Abstract [Required]:

Despite its increasing popularity, little is known about the techniques utilised in Brazilian Jiu-Jitsu competition and their relative success. This work aims to answer questions around the most used and successful takedowns, guardpasses, guard sweeps and submissions to allow development of coaching methods towards enhancing performance at lower belt levels. 140 tournament fights were analysed. The most common takedown was guardpull with 94% success. Significantly more single leg takedowns were attempted for blue belts, compared to white belts (p = .013). However, there was no significant difference in success (p = .150). White belts used 3 main types of guardpasses with 93% covering knee slice, knee pin and bullfighter pass. A greater variety of passes was observed at blue belt with 71% coming from these three passes. The four most commonly attempted guard sweeps were scissor sweep, back take, X-guard sweep and SitUp sweep all experiencing varying levels of success: 55% for the scissor sweep, 60% back take, 63% X-guard sweep and 38% for the sit up sweep. Of all the submissions attempted 34% were for arm bar, 21% triangle, 12% cross collar choke but there is almost an inverse relationship between use and success with the least used having higher success rates. Brazilian Jiu-Jitsu competition at this level was dominated by guard pull takedowns and submission attempts from guard illustrating the early focus on developing a competition strategy around this position. This information will aid coaches in development of techniques and tactics in order to better prepare players for competition.

Keywords: combat sport, performance analysis, scoring frequency, martial arts

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Background

Brazilian Jiu-Jitsu (BJJ) has its foundation as a self-defence art but has rapidly grown into a widely practiced competitive sport. As such, competitive contests are primarily decided by submission from joint locks or chokes or failing this by accumulated points decided based on superior positions or positional transitions (1). The success of BJJ in the early days of the Ultimate Fighting Championship firmly cemented its place in the martial arts offering since 1993. Since that early introduction it has grown to become one of the most popular martial arts currently studied (1).

The presence of scientific articles on BJJ are limited, with the focus being injury profiling (2,3,4), athlete profiling (5,6) or understanding the physiological demands (7,8,9). Whilst these endeavours could contribute to the understanding of the demands of the sport and therefore potentially aid in coaching development, competitive performance analysis is lacking. Performance analysis has been used successfully in many sports including those with similarities to BJJ (10,11) to objectively measure tactics. Such information is invaluable to the technical and tactical development of such sports. To date similar approaches have not been applied to BJJ.

Competitive BJJ allows participants to employ a large variety of techniques with the aim to outscore or submit the opponent. Multiple takedowns, pins, joint locks and chokes can be combined to provide a victorious outcome and to date no attempt to compare the effectiveness of different techniques has been undertaken. At its core, competitive points are accumulated from throwing an opponent or pinning them whilst on the ground, whilst a successful submission will award victory to the practitioner regardless of the score. For this reason, it is important that a deeper understanding of technique success is developed to aid in the identification of the technical and tactical aspects most likely to be successful in
competition. Such an understanding will aid in the development of coaching education. Therefore, the aim of this study was to analyse beginner BJJ matches to better understand the nature of the techniques and their successes.

Methods

Using performance analysis to assess the fights required the establishment of objective definitions for the techniques. A pilot review of BJJ contests by two authors was used to establish the usability of a series of definitions for observable events. A tagging panel was created using these definitions in Dartfish (v8).

Sample

With institutional ethical approval, the sample consisted of 140 fights and were obtained from video footage of BJJ tournament fights from a publically accessible website. All personal data were excluded from the final results. The inclusion criteria for contests were the whole contest needed to be available, fighters were of white or blue belt rank, Gi or kimono fights only, male (due to lack of available quantity of female fights) and all weight classes were permitted. The use of Dartfish (v8) for the data collection allowed each athlete to be coded with the time when the specific event occurred, the technique used (examples of which include takedown attempt, guard pass, submission attempt etc). In addition, whether such an attempt was successful or not. Briefly success was defined as scoring takedown, successful position reversal (from bottom to top), full guard pass (not to half guard) or submission. The option to code an event as ‘other’ was available for collective analysis of techniques not recognised.
All data were collected by the same researcher, with over 9 years of experience in BJJ, to provide consistency of interpretation for techniques. Completed data collection resulted in each contest being represented by a coded matrix of events which was stored for later analysis. Collective matrices were analysed using MatLab (R2017b) where bespoke algorithms were developed to identify descriptive and analytical statistics relating to specific techniques and their outcome.

Analysis

The resulting data were analysed and presented as attempts, success rates and percentages. Each variable is considered independent for the analysis and breakdown into belt colour was completed. Where possible chi-squared testing on the frequency data was completed to investigate differences between blue belt (BB) and white belt (WB). Success was defined according to Miller and colleagues (12) as:

\[
\text{% of successful techniques} = \left( \frac{\text{No. of successful techniques}}{\text{total number of attempted techniques}} \right) \times 100
\]

Results

Takedowns

A total of 247 takedown attempts were recorded, from the 140 fights. The most common takedown attempted was ‘guardpull’ which had an attempt frequency almost 3 times that of the next most common. Guardpull was identified as 50% of all takedown attempts. 94% of guardpull attempts were determined as successful and it was the most success of all
takedowns. Footsweeps and backwards takedowns also achieved high success rates (86%).

Other frequencies and successes are evident in figure (1).

“The Insert Figure 1 here”

The belt split demonstrated a similar breakdown for white and blue belts, where 46% of all takedowns were classified as guardpull for WB and 53% for BB with a common success rate of 94%. There were a similar number of attempts of double leg takedowns across the belts, whereas there was a significantly greater number of single leg takedowns attempts for BB (18%, n=24) compared to WB (7%, n=8); \( \chi^2 (1, N = 247) = 6.13, p = .013 \). However, there was no significant difference in success \( \chi^2 (1, N = 247) = 2.06, p = .150 \), (figure 2).

“The Insert Figure 2 here”

The most frequently attempted takedowns (guardpull, single leg and double leg) resulted in a mixed array of ground positions. Guardpull resulted in guard or half guard (bottom) 93% of the time. Double leg takedown resulted in side control 31% of the time, however it also had a high prevalence of resulting in guard (top) and turtle (bottom) 28% and 19% respectively. Single leg takedown resulted in similar resulting positions, side control (top) 30%, guard (top) 27% and turtle (bottom) 17% of the time.

The belt split illustrates that the double leg takedown by WB resulted in guard (top) 47% of the time in contrast to just 11% for BB. Similarly, the double leg takedown resulted in side control (top) 47% in contrast to WB where just 12% of double leg takedowns resulted in side control (top). Furthermore, WB double leg takedowns resulted in guard (bottom) 18% in contrast to 0% at BB.
Guard passes

A total of 107 guard passes were recorded. The most common guard pass attempt was knee pin and knee slice, closely followed by the bullfighter pass. Success rates identified bullfighter pass as most successful with similar success rates for the sao paolo and knee pin pass.

“Insert Figure 3 here”

Passes at WB concentrated three passes, knee slice, knee pin and bullfighter pass accounting for 93% of pass attempts. A greater variety of passes was witnessed at BB with 71% coming from these three passes. Double under and leg drag passes accounted for a further 19% of passes at BB compared to 0% at WB. The BB, WB split showed similar attempts of knee slice and bullfighter passes. Knee pin was attempted more at blue belt but this was not significantly different $\chi^2 (1, N = 141) = 0, p = .995$.

Of the three common WB passes knee pin was 100% successful, with 81% and 82% success rates for knee slice and bullfighter respectively. At BB bullfighter pass was most successful of these three passes (89%) with 69% and 70% success for knee slice and knee pin respectively. A particularly low success rate was noted for the double under pass at BB (29%).

Guard sweeps

A total of 56 guard sweeps were observed. The four most commonly attempted guard sweeps were scissor sweep, back take, X-guard sweep and SitUp sweep. Various levels of success
were noted for these sweeps; 55% for the scissor sweep, 60% back take, 63% X-guard sweep
and 38% for the sit up sweep. The belt split shows that WB attempted a scissor sweep on 10
occasions compared to just once for BB. DeLaRiva was attempted 5 times more often at blue
belt as was backtake (twice as often). In contrast Situp sweep was three times more common
at white belt as was spiderguard sweep.

Submissions

173 submission attempts were observed. Of all the submissions attempted 34% were for arm
bar, 21% Triangle, 12% cross collar choke, 8% kimura and 7% rear choke. All other
submissions had an attempt frequency of less than 5%. The success for these top five
submissions were best for the rear choke (75%) falling to triangle at just 22% (figure 4).

The belt split illustrates a similar pattern of attempts at white belt (figure 5) for arm bar,
triangle, kimura and cross collar choke, however rear choke was lower with less than 5%
attempt frequency. BB Kimura attempts were below 5% attempt frequency with omoplata
registering as the 5th most common submission attempt at blue belt despite no attempts for
WB. Chi-squared testing reveal no significant difference in arm bar attempts $\chi^2 (1, N = 173)
= 0.58, p = .445$, Cross collar choke $\chi^2 (1, N = 173) = 1.74, p = .186$, or triangle $\chi^2 (1, N =
173) = 2.09, p = .148$, attempts between the belts.

A strong dominance of the guard was evident when investigating submission position. At
least 76% of arm bar, cross collar choke and triangle chokes where observed from the guard
(bottom) position. A greater variety of positions were observed for Kimura attempts but guard was still the most frequent (30%) and side control top the next most frequent (20%). The belt breakdown demonstrated a similar pattern with over 80% of arm bars, cross collar chokes and triangles attempted from guard (bottom). At 63% of BB arm bars were attempted from the guard, and over 75% of cross collar chokes and triangle chokes attempted from guard. A statistically significant greater number of guard arm bar attempts were witnessed at white belt compared to blue belt, $\chi^2 (1, N = 103) = 4.13, p = .042$.

Discussion and Conclusion

The aims of this paper were to conduct an event based performance analysis of WB and BB BJJ fights, and this represents the first such analysis therefore the findings are considered to be novel. The findings are believed to offer players, coaches, referees and organisational committees/governing body’s insights into the events commonly encountered during this level of BJJ match. All matches commence in the standing position and the data generated by this study illustrates that guardpull was by far the most common take down event and one which was highly successful. Players at both belt levels achieved a high percentage of success resulting in a guard control position. This strong focus on the sacrifice of the top position is highly unique to BJJ, despite this previous studies have not quantified this (13,14) therefore this is the first study to identify and quantify guardpull dominance in beginners BJJ. Throw analysis in judo illustrated that sutemi-waza (sacrifice throws) were much less frequent and successful in comparison to Te- or Ashi-waza (12). This suggests that the guard pull technique has either been a strong focus of beginners BJJ or that the technique in itself is simple to master or difficult to defend. It is not clear whether opponents are happy to follow this technique to the
ground i.e. allow the technique to be effective, in order to end up in the familiar guard top
position or whether effective defence to such a technique is lacking or difficult to grasp at this
level.

There were some interesting findings around the other takedowns regarding little used but
high success rates. A foot sweep and backwards takedown demonstrated an overall success
rate of 86% despite only being attempted 9% (n = 21) and 3% (n = 7) of the time
respectively. At WB, this success was 100% for backwards takedown, and foot sweeps 85%
and 88% respectively for WB and BB. This coupled with a 100% success rate for forwards
takedowns at blue belt suggest that certain techniques appear to be highly successful but only
for a few individuals. It is not known as to the back ground of these players, i.e. whether they
possess these skills prior to commencing training in BJJ or whether they have been able to
develop a high level of proficiency for these specific techniques. It seems however that the
players using these are highly successful with these takedowns and that these takedowns are
not attempted by those who are less confident of their competency.

However just looking at the success of the takedown does not consider the resultant position
achieved from the takedown. Unlike Judo, BJJ cannot be won outright by a throw/takedown
therefore resultant position is one of the primary aims of such techniques. This is critical to
understand if significant match advantage has been gained from the takedown. For example,
the backwards takedown resulted in equal chance of ending in side control, taking the back
(top) and mount (top) which could be described as attacking positions and a positive
outcome, however it also resulted in guard (bottom), a neutral/attacking position but in
addition guard (top), a negative position. Therefore, takedowns resulting in attacking
positions are critical to inform coaching practice. Few takedowns resulted in mount top or
back top, however 38% of single leg and forward takedowns and 33% of backwards
takedowns resulted in side control (top) for WB. This suggest that with 100% success rate for
backswards takedowns a 1 in 3 chance of ending up in side control (top). In addition, when observing the other outcomes from this takedown, namely a 1 in 3 chance of ending in guard (bottom) or back (top) this technique appears likely to result to significant attacking advantage and unlikely to result in a negative position. This is in contrast with the forward throw, which is usually attempted by turning your back on your opponent in standing, which was only successful 53% of the time and resulted in a 1 in 4 chance of ending with your opponent taking the back (top) position, one of the high scoring positions in BJJ. It did however yield side control (top) 38% of the time, therefore this represents a high risk, high reward tactic for WB. The single leg takedown, which resulted in side control top 38% of the time also resulted in 1 in 4 landing in guard top demonstrating a medium risk for high reward. Therefore for the white belt BJJ player who is keen to avoid ending up in the opponents guard or a negative non attacking position, a forwards takedown or backwards takedown offers low risk, however there is a high risk of a back take with a forwards takedown, therefore the backwards takedown could be the preferred low risk, high reward option.

For BB, the 100% success observed with a forward throw resulted in ending up in guard or half guard (top) 75% of the time which is not necessarily an attacking position. Similar findings are evident for the foot sweep which despite a high success rate at blue belt (88%), guard or half guard (top) was the outcome 63% of the time and only an attacking position 38% of the time. Therefore, the outcomes of such techniques for gaining advantage should be questioned. The takedown most successful for securing an attacking position at BB leg takedown which resulted in side control (top) almost 50% of the time. This takedown, perhaps with its origins in judo (Morote Gari) where, before it became illegal, had an observed successful frequency of 3% compared to all throws (15), or freestyle wrestling with an observed frequency of 10% of all successful takedowns (16). Side control (top) would be considered a strong attacking position and a very positive outcome from a takedown,
however there was a 1 in 4 chance that such an attempt would result in the opponent securing the back. Moreover, despite a very low usage (only 3) the sacrifice takedowns resulted in either mount (top), guard (bottom) or in back take for the opponent in equal measures. Therefore, for the BB looking to secure a strong attacking position either sacrifice throw (which maybe the domain of those who have grasped these techniques), or double leg takedown with a high proportion ending in side control.

The outcomes of these takedowns have important implications for coaching, technique development or tactics. It seems to suggest that either students at this level struggle to secure the resultant position to take full advantage of the takedown or that defending these takedowns is well developed as such to minimise the impact of the takedown. The exceptions to this are the little used takedowns which seem to be adopted with those who have concentrated on the development of these specific techniques. Perhaps specific drills or focus should be placed on how to complete the takedown to ensure maximal advantage. This notion has been identified in other combat arts and is sometimes referred to as transition. This is unique in BJJ over Judo as with a perfectly executed takedown a Judo contest is over thus preventing the need to secure the ground position. In contrast takedowns in BJJ serve only for the transition to the ground.

Due to the dominance of the guard position, one of the key challenges in BJJ is passing the guard. The findings of this study suggest that 93% (WB) and 71% (BB) of all guard passes fall into the knee slice, bullfighter and knee pin pass categories. These were highly successful at white belt suggesting either a strong focus on guard passing at this level or perhaps due to less developed guard retention. The high success rates suggest this is a highly effective tactic for this level of BJJ. However, this level of success reduces slightly for the knee pin and knee slice for blue belt. The reasons for this are not immediately clear but suggests that as experience is gained so does the ability to defend this attack. This suggests that an early focus
for BJJ coaching should be built around defending these very common attacks. In addition, it may be tactically relevant to develop and train less common passes in order to surprise opponents rather than rely on the common passes.

Submissions are a critical aspect of BJJ as they result in an instant victory. Therefore, BJJ training is largely based around the idea of securing a submission. Over the years a great number of submission techniques have been developed. Despite such a large quantity of available submissions, only 8 types of submission were witnessed for white belt, and 9 for blue belt. There was a strong focus on submission attempts from guard with 75% of all submission attempts common from the guard (bottom) position. Of all the submission attempts at white belt from the guard 37% were for the arm bar. At BB around 2/3rds of all submission were from the bottom guard position and of these 1 in 5 was for the arm bar. Such a propensity for one technique seems to suggest that competition results in a reductionist approach to submission attempts where the submission repertoire of beginners is narrowed significantly. Mixed martial arts demonstrated that the elbow locks (very similar to the arm bar) were responsible for 9% of all stoppages (17) and was by far the most common joint lock witnessed. This suggests such a technique is high popular and effective across a range of arts perhaps due to its ease in application or effectiveness as a submission or difficultly to defend. Coaches should concentrate of developing methods of appropriate defence for this highly popular submission. Despite this high popularity, the triangle choke was more frequent at blue belt with 1 in 4 submission attempts from the guard being for this technique. This was observed to cause 2.3% of stoppages in MMA matches being the third most common (17). As some of the fighter in the study by Buse (17) were from a BJJ background it is possible that these skills are reflective of those learnt at beginner BJJ players. Despite these subtle differences it identifies the strong emphasis of early BJJ training involving the guard. It is
evident that avoiding defeat at this level of competition requires an ability to defend arm bar and triangle attacks from inside the guard.

The synthesis of these matches seems to suggest a common thread or theme to the generic approach to BJJ at this level. There appears to a strong focus on the guard. Takedowns dominated by guard pulls, low guard pass counts, submission attempts from guard with a strong focus on arm bar and triangle and therefore this information should prove valuable to players and coaches alike in developing training to defend or enhance tactical approach to winning at this level.

This study demonstrates for the first time an analysis of the techniques used during beginner BJJ matches. The results were dominated by the guard, from guardpull as the most common takedown to submissions from guard being most prevalent. This confirms the uniqueness of BJJ for developing a strong propensity for developing a competition strategy dominated from being on ones back. This information will aid coaches in development of techniques and tactics in order to better prepare players for competition.

References


Figure 1. Percentage of takedown attempts and percentage of success
Figure 2. Percentage of use of different takedown types, split by belt.
Figure 3. Overall use of guardpass attempts and percentage success
Figure 4. Use of submission attempts and percentage success

Figure 5. Submission attempts across blue and white belt.
17th Sept, 2018

Dear Editor,

Re: Technique utilisation and success in competitive Brazilian Jiu-Jitsu matches at white and blue-belt

We would like to take this opportunity to thank you for considering our manuscript.

As corresponding author I can confirm all authors contributed significantly to the manuscript and are to be considered authors. I have the authority to act on behalf of the authors.

The material submitted is unpublished and original it had not and will not be submitted for publication elsewhere until a decision is made regarding its acceptability for publication in the Asian Journal of Sports Medicine. If accepted for publication, it will not be published elsewhere without the written permission of the Editor-in-Chief. The experimental work conforms to the highest standards of safety and ethics, and to the laws of the country in which the work took place. As the study used publically available data no consent was necessary.

We look forward to you considering our work for publication.

Yours sincerely

Dr Jonathan Williams