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THE ROLE OF COGNITIVE-BEHAVIORAL THERAPY IN IMPROVING ATHLETES' PERFORMANCE: A SYSTEMATIC REVIEW WITH ADHERENCE TO PRISMA GUIDELINES

Aqsa Shamim Ahmed[1], Ayesha Qudus[2], Asima Munawar[3], Rabia Karim[4], Umair Liaqat[1], Muhammad Farhan Tabassum[1,5*]

[1]Department of Sports Sciences & Physical Education, Faculty of Allied Health Science, University of Lahore, Lahore, 54000, PAKISTAN
[2]University Institute of Radiological Sciences and Medical Imaging Technology, Faculty of Allied Health Science, University of Lahore, Lahore, 54000, PAKISTAN
[3]Capital University of Science and Technology, Islamabad, 44000, PAKISTAN
[4]University of Home Economics, Lahore, 54000, PAKISTAN
[5*]Depaertment of Mathematics, University of Management and Technology, Lahore, 54000, PAKISTAN

[*]**Corresponding Author:** Muhammad Farhan Tabassum, farhanuet12@gmail.com

Abstract
This systematic review aimed to examine the role of cognitive-behavioral therapy (CBT) in enhancing athletes' performance. A comprehensive search was conducted in electronic databases of PubMed, Medline and ScienceDirect, and relevant studies were selected based on predefined inclusion criteria. A total of 10 studies were included in this review, which varied in terms of intervention type, outcome measures, and study design. The results of this review suggested that CBT interventions can be effective in improving athletes' performance by addressing negative thoughts and behaviors related to sports performance, managing stress and anxiety, eating disorders and other psychological conditions by enhancing motivation, self-efficacy and self-regulation. Moreover, CBT interventions can be tailored to target specific areas of cognitive and behavioral functioning that are relevant to individual athletes' needs and goals. It can be concluded that CBT-based interventions are effective in enhancing the athletic performance. Future research should focus on developing and evaluating tailored, athlete-centered CBT interventions with standardized outcome measures to enhance the effectiveness of CBT in improving athletes' performance.

Keywords: CBT, Performance, PRISMA, Systematic Review, Athlete.

Introduction
Sport has become increasingly competitive, and athletes need to perform at their best to achieve their goals. Achieving peak performance requires not only physical training but also mental preparation. Athletes need to maintain a positive mindset, manage stress, and cope with pressure to perform at their best. However, athletes often face mental barriers that can hinder their performance, such as negative self-talk, anxiety, and self-doubt. Therefore, there is a need for psychological interventions that can help athletes overcome these barriers and enhance their sports performance.

Cognitive-behavioral therapy (CBT) is a widely recognized form of psychological intervention that has been found effective in addressing a range of mental health conditions. Recently, CBT has been applied to the field of sports performance to help athletes enhance their performance and mental wellbeing.

CBT is a psychotherapeutic approach that aims to help individuals identify and change negative thought patterns and behaviors that contribute to mental health problems (Beck, 2011). CBT is based on the principle that our thoughts, emotions, and behaviors are interconnected and that changing one can led to changes in the others. CBT involves a collaborative process between the therapist and the client, where the therapist helps the client identify and challenge negative thoughts and behaviors and develop more positive and adaptive ones.

CBT has been found effective in treating a range of mental health conditions, such as depression, anxiety, and post-traumatic stress disorder (PTSD) (Hofmann et al., 2012). CBT is a brief and structured intervention that can be delivered in a variety of settings, including individual therapy, group therapy, and online therapy.

CBT has been applied to the field of sports performance to help athletes overcome mental barriers and enhance their sports performance. CBT interventions for sports performance are typically aimed at improving cognitive and emotional factors that influence athletic performance, such as self-confidence, anxiety, focus, and motivation.

A meta-analysis conducted by Zhu and colleagues (2021) found that CBT interventions can significantly improve athletic performance and psychological wellbeing. The study included 26 randomized controlled trials (RCTs) that evaluated the effectiveness of CBT interventions on sports performance. The results showed that CBT had a positive effect on various aspects of sports performance, including self-confidence, anxiety, focus, and motivation.

CBT interventions for sports performance typically involve a combination of cognitive and behavioral strategies. Cognitive strategies involve identifying and challenging negative thoughts that may hinder performance, such as self-doubt or fear of failure. Behavioral strategies involve developing effective coping strategies for managing stress and pressure, such as relaxation techniques or goal setting.

One of the key benefits of CBT for sports performance is its ability to help athletes overcome negative thinking patterns that may hinder their performance. CBT can help athletes identify and challenge negative thoughts and replace them with more positive and productive ones. For example, an athlete who struggles with self-doubt and negative self-talk may be taught to identify and challenge these thoughts and replace them with more positive and affirming ones.

CBT can also help athletes develop effective coping strategies for dealing with stress and pressure in high-stakes situations, such as competitions or games. By learning how to manage their emotions and thoughts, athletes can improve their ability to stay focused and perform at their best under pressure. CBT interventions for sports performance may involve teaching athletes' relaxation techniques, visualization, or goal setting.

In addition to improving sports performance, CBT can also help athletes manage stress and avoid burnout. A study by Broman-Fulks and colleagues (2018) found that CBT-based stress management interventions can reduce stress and improve mental health in athletes. The study included 13 RCTs that evaluated the effectiveness of CBT-based stress management interventions on stress, anxiety, and depression

A systematic review of the literature on the role of CBT in sports performance can provide an evidence-based assessment on the effectiveness of CBT interventions in improving mental skills and sports performance. Such a review can also identify gaps in the current literature and highlight areas for future research. Additionally, a systematic review can inform the development of evidence-based interventions for athletes and provide guidance for sports psychologists, coaches, and other practitioners working with athletes.

Martials and Methods

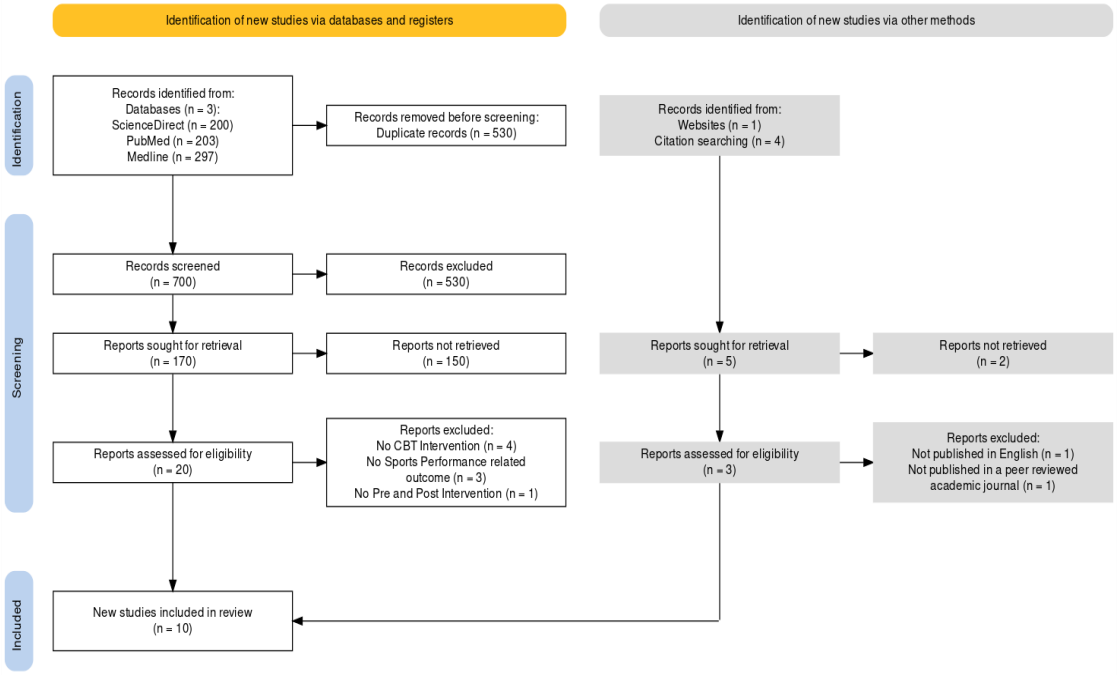
The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines served as the template for reporting the present review (Rethlefsen, & Page, 2022).

Search Strategy: A computer database search of relevant English-language publications was identified by systematically searching PubMed, ScienceDirect and Medline. Initially ScienceDirect produced 200 results, PubMed 203 and Medline 297 results. The key words used were "Performance" and "cognitive behavioral therapy" with Boolean operators AND/OR in the abstract, key words, or title. In the process of retrieval, the search terms were modified according to the search rules for the different databases. Websites, Reference lists of the original papers to find additional relevant articles were also searched that yielded additional 5 papers. After excluding duplicates and studies predominantly addressing the provision of CBT to other clinical and psychological manifestations and/or not including specific evidence considering the acceptance, efficacy and adherence of CBT to sports performance, a total of 10 studies were deemed relative to the current review topic.

Study Selection: The Inclusion criteria of the study was based on the population, intervention, control, outcomes, study type (PICOS) approach (Higgins et al, 2019). The target *population* was sports persons or in some way related to any kind of sports. *Interventions* were described as CBT or based on CBT principles. The strategies had to be under the umbrella of CBT including cognitive therapy and behavioral therapy, and common CBT techniques such as problem-solving, relaxation, goal-setting, behavioral experiments, and cognitive restructuring delivered face-to-face or remotely (e.g., via telephone and internet) and used in individual or a group form. The *control* conditions included CBT applied to areas other than sports performance. The primary *outcome* of the study is to analyze the effectiveness of CBT in enhancing the sports performance and secondary outcome is to grasp what are the most frequent techniques used in the performance improvement. *Studies* had to involve a randomized controlled trial (RCT) design intervention study, case studies, with no restrictions on the length of follow-up. Only those studies were included for which the researcher had the accessibility of full-text publication.

The study exclusion criteria were Participants with cognitive impairment or substance abuse. Solely cognitive or behavioral interventions as opposed to a comprehensive, integrated CBT approach. Also, those studies that are not focused on performance related outcomes. Studies that are Literature reviews or protocols, incomplete in terms of data used or inconsistent statistical methods or lacking quantitative analysis are excluded from the study. Duplicate publications and non-peer-reviewed journal articles, thesis dissertations were excluded.

Figure 1*Flow-chart of the literature search according to the recommendation of the PRISMA guidelines*



Data Extraction: Titles and abstracts of the records were independently screened by researchers. The following information was extracted: (a) Basic information, including first author, year of publication, country; (b) Study design, including information on participants (number, age, gender), frequency/length of follow-up, type of sport, tools used, intervention method, comparison group and finally outcomes.

The methodological quality of the included studies was assessed using the CASP tool (Critical Appraisal Skills Programme, 2021). Studies were categorized as follows (Table A1 in Appendix A)

- Red color for a negative response to the criteria
- Yellow color for an uncertain response to the criteria
- Green color for a positive response to the criteria

Data Analysis and Results

Review Process: This systematic Review includes the effects of CBT on Sports Performance. Initially 705 records were identified including other sources, after duplicate exclusion 175 records were retained. After screening the title and abstracts 150 records were excluded. Remaining 25 full text were analyzed for eligibility, of which 15 were excluded. Finally, as presented in Table 1, a total of 10 texts were retained.

Characteristics of Included Studies: In all, 10 studies a total of 426 participants from 5 countries were included. This review comprised of 3 randomized control design, 2 quasi experimental design, 2 single subject design whereas, one case study, pilot study and matched group factorial design.

Review of the studied CBT and Athletic Performance: Regarding interventions, 6 out of 10 studies only uses CBT while 4 studies used CBT in combination to other therapies where most frequent techniques of CBT were Jacobson's Progressive Relaxation Technique, Imagery and positive self-talk. The minimum duration of the CBT applied was 5 weeks (Kirschenbaum et al, 1982) whereas, the maximum duration was 34 weeks (Neil et al, 2012). Six studies measured only sports performance outcomes whereas, 4 studies measured other outcomes in addition to performance.

In a study conducted by Folgar.et al (2022), quasi experimental design was used in order to study the effects of a cognitive-behavioral therapy intervention on the rowers of the Junior Spain National Team. 10 sessions of CBT were given to a sample of 16 rowing players out of which 7 were women. The mental training techniques used were goal setting, visualization, Jacobson's Progressive

Relaxation Technique. Scores of the Sport Performance Questionnaire revealed the improvement in athletic performance. On the other hand, CBT was also used in combination to hypnosis and positive imagination to improve the performance of male soccer players (Hamid et al 2018).

Table 1 *Reviewed studies characteristics included in the Systematic Review*

Author	Study Design	Participant Characteristics	Type of Sport	Groups	Techniques Used	Training Characteristics	Scales	Outcome Measures
Folgaret al (2022) Spain	Quasi-Experimental Study	N = 16 Women (n = 7), Men (n = 9) *M*age= 17.1	Rowing	1	Mental Training, Motivation Mental Concentration Goal Setting Visualization Jacobson's Progressive Relaxation Technique	10 sessions	Sport Performance Questionnaire	Improved athletic performance
Çakmakçı et al (2020) Turkey	Quasi-Experimental Study with three-month follow-up test	N = 16 Boys (n=5) Girls (n=11) *M*age= 16 to 28 years	Swimming Running Gymnastics, Taekwondo Wrestling Bodybuilding	2 Pretest(n=8) posttest(n=8)	CBT treatment based on Fairburn et al. (2008)	21 sessions	Eating Disorder Diagnostic Scale (EDDS) Semi-Structured Clinical Interview by First et al. for DSM-IV Axis I Disorders (SCID-I)	Improvement of Bulimia Nervosa symptoms and weight management affects the performance.
Coronado et al (2019) US	Pilot Study	N=8 *M*age=20.1years Females n=6 Males n=2	Basketball, Frisbee Soccer Running Basketball	1	Controlled Breathing, Grounding Graded Activity Plan Athletic Identity Self-Talk, Setting Daily, Guided Imagery Intention Present-Mindedness	7-sessions Telephone Based CBPT-ACLR Intervention	Knee Injury and Osteoarthritis Outcome Score (KOOS). Sports/Recreation and Quality of Life (QOL) International Knee Documentation Committee (IKDC), Tampa Scale of Kinesiophobia (TSK), Pain Catastrophizing Scale (PCS) Knee Self-Efficacy Scale (K-SES), Subjective Patient Outcome for Return to Sports satisfaction.	Patients returned to their same sport at the same level of effort and performance.
Hamid et al (2018) Iran	Randomized Control Experimental Design	N = 30 Boys *M*age = 14,	Soccer	2 Experimental (n=15) control (n=15).	Jacobson's Progressive Relaxation Positive Imagination Hypnosis	8 sessions	Yeagly's Football standardized test (YFT)	Cognitive-behavioral therapy accompanied by the positive imagination of success during hypnosis significantly increased the athletic performance in the experimental group
Didymus & Fletcher (2017) UK	Single-Case Research Design with a three months post-intervention follow-up	N=4 *M*age = 19.50	Field Hockey	1	Cognitive Restructuring	26 Weeks	Appraisal of Life Events Sport Emotion Questionnaire Subjective Performance Satisfaction Social Validation Measure	The findings suggest that cognitive restructuring encouraged challenge appraisals, pleasant emotions, and enhanced

								performance satisfaction
Gustafsson et al (2016) UK	Case Study	N=1 Female 17-year-old	Skying	1	Behavioral Analysis, Psychoeducation Exposure	6 sessions	GAD-7 Brief Inventory of Perceived Stress (BIPS) 24-h Food Recall	After the intervention the athlete perceived lower levels of anxiety as well as improved behavioral repertoire and more functional sport-specific behavior
Buffington et al (2016) US	Randomized Controlled Experimental Design	N=153 Female *M*age =18	Basketball, Swimming Diving Volleyball Soccer Tennis Cheering Cross Country Track Fencing	3	Positive Self-Talk Staying in the Moment Self-Esteem Energy Balance	10week	GAD-7 for anxiety, Brief Inventory of Perceived Stress (BIPS) 24-h Food Recall	Cognitive Behavioral ARC intervention with more facilitative interpretations of emotions and better golfing performance reported during and post-intervention.
Neil et al (2012) UK	Single-Subject Design	N=4 Male Players *M*age = 26	Golf	1	ARC Technique	34-week	Sport Emotion Questionnaire (SEQ) Subjective & Objective Performance Measures	Results revealed, that in comparison to the control group, the treatment group showed greater decreases in anxiety, increases in academic performance, and increases in psychological skills associated with successful athletic performance.
Holm et al (1996) USA	Randomized Controlled Experimental Design	N= 62	Football (n=26) Swimming (n=13)	2 Experimental (n=31) Control (n=31).	Relaxation Imagery Performance	7 weeks	Psychological Skill Inventory for Sports (PSIS) Cognitive Somatic Anxiety Questionnaire Academic Performance Measures Physical Performance in Games.	Positive Self-Monitors increased bowling averages substantially in comparison and control condition.
Kirschenbaum et al (1982) USA	Matched Group Factorial Design	N=133 Women	Cricket (Bowling)	6	Self-Regulation Positive/ Negative Self-Monitoring	5 weeks	Performance in Game	

Cognitive restructuring was used in field hockey to enhance the performance of players (Didymus & Fletcher, 2017). This study was conducted as a single-case research design with a three months post-intervention follow-up. On the contrary a 34-week training of ARC technique was conducted for better understanding of emotions and effective golfing performance (Neil et al, 2012). Similarly, self-

regulation has also been used to increase the bowling averages in cricket (Kirschenbaum et al, 1982) where positive self-monitoring was accounted to have more affect as compared to negative self-monitoring techniques.

The effects of CBT had not only been studied on the overall sporting performance but it has remarkable impact on other additional psychological factors that may be known to contribute towards the elevation of the athlete's performance. Anxiety is one of the most debleating factors that can drastically affect the sports performance. CBT is known to have astonishing contribution in terms of dealing with anxiety. In our systematic review three studies revealed that after the intervention the athlete perceived lower levels of anxiety as well as improved levels of performance (Holm et al1996; Buffington et al 2016; Gustafsson et al 2016). In one study CBT is combined with energy balance to cope anxiety that can affect the health, lifestyle behaviors, and hence, performance measures of female athletes (Buffington et al 2016). Similarly, 16-week CBT intervention based on the Fairburn et al. (2008) was used to manage the symptoms of Bulimia Nervosa that was thought to be reason of deteriorating performance of swimming and running, gymnastics, taekwondo and wrestling, bodybuilding athletes (Çakmakçı et al 2020).

Cognitive Behavior therapy was also found to be very useful in the rehabilitation process after an injury in the field of sports. A pilot study was conducted in 2019 by Coronado et al to study the outcome of Cognitive-behavioral-based physical therapy to enhance return to sport after anterior cruciate ligament reconstruction in pre and post operative sessions. It was found out that ACBPT-ACLR program is feasible and acceptable for addressing psychological risk factors after ACLR. 38% patients returned to their same sport at the same level of effort and performance. All patients were satisfied with their recovery.

Discussion

Cognitive Behavioral Therapy (CBT) is a type of psychotherapy that has been widely used to treat a range of mental health issues, such as anxiety and depression. However, CBT has also shown potential in enhancing sports performance and athletes' mental health (Lochbaum et al, 2022). The aim of this systematic review was to summarize the current evidence about the role of CBT in athletic performance. The results indicated that CBT based interventions were efficient in enhancing the sports performance alone and in combination with other techniques. Its effects have also been found on reducing the symptoms of anxiety, bulimia nervosa as well as in the management of injury rehabilitation for recovering to sporting performance.

CBT is based on the idea that negative thoughts and beliefs can lead to negative emotions and behaviors. Through CBT, individuals learn to identify and challenge negative thoughts and replace them with more positive and adaptive ones. This approach has been applied in the context of sports performance, where negative thoughts and beliefs can impact an athlete's performance (Stavropoulos et al, 2019).

CBT can be particularly helpful for athletes who struggle with anxiety and performance. Anxiety can lead to physical symptoms such as increased heart rate, sweating, and muscle tension, which can interfere with an athlete's ability to perform at their best. CBT can help athletes learn to manage their anxiety by identifying and challenging negative thoughts and developing coping strategies, such as relaxation techniques and visualization.

CBT can also help athletes develop a more positive mindset and improve their self-talk. Self-talk refers to the internal dialogue that an athlete has with themselves, and it can have a significant impact on performance. Negative self-talk can lead to feelings of self-doubt and undermine an athlete's confidence. Through CBT, athletes can learn to identify and challenge negative self-talk and replace it with more positive and adaptive thoughts (Van Dis et al, 2020).

In addition to its potential benefits for sports performance, CBT can also have a positive impact on athletes' mental health. Athletes are at an increased risk of developing mental health issues such as depression, anxiety, and eating disorders. CBT can help athletes manage these issues by providing

them with coping strategies and addressing underlying negative thought patterns (Buffington et al 2016; Çakmakçı et al 2020).

It is worth noting that while CBT has shown promise in enhancing sports performance and mental health outcomes in athletes, it is not a one-size-fits-all solution. Athletes have different needs and may respond differently to various interventions. It is important to tailor CBT interventions to individual athletes and to work with a qualified mental health professional who is experienced in working with athletes (Li et al, 2021).

In conclusion, CBT has the potential to be a valuable tool for athletes looking to improve their sports performance and mental health. Through identifying and challenging negative thoughts and beliefs, developing coping strategies for anxiety and stress, and improving self-talk, athletes can learn to perform at their best. While more research is needed to fully understand the relationship between CBT and sports performance, the existing evidence suggests that CBT can be a powerful tool for enhancing athletic performance and promoting mental well-being in sports.

Conclusion

In conclusion, cognitive-behavioral therapy (CBT) has been shown to be an effective intervention for improving sports performance. It involves identifying and changing negative thoughts and behaviors that may be impacting an athlete's performance, as well as developing coping strategies to manage stress and anxiety related to sports performance. CBT can be tailored to address specific areas of an athlete's cognitive and behavioral functioning and can be integrated with other therapeutic modalities to enhance its effectiveness. Personalized, athlete-centered interventions can be developed to target specific areas relevant to an athlete's sports performance, and online delivery can be used to increase accessibility. Cultural and contextual factors should also be considered when developing and evaluating CBT interventions in different sports and countries. Overall, CBT is a valuable tool for enhancing sports performance and improving the overall well-being of athletes.

Study Limitations and Future Directions: Our results highlight the relative lack of research on CBT in sports and, more particularly, by questioning the existence of a link with performance. This study presented some limitations. The studies identified are heterogeneous: different population, different sports, athletes of different levels, different scales of measurement used to weigh the outcomes. While CBT can be an effective tool for improving sports performance, there has been lack of awareness for using it in the sports field. Many athletes, coaches, and sports organizations may not be aware of the benefits of CBT and how it can help improve sports performance. There may be stigma attached to seeking mental health support, which can deter athletes from seeking CBT. Additionally, some athletes and coaches may have misconceptions about CBT and believe that it is only for individuals with mental health disorders.

Cognitive-behavioral therapy (CBT) has been shown to be an effective intervention for improving sports performance and future research can explore the integration of CBT with other therapeutic modalities, such as mindfulness-based interventions, to enhance its effectiveness. There is a need to investigate ways to enhance athletes' motivation and adherence to CBT interventions. This can be achieved through developing tailored interventions that are athlete-centered and address their unique needs and goals.

Personalized interventions can be developed to target specific areas of an athlete's cognitive and behavioral functioning that are relevant to their sports performance. This can be achieved through the use of cognitive assessments and profiling tools. There is a need to examine cultural and contextual factors that may impact the effectiveness of CBT interventions in different sports and countries.

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Appendix A

Table A1 *The methodological quality of the included studies assessed by the CASP.*

	CASP 1	CASP 2	CASP 3	CASP 4	CASP 5	CASP 6	CASP 7	CASP 8	CASP 9	CASP 10	CASP 11
Folgaret al (2022)	+	?	+	-	+	+	+	+	+	?	?
Çakmakçı et al (2020)	+	?	+	-	+	+	+	+	+	?	?
Coronado et al (2019)	+	+	+	-	+	+	+	+	+	?	?
Hamid et al (2018)	+	+	+	-	+	+	+	+	+	?	?
Didymus & Fletcher (2017)	+	?	+	-	+	+	+	+	+	?	?
Gustafsson et al (2016)	+	-	+	-	+	+	+	+	+	?	?
Buffington et al (2016)	+	+	+	-	+	+	+	+	+	?	?
Neil et al (2012)	+	+	+	-	+	+	+	+	+	?	?
Holm et al (1996)	+	+	+	-	+	+	+	+	+	?	?
Kirschenbaum et al (1982)	+	+	+	-	+	+	+	+	+	?	?

+ Answer yes to CASP question

- Answer No to CASP question

? Answer Don't Know to CASP question