate the difficulties of users and guide their practice.

As Heinen et al (2009) say, hand spotting has a positive influence on somersault's learning because it assists in the correct placement of the segments and provides more correct executions with less danger. The learning process is based on progressions (different tasks for progressive skill achievement) allowing for better control and less risk.

5. Conclusions

In trampoline gymnastics the number of injuries is small, with less injuries among children due to coaches support and progressive skill achievement. Teenagers are the group with more risk exposure due to more autonomy and more complex skills.

Lower limbs are the most affected parts due to landings, but neck injuries are the most dangerous with some reported permanent injuries and the only death is due to head concussion.

In domestic trampolines we can assume that the higher risk is the absence of knowledge to use and also the reproduction of dangerous stunts available on the internet without guidelines.

In trampoline parks the biggest risks are related with uncontrolled jumps and users without a sense of risk. The untrained monitors are a relevant problem because staff knowledge and

safety support (hand spotting; mat spotting) in conjunction with a progressive skill achievement are very important to prevent accidents.

To increase safety in the trampoline parks, there must be practice areas that filter users. The first zone should be for learning and for the first contact with the trampolines, allowing users to learn safety rules. Then progressions must be made from basic jumps to somersaults. Thus, only the most qualified have access to the areas at greatest risk (i.e. foam pits or performance trampoline) and have authorization for more difficult jumps.

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