Study on Impact of Throwball for Health, Body fat, Muscle Bulk and Mental Health Improvement with Alcoholic and Drug Abuse Youth

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Abstract

Background and Objectives: Throwball is a non-contact ball sport played across a net between two teams of 7 + 5 players on a rectangular court. Playing the game entails movement as well as hand, eye, body co-ordination which can help as rehabilitation exercise for patients. The Throwball has grip around it and due to this grip, every time someone holds the ball, it gives acupressure to the palm. Our palm has acupressure points connected to each organ in the body. Therefore, playing throwball activates the entire nervous system and strengthens both internal and external organs. Objectives of this study is to understand the impact of throwball in improving the health, body fat and muscle bulk on people with Alcohol & drug addiction through statistical methods. Methods: A Pilot study was conducted with 56 inmates from Sri Sai Foundation, Alcohol, Drug Abuse Treatment, Counselling & Rehabilitation Center, Bengaluru. All subjects were male, with an average age of 39± 13 years. 13 throwball sessions were conducted in the span of 29 days. The daily routines of the participants were kept intact except for replacing 1 hour schedule with Throwball. Actofit Smart Scale was used for measuring the body composition. Microsoft Excel and PowerBI were used for data collection and statistical analysis. Results: The study showed significant improvement in body fat and muscle bulk of the participants. It reflected higher control over nervous system. Participants could balance and catch & throw the ball to target position, a reflection of improved eye-hand-brain co-ordination and nervous system improvement. The study also revealed improved appetite, mental happiness, going back to childhood and stamina.

Index Terms— Body fat and Muscle Bulk improvement, Brain Development, Health, Positive impact on internal organs, Sports for Health, Throwball for Alcohol Addicts, Throwball for Drug Abuse, Throwball for Health.

1. Introduction

Throwball is a non-contact, non-injurious game played by 7+5 players in each team. Throwball brings several unique advantages over other games by design, that can bring faster positive impact on human body and mind. Playing the game entails movement as well as hand, eye, body coordination which can help as rehabilitation exercise for patients The Throwball game ball has little dots for grip, which automatically provides acupressure to the person who catches/holds the ball. As our hands have the pressure points connected to the entire nervous system, playing throwball energizes internally. Throwball is one of the games, that reaches the internal organs faster and improves the health while impacting external organs too.

As per Throwball rules, when a person receives the ball on right side, he/she needs to throw from right hand alone and if received from left side, they must throw from left hand without taking support from right. This helps improve the brain, body and nervous system balance equally on both sides. The ball must be received as per the guidelines and has to be thrown across the net within 3 seconds. This involves the coordination of eye, hand, leg, shoulder movements with both sides of the brain controlling the body. Throwball is the only group game that mandates the accurate balancing of both sides of the brain and body parts, as per our

knowledge. Thus, Throwball helps develop the brain power faster, internal organ health development faster.

Here is a study that observes the hypothesis that was conducted in a controlled environment with Sri Sai Foundation, Alcohol, Drug Abuse Treatment, Counselling & Rehabilitation Center, Bengaluru. The findings are reviewed and acknowledged by doctors.

International Throwball Federation, in association with Throwball Federation of India conducted a controlled study from 31-Jul-2022 to 28-Aug-2022. A total of 13 throwball sessions conducted on alternate days basis, in 29 days. 56 people participated, aged between 16-66 with average age of 39± 13 years. 23% of them were of lower weight with low body fat% (41), 75% of them had medium range of Body Fat%. 100% of them were men who were addicted to alcohol or drug, trying to get back to normal life with the help of rehabilitation center.

The participants had a prescribed routine every day and a defined diet. They were not given any extra medicines during the study period. They had difficulty in balancing the body while catching the ball and throwing it during the initial period.

Based on the prior positive experience [7][8] with Special Children and Patients, ITF approached the rehabilitation center to conduct the Throwball session to help the children and observe the impact of throwball on their health. Mr. Venkatesh K, the head of the organization, and their team graciously agreed to provide an opportunity for throwball exercise.

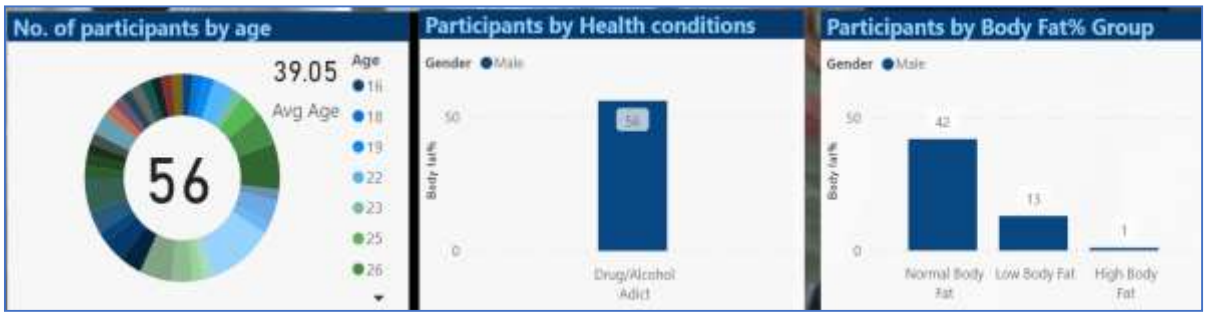

Fig. 1: Participants demography

2. Procedure for Paper Submission

ITF measured the impact based on participants weight along with 6 different body compositions parameters. Also, requested the trainers to observe the changes in participants. We used ActoFit smart scale [10] for measuring the body compositions accurately.

Key measurements of participants included

• **Weight**: Body weight in kilograms

• **Body fat%:** It is the proportion of body fat weight to the total body weight. Higher body fat% can damage long-term health. Very low Body fat % also leads to poor health.

• **Subcutaneous Fat%**: It is the proportional weight of fat below the skin to the total body weight. Higher subcutaneous fat value is an indicator of bad physical health.

• **Visceral Fat%:** It is located deep in the core abdominal area, surrounding, and protecting the vital organs. Healthy level of visceral fat directly reduces the risk of certain diseases.

• **Lean Mass**: It is the weight of all muscle tissue in the body including skeletal, cardiac & smooth muscles. Higher muscle mass indicates good muscle health. It is measured in kilograms.

• **Fat Free Weight**: It is also known as lean body weight refers to the weight of all body components except fat. It includes the body's water, bone, organs, and muscle content. It is measured in kilograms in this study.

• **Bone Mass**: It is the total bone tissue (Bone minerals + Bone Matrix) in the body. Higher bone mass indicates better bone health. It is measured in kilograms.

• **Protein%**: It is the proportional weight of body protein components to the total body weight. Adequate protein levels are essential for normal body function.

• **Skeletal Muscle%:** Skeletal muscles are attached to bones by tendons, and they produce all the movements of body parts in relation to each other.

Acupressure: Also, the principals of acupressure were studied and followed: Entire body nervous system is connected to palms, feet, and other parts. Applying pressure on respective parts stimulates the nervous system and improves the blood circulation to those organs.

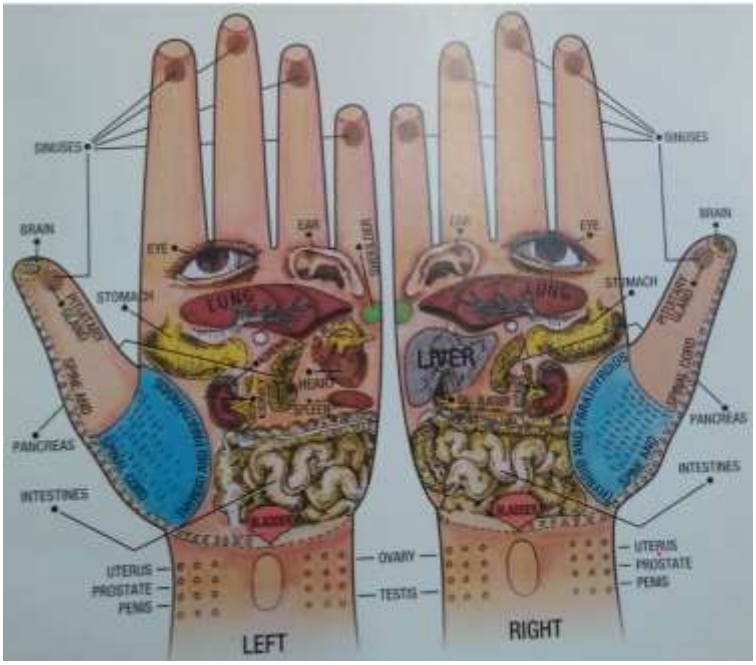

Fig. 2: Acupressure points in hands connecting to all organs [10]

Fig.3: Participants playing Throwball

Fig. 4: Participants playing Throwball

Fig. 5: Participants playing Throwball

8 Coaches started the sessions with regular warm up, followed by different Throwball techniques of catching and throwing. Participants were made to throw the ball with the support of both hands, then with right hand alone, and thereafter left hand alone. They were also taught the hand movements, holding the ball at shoulder level and throwing it back with force, leg movements for balancing the body appropriately as per anatomy and throwball rules. Balancing the ball using non-primary hand was critical for utilizing the brain functions on both sides. That helped balance the body equally on both sides.

Coaches also adapted a few fun games, throwing to the target, passing the ball, etc. in between to keep the game even more interesting. Participants participated and waited for the session, as it is a game. Game brings enjoyment followed by the health benefits.

One of the observations from coaches was that participants enjoyed throwball more than regular monotonous exercises. Participants also stretched themselves automatically, while trying to catch the ball, that provided a higher level of exercise to the body. There were also team building actions among participants. When one person was unable to throw, another was teaching and ensured success of fellow participants. There was good collaboration among participants

3. MATH

Equations: We used the following equations for measuring accuracy.

1. Co-relation co-efficient [09]:
2. $r = n (\sum xy) - \sum x \sum y / \sqrt{} [n^* (\sum x^2 - (\sum x)^2)] * [n^* (\sum y2 - (\sum y)^2)]$ …… formula 1

3. t-Score: $t = r\sqrt{(n-2)} / (1-r^2)$ ……. formula 2
4. p-Value: p=tdist (x, deg_freedom, tails) ……. formula 3

4. Results

After completion of 13 sessions, on 28th Aug 2022, the same measurements were taken and analyzed the improvements. Results are as below:

The results divided into 2 categories for observation:

a. Below normal/Low Body Fat% (<22%) referenced here as LBF
b. Normal or Above% (>=22%) referenced here as HBF

Table 1: Demographic data and measures before Throwball

Parameters	Mean ±SD	LBF Mean±SD	HBF Mean±SD
Age (years)	39± 13	40 ±13	38± 13
Weight (kgs)	60 ± 12	50±6	63±12
Body Fat%	27±8	19±4	30±6
Fat Free Weight (kgs)	42±5	41±6	43±5
Subcutaneous Fat%	24±6	20±5	25±6
Visceral Fat	6±4	3±2	7±4
Skeletal Muscle%	38±5	43±3	37±4
Lean Mass (kgs)	42±8	37±3	43±8
Bone Mass (kgs)	2.4±0.2	2.3±0.2	2.4±0.2
Protein%	17±3	19±3	16±3

Results after Throwball

Fig. 6:Results – Weight loss in HBF

Fig. 7:Results-Weight gain in LBF

Fig. 6 & 7: Results-Weight

There was small variation in the weight in the most of the participants. However, it was average -1.3% weight loss with HBF 0.91 KGs and 5.9% weight gain with LBF 2.94KGs. 71.4% of HBF had weight reduction and 100% of the LBF had weight gain which is positive.

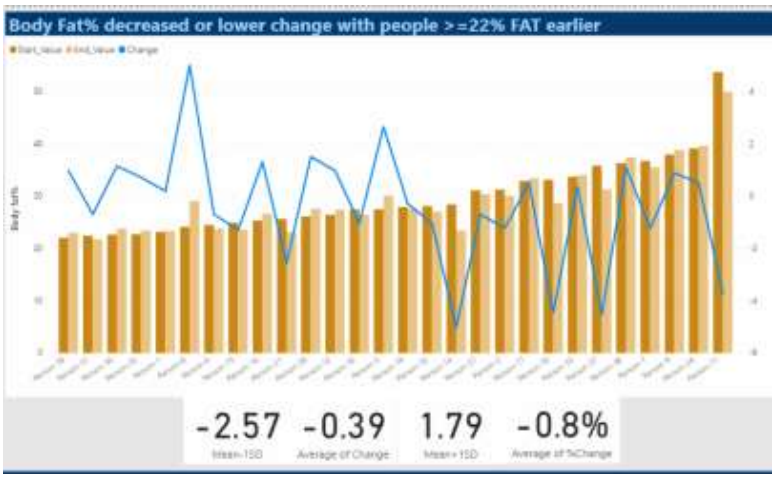

Fig. 8: Results-Body Fat% reduction by -0.8% with HBF

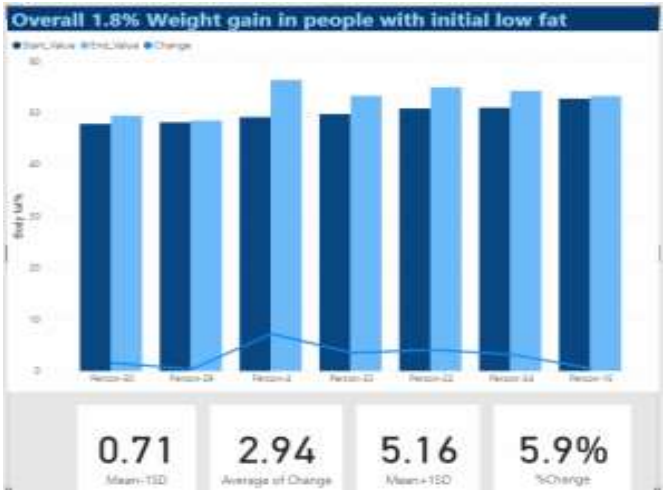

Fig. 9:Results-Weight gain in LBF

Fig. 8 & 9: Results-Body Fat%(BF)

There was considerable change in Body Fat in participants.

Average 0.8% reduction in the HBF with -0.39±2.18 ranging -2.57 to 1.79.

Average 10.9% increase in the HBF with 2.32±4.71 ranging -2.39 to 7.04.

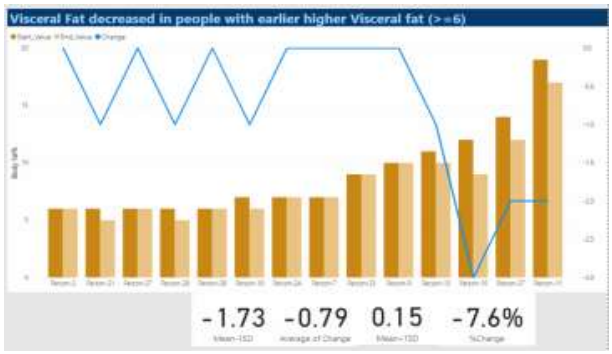

Fig. 10:Results-Visceral Fat(VF) reduction who had >=6 VF earlier

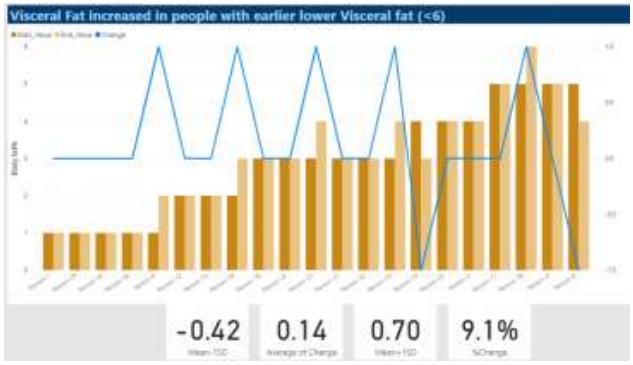

Fig. 11:Results- Visceral Fat(VF) retained or increased who had <6 VF earlier

Fig. 10 & 11: Results-Visceral Fat(VF)

There was considerable change in Visceral Fat in participants.

Average7.6% reduction in the VF for those who had earlier VF>=6.

Average 9.1% VF retained or increased in people whose VF was <6 earlier.

100% of the participants had retained or decreased VF who had >=6 VF earlier.

90.5% of the participants had retained or increased VF who had <6 VF earlier.

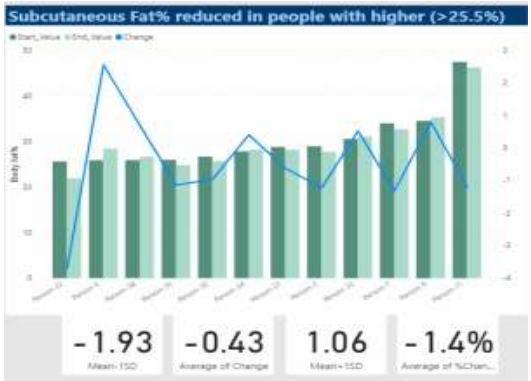

Fig.12:Results-Subcutaneous Fat% (SF) reduction for >25.5 SF earlier

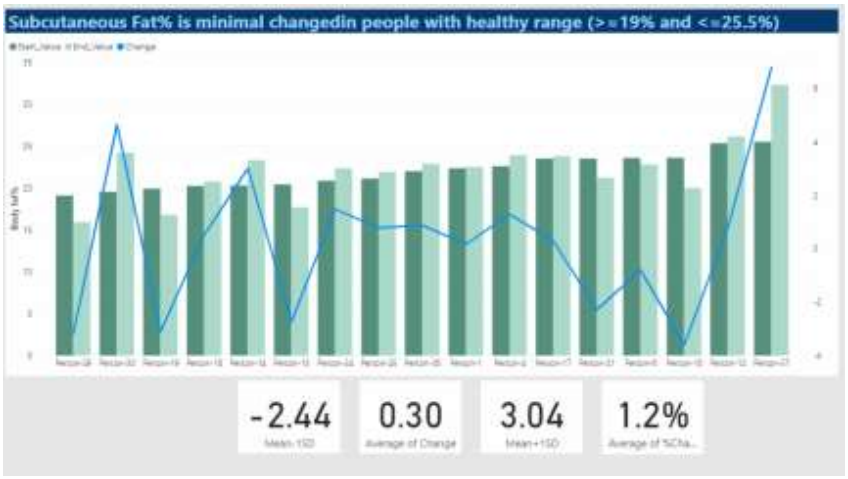

Fig. 13:Results-Subcutaneous Fat% (SF) increased by 8.2% for normal SF earlier

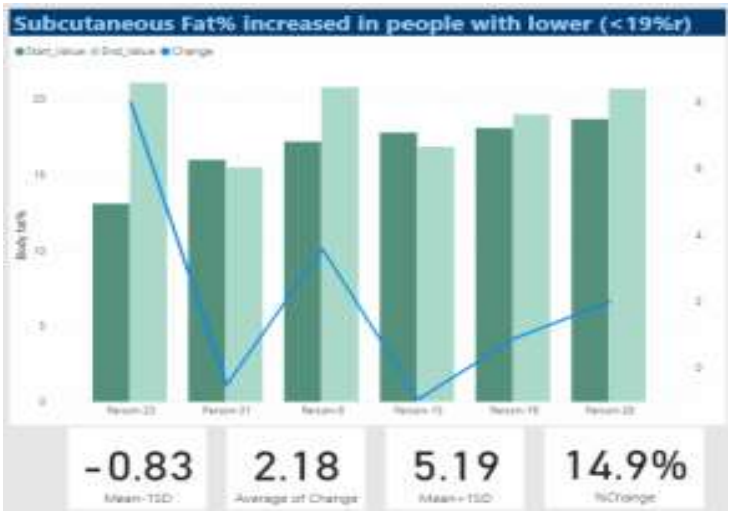

Fig. 14: Results-Subcutaneous Fat% (SF) improved for people with SF <19% earlier

Fig. 12, 13 & 14: Subcutaneous Fat(SF)% slightly reduced (average 1.4% in people who were at higher level (>25.5%).

Those with lower SF (<19%) significantly gained SF% (14.9%) on average which is a positive sign of improved health.

Those with normal range of SF >=19 and <=25.5% had 1.2% increase in their SF.

Fig. 15:Results-Skeletal Muscle% improved in 46% of HBF

Fig. 16:Results- Skeletal Muscle% improved in 46% of LBF

Fig. 15 & 16: Skeletal Muscle%(SM) had slight variation. 46% of HBF participants had increase in SM, where as others had some decrease.

SM was considerably increased in 57% LBF with average 1.5% change. (0.64kg change).

Fig. 17:Results-Lean Mass (LM) improved by 0.2%

Fig. 17: Lean Mass(LM) slightly improved average 0.11kg (0.2%), between the range -1.9 to 2.11kg. The change is across the population, irrespective of their prior body fat%

57% of the participants had the increase in Lean Mass.

Fig. 18:Results-Fat Free Weight improved by 0.1%

Figure 18: Fat Free Weight slightly improved average 0.07kg (0.1%), between the range -2.03 to 2.16kg. The change is across the population, irrespective of their prior body fat%

57% of the participants had the increase in Fat Free Weight.

We applied Pearson co-relation test for understanding the statistical significance of the results for validation.

Table 2: Results comparison after Throwball sessions for 29 days(13 sessions)

Parameters	Mean ±SD	R	t-Score	p-Value	Significant? *
Weight (kgs)	59±11	0.978	129.03	3E-46	Yes
Visceral Fat	5±3	0.984	173.65	1.90E-50	Yes
Subcutaneous Fat%	24±6	0.910	30.52	9.18E-26	Yes
Lean Mass (kgs)	40±5	0.920	34.33	2.11E-27	Yes
Body Fat%	28±7	0.903	28.18	1.15E-24	Yes
Fat Free Weight (kgs)	42±5	0.885	23.44	4E-22	Yes
Skeletal Muscle%	38±5	0.906	29.10	4E-25	Yes
Bone Mass (kgs)	2±0	0.879	22.19	2.10E-21	Yes
Protein%	16±2	0.807	13.27	8.83E-15	Yes

*Statistically significant change where the p-value is <0.05

Source: (Sri Sai Foundation, Alcoholic and Drug abuse treatment, consultation and rehabilitation center, Throwball session study by ITF)

5. Discussion

Body composition change:

Based on the results, we observed that the 56 participants with Alcohol Addiction and Drug abuse aged between 16-66 years (age mean 39± 13), all males, with 13 Throwball sessions in 29 days had significant change in their body health. The average weight change was -0.91kgs±2.13 for people who were at/above normal body fat% (>=22%), 1SD range is between -3.04 to 1.22 Kgs which is significant change in one month.

For the people who were below the normal body fat% (<22%) had weight gain of average 2.94± 2.23, 1SD range 0.71 to 5.16KGs. The Lean Mass average of 0.11kgs± 2KGs increase across all participants, ranging from -1.9 to 2.11KGs. Both having p-value <0.05 indicating statistically significant change.

There was considerable change in Body Fat in participants.

Average 0.8% reduction in the HBF with -0.39 ±2.18 kgs ranging -2.57 to 1.79KGs.

Average 10.9% increase in the HBF with 2.32 ±4.71 kgs ranging -2.39 to 7.04KGs.

Subcutaneous Fat(SF)% slightly reduced (average 1.4% in people who were at higher level (>25.5%).

Those with lower SF (<19%) significantly gained SF% (14.9%) on average which is a positive sign of improved health.

Those with normal range of SF >=19 and <=25.5% had 1.2% increase in their SF.

There was considerable change in Visceral Fat in participants.

Average7.6% reduction in the VF for those who had earlier VF>=6.

Average 9.1% VF retained or increased in people whose VF was <6 earlier.

100% of the participants had retained or decreased VF who had >=6 VF earlier.

90.5% of the participants had retained or increased VF who had <6 VF earlier.

The findings were cross-verified with the participants and got to know the following:

- The participants felt that their appetite increased significantly after playing throwball. They were able to consume good healthy food and able to digest easily.
- They could sleep well, which otherwise they were not.
- They could free up their mind, felt happy because of the game.
- Some of the participants who had body aches, trembling and therefore challenge in catching the ball during initial days could gain the strength in 2-3 sessions, felt very energetic, freed from body issues.
- Everyone said that they could go back to their childhood days which brought higher happiness.
- Those who were under weight earlier, gained weight and felt healthy.
- Those who were over weight, lost a few kgs and felt healthy too.

Results in the analysis matched with participants' feedback and indicated true health improvement.

These are the reflection of improved body tissues and motor abilities because of positive impact on blood circulation, nervous system, appetite improvement.

Over & above physical health, key observations about several mental and soft skills improvements from the facility staff are.

Mental Health and Enjoyment: Management staff said Throwball did play an important role in increasing the enjoyment and enthusiasm in the participants. Enjoyment is critical for people's mental health. The participants were eagerly waiting for throwball sessions. Some people who used to be reluctant to participate in daily exercise/yoga, also came forward, actively participated in Throwball game.

Getting Back to childhood: Game was played by all the participants, irrespective of the age group. Everyone re-lived their childhood during the game.

Soft skills: It also improved the cognitive skills of the participants. Coordination and collaboration among the participants improved while and after playing throwball. Participants enhanced their reach to help each other.

Limitations of the study: Since this was a pilot study, the number of participants that took part in the study was smaller in size and follow up period of the study was 29 days only. Since it is a rehabilitation center, 37% of the participants got discharged during the program. The final

sample size therefore was reduced from 56 to 35. Yet, we heard that the discharged participants also benefited from the observation made by coaches and the management team.

It is aimed to increase the sample size and provide a longer follow-up period to look for further improvements in a separate study.

6. Conclusion

Based on the above study, we could unanimously conclude that Throwball helps improve the Physical and mental health of participants. It not only helps improve the external body, but also the brain power, cognitive skills, internal organs of the body, through automated acupressure while playing.

Acknowledgment

This paper is an output of the science project with Sri Sai Foundation, Alcohol, Drug Abuse Treatment, Counselling & Rehabilitation Center, Bengaluru, India. We acknowledge Mr. Venkateshwarulu, all staff members and the participants for supporting us.

We also acknowledge Dr. Arvind Conjeevaram and Trustwell hospital, Bengaluru, India who had sponsored the event for conducting the Throwball Online sessions for CKD patients for improving health that enabled ITF to conduct this study.

We also acknowledge the following members who conducted the Throwball sessions on regular basis, that helped getting appropriate results:

- Mr. Santhosh, Chairman, Throwball Game Development committee (ITF), International Throwball Coach, India
- Mr. Sharan P, International Throwball Player and Coach, India
- Mr. Uday Kumar, International Throwball Player and Coach, India
- Ms. Annie John, National Level Throwball Player, India
- Ms. Chaithanya, National Level Throwball Player, India
- Ms. Saranya, National Level Throwball Player, India
- Mr. Vinesh, National Level Throwball Player, India
- Ms. Priya, National Level Throwball Player, India
- Ms. Ananya, National Level Throwball Player, India
- Ms. Swathi, Throwball Player, India
- Ms. Prabha, Throwball Player, India

References

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[3] Dr. Arvind Conjeevaram, Consultant Nephrologist and Transplant Physician, Mentor for International Throwball Federation "Throwball for Health" initiative. Bengaluru, India. Email: canchi8@gmail.com
[4] Dr. Mani S, Vice President, International Throwball Federation and Secretary General, Asian Throwball Federation. Bengaluru, India. Email: senniappan.mani@gmail.com
[5] Mr. Sharan P, International Throwball Player and Throwball Coach, International Throwball Federation. Bengaluru, India. Email: sharusharan220@gmail.com
[6] ITF: International Throwball Federation, No 29, Raja Ram Mohan Roy Road, Sampangirama Nagar, Bengaluru 560027, Karnataka, India.
[7] Throwball for Patients: ITF had conducted Online Throwball sessions for Chronic Kidney Disease (CKD) patients from Mar-Jun 2021 under the guidance of Dr. Arvind Conjeevaram, Consultant Nephrologist and Transplant Physician, MD. The event was inaugurated on World Kidney Day on Mar 11, 2021 at Trustwell Hospital, Bengaluru, India. The event was successful. The patients' blood pressures were stabilized after starting the Throwball session. Patients were able to gain higher stamina and energy followed by enjoyment and mental peace.
[8] Throwball for Intellectually Disabled: ITF conducted another study* with Aruna Chethana Special Children School from Mar 18-Apr 8, 2022 for children with Intellectual Disability. The study revealed that there was significant improvement in Fat reduction and Muscle bulk improvement by playing throwball. Also improved soft skills, eye-hand-brain coordination were noted. *This paper was accepted and presented in 2nd Global conference for Children and Youth, 2022 at University of Cambridge, UK, 26-28 Aug 2022.
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