



The effect of mood on risk taking: a systematic review

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Abstract

This research investigates the nuanced influence of internally experienced moods, specifically focusing on positive and negative moods, on individuals' propensity for risk-taking behavior. The objective is to discern the intricate impact of mood on risk-taking, a subject that has elicited varying results in diverse studies. A systematic search for experimental-research studies, spanning from the present to 1983, was conducted using PubMed and Semantic Scholar databases. After a meticulous examination of the complete texts, a final set of 13 studies was chosen for analysis. The results revealed divergent findings: some studies indicated that positive mood increased risk-taking behavior, while others suggested a similar effect for negative mood. These opposing outcomes are explained by two hypotheses: the Mood-Maintenance Hypothesis and the Affect Infusion Model. This study aims to comprehensively explore and compare the substantiation of these two theories across a range of experimental studies, contributing to a deeper understanding of the complex interplay between mood and risk-taking behavior.

Keywords Mood · Mood induction · Risky behavior · Risk taking · Emotion

Introduction

The emotional states and feelings that individuals experience play a significant role in shaping their perception of the world around them and how they evaluate their own behaviors. Furthermore, these emotions also have a notable impact on the individual's willingness to take appropriate actions aimed at enhancing their chances of survival (Loewenstein, 2000).

Decision making processes and risk-taking behaviors are function various emotions that individuals in it. Risk taking is a behavior that covers cognitive, emotional and behavioral areas, in which a consciously or unconsciously controlled decision is made, and the individual is not sure

about the benefits and harms of a situation whose outcome is uncertain (Zinn, 2019). Risk-taking behavior occurs with the decision-making process that is a particularly functional aspect of human nature, and from an evolutionary point of view, it adds value to people in terms of survival instinct in the presence of negative emotions such as anxiety and tension. In this context, the decision-making process depends on various cognitive and emotional functions from individuals' beliefs, past experiences, learned knowledge, and problem-solving skills (de-Juan-Ripoll et al., 2021). In particular, the influence of cognitive and emotional processes in decision making influences how and how much individuals taking risky behaviors.

Studies have been conducted on information processing of different emotional states. Accordingly, Mittal and Ross (1998) discovered that participants experiencing negative moods were more impacted by framing manipulations than those in positive moods. From this, they inferred that, individuals in positive moods exhibited less susceptibility to framing, implying that positive moods are linked with more effective and unbiased information processing compared to negative moods. They contended that individuals in negative moods were more influenced by framing regarding issue interpretation and risk-taking than their positive-mood

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counterparts, leading to the conclusion that those in positive moods were more adept processors.

Theoretical concept

In the light of decision making, the effect of mood and cognitive processes in displaying risky behaviors are presented in the literature with two hypotheses; Mood-Maintenance Hypothesis and Affect Infusion Model. The extensive research on emotions and social cognition has provided convincing evidence that our emotional states significantly impact how individuals learn, remember, think, take risks, and evaluate complex social information (Berkowitz et al., 2000; Bless & Forgas, 2000; Clore et al., 1994).

Earlier research by Isen and Patrick in 1983 focused on emotions and risk-taking. The researchers discovered that when people are in positive moods (often induced by small gifts), they tend to be more cautious and avoid taking risks. Conversely, negative emotions tend to lead to riskier behavior in activities like gambling and lotteries. Similarly, Mittal and Ross (1998) argued that when individuals are in an adverse emotional state, they might be more motivated to take larger risks in hopes of achieving greater rewards and potentially improving their negative emotional state. In addition, Isen and Patrick (1983) found that people in negative moods are more likely to make risky decisions to improve their mood, which is named by Mood-Maintenance Hypothesis. As a result, they avoid taking risks because they fear that such actions could lead to significant losses, which would negatively affect their positive feelings (Isen & Patrick, 1983).

Mood-Maintenance Hypothesis posits that individuals experiencing positive affect are generally less inclined to engage in risky behaviors, or participate in them to a lesser extent, compared to individuals in a neutral emotional state. The underlying premise of this hypothesis is that individuals are motivated to preserve their positive emotional states and are therefore less willing to take actions that might jeopardize or undermine their current mood.

In simpler terms, people tend to avoid taking risks when they are feeling positive because they want to maintain their good mood. For instance, Nygren et al. (1995) conducted a study where undergraduate participants who were greeted warmly and given a small bag of candy were subsequently observed to be less inclined to gamble the course credit they were about to earn for their participation in the experiment, in comparison to students who did not receive such positive reinforcement. This suggests that positive emotions serve as a buffer against risky decision-making, as individuals are less likely to take chances that could potentially lead to negative outcomes and disrupt their current positive mood state. Therefore, the Mood-Maintenance Hypothesis sheds

light on how emotions influence risk-taking behavior and decision-making processes.

With the same direction, Mano's (1992) research showed that people in a negative emotional state tend to take more risks compared to those in a neutral state. However, this increased risk-taking is not solely because of the emotional "feeling" of negativity. Instead, it is mainly driven by the heightened alertness and energy that come with negative emotions. This heightened state of arousal can make people less focused on their surroundings, leading to riskier behavior. In simple terms, it is not about trying to feel better or avoiding feeling worse; it is more about how our brain processes information differently when we're in a state of emotional intensity. Mano's research has uncovered two significant findings. Firstly, individuals in a positive mood are inclined to be risk-averse compared to those in a neutral mood. However, the degree of risk aversion is influenced by how the decision is presented or framed: when the decision is framed as a chance for gain (like purchasing a lottery ticket), people in a positive mood tend to be even more risk-averse than when the decision is framed as avoiding a loss (such as buying insurance to prevent potential losses).

On the one hand, Forgas (1995) found that people in negative moods engage in more careful and deliberate information processing, which can lead to less risky decisions and is called Affect Infusion Model as information-processing paradigm. The basic aim of AIM is understanding the impact of effect on judging and evaluation of decisions. According to Forgas (1995) impact of emotions becomes more pronounced in intricate scenarios that necessitate significant cognitive processing. Put simply, as situations grow more complex and unforeseen, emotions exert a greater influence on guiding evaluations and responses. This excerpt discusses a research area focused on utilizing the Affect Infusion Model (AIM) to comprehend individuals' tendencies towards engaging in risky behavior. Acknowledging that risky actions can elicit diverse emotional reactions like excitement, apprehension, or willingness to embrace consequences, it suggests that one's mood is likely to play a substantial role in shaping their inclination towards risk-taking. Since the mood of the individual affects the processing, recall and evaluation of information, the decision-making and reasoning process is also affected. According to this phenomenon, individuals in a negative mood seem to be more analytical, demanding and engaged in accurate information processing than those in a positive mood. These information processing strategies, in turn, are associated with more rational and sometimes more profitable decision outcomes. In this context, the higher level of rationality observed in decision making among people with negative moods is considered positive in terms of risk aversion (Forgas, 1995).

Simply, according to the Affect Infusion Model, when individuals experience positive emotion, their inclination to take risks is amplified. This occurs because positive moods accentuate the favorable aspects associated with risk-taking while downplaying the potential drawbacks linked to it.

The Affect Infusion Model is also explained by priming and selective attention concepts. Selective attention and priming, as elucidated by Rusting and Larsen (1995), play a pivotal role in shaping individuals' subjective probabilities. When experiencing a positive mood, individuals tend to direct their attention towards positive cues present in their environment. Conversely, a negative mood triggers individuals to shift their focus towards the negative aspects of the situation. This cognitive process of selective attention and priming thus influences how individuals perceive and interpret risks, potentially leading to variations in risk tolerance levels based on their current mood states (Grable et al., 2008).

Previous research has indicated that distinct negative emotional states can have varying degrees of influence on an individual's inclination towards taking risks. Specifically, feelings of anxiety and anger tend to elevate the likelihood of engaging in risky behaviors, whereas a sense of depressed mood diminishes this inclination (Leith & Baumeister, 1996). Based on the findings of the literature review, experimental studies have supported the concepts of the Affect Infusion Model and Mood-Maintenance Hypothesis. Some studies supported the MMH, while others supported AIM, that is the effect of positive and negative mood on risk taking behavior is controversial.

As the literature was reviewed, the mood induction method was used to create positive and negative moods for the participants. Induction methods were made with short video clips, short stories and sentences of positive/negative value, autobiographical recall and music. Although the effectiveness of different types of emotion induction methods and its adequacy in manipulation of the emotions are controversial, it has been found that multiple mood induction method (using more than one and methods) and autobiographical recalling of events are successful in imparting positive and negative emotions to the participant (Bless et al., 1996). In the literature review, studies exploring how mood affects risk-taking behavior did not encounter any instances where mood induction was carried out using the multiple mood induction method. However, in a study examining the effect of incidental emotions in the process of making risky decisions, the autobiographical recall method gave successful results in expressing feelings of anger, happiness and fear (Yang et al., 2020).

Taking this into account, the present study aims to conduct a systematic review of experimental studies analyzing the effect of various positive and negative moods on

risk-taking behaviors. It seeks to identify gaps and inconsistencies in the literature pertaining to the influence of mood on risk-taking behaviors. Additionally, the study intends to propose avenues for future research to address the identified gaps and inconsistencies and advance understanding in this field. Furthermore, it aims to provide a comprehensive analysis of theoretical frameworks guiding research in the intersection of emotions and risk-taking behavior and elucidate the implications of emotional influences on risk-taking behavior for individual decision-making processes and societal outcomes.

In light of these objectives, the study will examine how different emotional states affect individuals' tendencies towards risk-taking behaviors and the effects of theoretical frameworks such as the Mood-Maintenance Hypothesis and the Affect Infusion Model on risk taking. Additionally, the study will synthesize important hypotheses in the literature; H1: Individuals experiencing positive mood will exhibit lower levels of risk-taking behavior compared to individuals in neutral or negative mood. H2: Individuals in a positive mood will exhibit higher levels of risk-taking behavior compared to individuals in a negative mood. H3: Risk-taking behavior will be affected by different framing of decisions depending on individuals' emotional states. H4: The effect of mood on risk-taking behavior will vary by cognitive processing. By addressing these research questions and hypotheses, the study aims to contribute to a deeper understanding of the role of emotions in decision-making processes and their impact on individual and social outcomes for future studies.

Materials and study design

Transparency/openness and study desing

The search adhered to the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses. A comprehensive systematic review was carried out to analyze experimental research studies available from 1983 June to present. This review was conducted across PubMed and Semantic Scholar databases. Additionally, a supplementary search was undertaken by examining the references cited within the identified studies to ensure a thorough exploration of the literature. However, although the titles and abstract parts of the articles showed equivalence in the reference search, the emotion manipulation and induction method did not meet the criteria, so it was excluded from study.

Inclusion/exclusion criteria

The present systematic review analyzed the effect of various type of moods on risk taking behavior. Only experimental studies that exclusively involved neurologically and mentally healthy adult participants were considered for inclusion in this review. Studies examining the effect of more than one component were excluded from the current study. Studies that did not have a control group in the method part of the studies were not included in the review. Studies without mood induction, focusing solely on participants' usual mood and risk-taking behavior, were excluded from the review. Studies where emotion induction manipulation was not effective were excluded from the review, meaning those that did not successfully evoke the desired emotion in participants were not included. The studies covered diverse countries without geographical or economic restrictions. Only studies published in English and accessible through reputable academic journals were eligible for inclusion. This selective approach was adopted to ensure a cohesive and comprehensive analysis while maintaining a consistent linguistic criterion for the review's scope (Table 1).

Research strategy

The search for studies was performed in PubMed and Semantic Scholar databases. Since there is no advanced filtering option on the Semantic Scholar database, in the studies that emerged after the keywords were written, the titles were examined first and then the abstract sections. Since Semantic Scholar offers a wider range of studies than PubMed, all studies added to the compilation via PubMed are also available in the Semantic Scholar database. While searching the experimental research on the subject on Pubmed database, title/ abstract filtering was not applied in order to make a wider search. The studies with matching titles were listed and the abstract parts were scanned, and then the method parts were examined thanks to the library database of the university, and the studies matching the emotion induction method were added to the compilation.

Table 1 Inclusion criteria for review

Inclusion Criteria	
Study Design:	Studies with experimental design and include pre-post test
Participants:	Studies including adult and neurologically and mentally healthy individuals
Method:	Studies examining emotional state as the only variable in risk taking
Result:	Studies with emotion induction and significant differences in emotion after induction
Translating:	Studies conducted in different parts of the world but whose article language is English

The search query applied for electronic search in Pubmed; (mood) AND (risk taking), (mood) AND (risk taking behavior), ((negative mood) AND (decision making), (emotion) AND (risky decision making), (induced mood) AND (risk taking), (((mood) OR (emotion)) AND (risky decision)) OR (risky choice) OR (risky behavior)

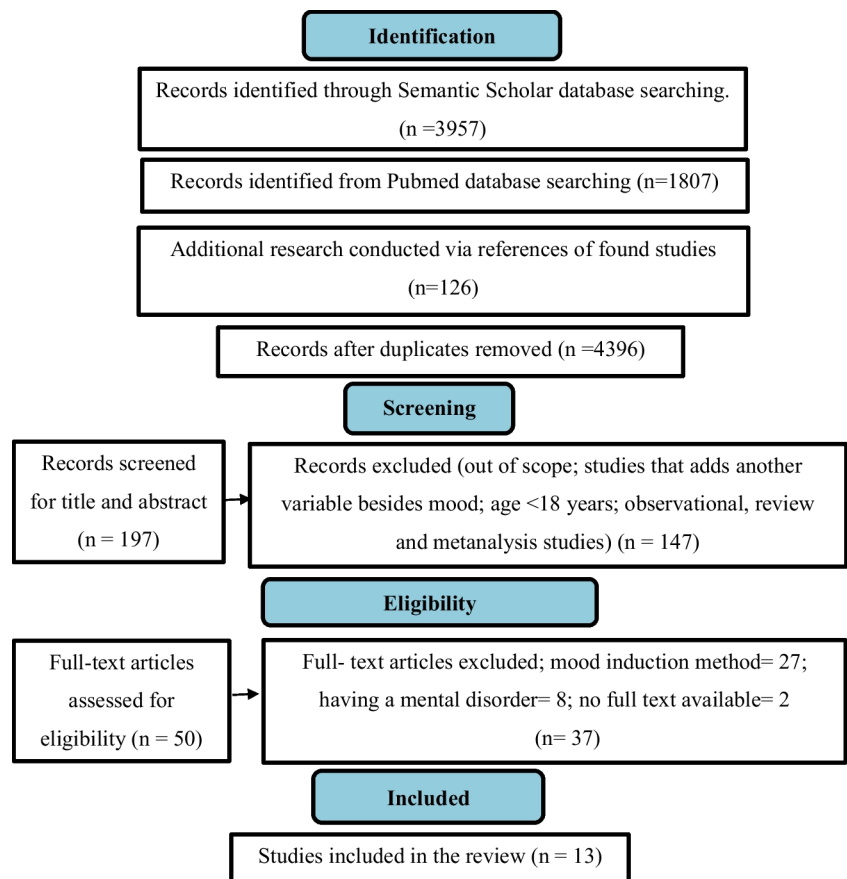
The strategy applied for electronic search in Semantic Scholar; (mood) AND (risk taking), (mood) AND (risky decision), (emotion) AND (risky decision), (feeling) AND (risk taking), (emotion) AND (risk preference)

Therefore, the search focused on gathering experimental studies within the literature. Studies were independently extracted by 2 researchers and screened based on the inclusion and exclusion criteria using a 3-stage procedure: (1) Studies were verified based on the title; and (2) studies included based on the title were verified based on the abstract. (3) Studies included by abstract were validated by method/procedure part. The sequential process of identification, screening, evaluation of eligibility, and eventual inclusion is visually outlined in Fig. 1. This schematic diagram provides a clear and structured representation of the steps undertaken to determine the studies suitable for incorporation into the review. This encompasses the process of identifying pertinent studies, the screening phase, the assessment of eligibility based on predetermined criteria, and the final incorporation of studies included appropriate into the review. In addition, this study's design and its analysis were not pre-registered.

Data extraction

Data extracted from the studies included the following: General details of the study (author, study design), participants (number of participants, gender proportions, age, inclusion criteria, exclusion criteria), manipulation (methods of mood induction), outcomes (Method of experiment, psychological measures, type of scales used in measure), and findings (conclusions). The following types of outcomes were included to the presented systematic review: Risk taking behaviors (Risk seeking behaviors, alcohol consumption, gambling behavior, risky decisions in daily life, evaluation risk taking scenarios, risk preference for lotteries, risky driving). Because a range of different outcomes were considered, and the number of studies for each outcome varied, the possibility of summarizing the results using a meta-analysis approach, which requires the inclusion of comparable studies, was not feasible. However, as the number of such studies is expected to increase in the future, performing suitable meta-analyses for each outcome will be beneficial to draw conclusive inferences.

Considering this, based on the data extracted and an evaluation of the overall quality of the studies, a synthesis

Fig. 1 Search and selection process of articles through stages of review

of the findings from the included studies was undertaken. This synthesis was organized according to the specific type of outcome.

Result

Table 2 provides details on the basic study characteristics and the experimental designs of the included studies. The studies listed in both tables are arranged based on their year of publication. While the effects of negative and positive moods on risk taking were examined in the included studies, studies that addressed only one of these 2 values and examined its effect on risk-taking behavior were also included in the review.

Among the 13 studies included in the review, the majority were conducted in European countries (3 studies), in China (5 studies), and the United States of America (USA) (5 studies). A diverse geographical representation is indicated by this distribution. The populations studied primarily consisted of adults, including individuals from various age groups, such as young, middle-aged, and older adults. In addition, while some studies have focused only on young individuals (Bradley, 2018; Conte et al., 2016; Isen & Geva, 1987; Isen & Patrick, 1983; Raghunathan & Pham, 1999;

Wang et al., 2010; Yang et al., 2020; Yuen & Lee, 2003), studies with middle-aged individuals are limited (Devos et al., 2018). Mixed populations were also investigated, including young-middle aged adults (Chou et al., 2007; Treffers et al., 2012) and young-old adults (Deldin & Levin, 1986). The characteristics of the study participants in the included studies for the systematic review can be found in Supplementary Table S1. Additionally, Table 3 provides information regarding the characteristics of the study exposure and the scales utilized to measure outcomes in these studies.

Out of the 3 included studies, mood detection scales or specific questionnaires designed to assess the mood states of participants were employed. These assessments included the use of self-reported mood questionnaires (Chou et al., 2007, Raghunathan & Pham, 1999), various forms of positive-negative affect scales (Bradley, 2018, Conte et al., 2016, Deldin & Levin, 1986, Devos et al., 2018), and the use of adjectives to describe different types of positive and negative emotions (Hu et al., 2013). Although it has been examined that movie clips with visual content (Bradley, 2018, Chou et al., 2007, Conte et al., 2016, Devos et al., 2018, Treffers et al., 2012) are frequently used in emotion induction methods, motivated fragment (Wang et al., 2010), reading different valanced statements (Deldin & Levin, 1986), video clips (Yuen & Lee, 2003), giving gifts or favorable

Table 2 General details of the study and design for the studies included to the systematic review

Authors	Study Design	Country	Study Group	Time
Bradley, 2018	Between-group design experiment-correlational study	United States of America (USA)	Undergraduate psychology classes at Georgia Southern University	2016
Chou et al., 2007	Between-group design experiment	China	60 > Adults < 80 18 < Adults > 25	2007
Conte et al., 2016	Within-subjects group design experiment	Germany	Undergraduate students from the Friedrich-Schiller University of Jena	2018
Deldin & Levin, 1986	Between-subjects group design experiment	United States of America (USA)	Adults	1986
Devos et al., 2018	Between-subjects group design experiment	France	Adults	2018
Hu et al., 2013	Cross-sectional design study	China	Adult drivers	2013
Isen & Geva, 1987	Between-subjects group design experiment (Random design with pretest–posttest control group)	United States of America (USA)	College students	1987
Isen & Patrick, 1983	Between-subjects group design experiment	United States of America (USA)	College students	1983
Raghunathan & Pham, 1999	Between-subjects group design experiment	United States of America (USA)	Students at Columbia University	1999
Treffer et al., 2012	Incentive-compatible experimental designs	Germany	18 > Adult > 43	2012
Wang et al., 2010	Between-subjects group design experiment (3 × 2 Factorial design)	China	Undergraduate students	2010
Yang et al., 2020	Between-subjects group design experiment	China	College students	2020
Yuen & Lee, 2003	Random design with pretest–post-test control group	China	Young adults	2003

staffs (Isen & Patrick, 1983; Isen & Geva, 1987), recalling emotional autobiographical past events (Yang et al., 2020) methods were also used. To assess risk taking, various aspects of it were analyzed in the studies, while either a single aspect or some aspects combined were assessed, including mainly risk-taking tendency (Chou et al., 2007; Yuen & Lee, 2003), risky decision making (Bradley, 2018,

Conte et al., 2016, Deldin & Levin, 1986), risk preference (Treffer et al., 2012, Raghunathan & Pham, 1999, Wang et al., 2010), risky behaviors (Devos et al., 2018, Hu et al., 2013, Isen & Geva, 1987, Isen & Patrick, 1983), including risky driving and gambling behavior.

MMH suggests that negative emotional states can increase the propensity to take risks which was supported by Bradley's (2018) study. According to Bradley's study, individuals experiencing negative emotional states may turn to risky behaviors by trying to change their emotional states. Similarly, Conte and his colleagues (2016) showed that negative emotional states, especially fear and anger, increase the tendency to take risks. These results support the MMH and show that negative emotional states can lead to risky behavior.

Dervos and his colleagues (2018) show in their study that individuals in a state of sadness tend to maintain their negative emotional states and therefore play riskier games for a longer time. This is among the findings that support the MMH. Raghunathan and Pham (1999) examined how sadness and anxiety affect individuals' risk preferences. The research shows that participants in a state of sadness are more inclined towards high-risk and high-reward options. This result shows that the state of sadness can influence risky choices and therefore supports the MMH. Isen's (Isen & Patrick, 1983, Isen & Geva, 1987) studies show that positive mood can affect risk preferences. These studies found that positive mood promotes risk aversion in high-risk situations and tends to take more risks in low-risk situations. Studies investigating the impact of different types of emotions on risk taking have also been found in the literature. For instance, Hu and his colleagues (2013) examined the effects of four different emotional state groups on drivers' risk perception and driving attitudes. Findings show that drivers with negative moods have higher risk perception, which increases their tendency towards risky driving. These results support the Mood-Maintenance Hypothesis because negative emotional states can lead to engaging in risky behavior.

On the one hand, Affect Infusion Model suggests that positive emotional states can increase risk-taking propensity. Chou and his colleagues' (2007) showed that positive mood increases risk-taking tendencies. In this direction, Deldin and Levin (1986) found that individuals in a positive emotional state tend to take more risks, while individuals in a negative emotional state tend to be more risk averse. Wang and his colleagues' (2010) also support AIM, showing that emotional state affects individuals' risk preferences and that positive emotional states can increase risk-taking tendency. Likewise, Yuen and Lee (2003) examined risk-taking tendencies of mood and showed that participants in a depressed mood took fewer risks. These findings suggest

Table 3 Information regarding the characteristics of the studies' dependent variables and the scales utilized to measure independent variables in these studies

Authors	Independent Variable	Mod-erating Variable	Measuring	Mood Induction	Dependent Variable	Measuring
Bradley, 2018	Gambling warning messages (messages to caution patrons against the dangers associated with excessive gambling to eliminate cognitive biases)	Positive and negative affect	Positive and Negative Affect Schedule (PANAS)	Film clips	Risky decision-making	Computerized game, The Balloon Analogue Risk Task (BART) for behavioral measure Participants were given the 40-item Domain-Specific Risk-Taking scale (DOSPERT- Self-Reported Risk-Taking.)
Chou et al., 2007	(1) Positive, negative, and neutral mood (2) Age Differences	-	Repeated measures on a self-reported mood questionnaire (11-point Likert-type scale)	Movie Clips	Risk taking tendency	Measured by perception of risk tasks. (Choice Dilemmas Questionnaire)
Conte et al., 2016	Emotions (Joviality, sadness, fear, and anger)	-	Positive and Negative Affect Schedule (PANAS-X)	Film clips	Decision making	Presented 100 pairwise choice problems between two different lotteries
Deldin & Levin, 1986	Positive, negative, neutral moods (Elation and depression conditions)	-	Beck Depression Inventory	Reading 60 different scenarios (VMIP)	Risky decision- making	5 hypothetical risk-taking scenarios to be evaluated (Contain risky- non risky options)
Devos et al., 2018	Negative and neutral emotion conditions (Sadness)	-	Positive and Negative Affect Schedule (PANAS)	Movie clips	Risky behavior (Gambling)	3-Reel slot machine task
Hu et al., 2013	Negative and positive emotion conditions	(1) Risk perception (2) Risk attitude	Three pairs of adjectives (pleasant–unpleasant were used to measure emotion (1) Asked to rate on driving risk perception (2) Six dimensions of the Driving Risk Attitude Scale to measure drivers' attitude toward risky behavior in traffic	Video clips	Risky behavior (Risky driving)	Asked to report the speed they would like to drive
Isen & Geva, 1987	Positive and neutral affect conditions	-	Not stated	Giving candy	Risk taking	Game of roulette
Isen & Patrick, 1983	Positive and neutral feeling conditions	-	Not stated	Giving McDonald's gift certificate	Risk taking (1) Hypothetical risk situations (2) Betting behavior	(1) Reading 2 different dilemma, include 3 different risk levels and scaling from 1 to 10, their likelihood of taking the chance (2) Game of roulette
Raghu-nathan & Pham, 1999	Negative and neutral mood (Sadness and anxiety)	-	Presenting a scale consisting of 15 items each phrased in the form describing current feeling	Empathizing with three emotional scenarios	Decision Making	First Study: Consumer Decision Making Questionnaire (Having different probability of winning) Second Study: Choosing between two job options that criteria are different from each other in terms of salary and job security Third Study: The framing of the decision differed across conditions (Self vs agent)
Treffers et al., 2012	Positive and negative mood conditions (Joyful, fearful, or sad mood)	-	Positive and Negative Affect Schedule (PANAS-X)	Film clips	Risk preferences	Making choices among different lotteries for different payoff

Table 3 (continued)

Authors	Independent Variable	Mod-erating Variable	Measuring	Mood Induction	Dependent Variable	Measuring
Wang et al., 2010	Positive, negative, and neutral emotion conditions	-	Positive Negative Affects Scale	Motive fragment	Risk decision making	Economic, feeling and life decision that included 20 problems. Each problem contains two choices, and each choice required subject to choose tendency level
Yang et al., 2020	Incidental emotions (Anger, fear, and happy conditions)	-	The 9-point scale combined the arousal and valence dimensions of affective experience scale	Personal experiences	Risky decision making	Gambling task (forced choice between a risky option and a risk-avoidant option)
Yuen & Lee, 2003	Happy, sad, and neutral mood states conditions	-		Movie clips	Risk- taking decision	Measuring risk tendency level by applying Choice Dilemmas Questionnaire

that positive emotional states can influence risk preferences and that participants in a negative emotional state tend to avoid risk. These findings support the AIM.

Yang and his colleagues' (2020) study examined the effects of different emotional states on decision making. The findings show that participants, especially those in angry and happy states, prefer more risky options. However, it was determined that participants in a fearful situation tended to avoid risk. These results suggest that fear is associated with the perception of uncertainty and a sense of lack of control, thus promoting a tendency to avoid risk. Although these results do not fully support the Affect Infusion Model, the results are close to the model, because it appears that emotional states affect individuals' risk preferences, and especially the happy state can increase the tendency to take risks. Treffers and his colleague's (2012) study shows that sadness increases the tendency to avoid risk. This result supports the Affective Infusion Model (AIM) theory, as individuals in a state of sadness appear to be more risk averse, and this is based on emotional processing and thought processes. However, this study shows that neither happiness nor fear states significantly influence risk preferences, suggesting that AIM and MMH theories may not be explanatory in some situations.

The characteristics of the study findings for the studies included to the systematic review is presented in the Table 4. Therefore, in experimental design studies examining the effect of mood states of different valence on risk taking, positive mood increases risk-taking behavior, however, studies supporting the MMH, revealed the opposite result; individuals with a positive mood tend to take less risk when comparing with negative mood induced individuals. These conflicting results highlight the complex relationship between people's mood and risk taking.

Discussion

The issue of how emotional states, especially negative emotional states, affect individuals' risk-taking tendencies has been studied in the field of psychology for a long time. Research on this subject presents impressive findings from two important theories such as Mood-Maintenance Hypothesis (MMH) and Affect Infusion Model (AIM).

This systematic review delved into the intricate relationship between emotional states and risk-taking behaviors, synthesizing findings from a diverse array of experimental studies. Across the literature, there is a consensus regarding the profound impact of emotional states on individuals' propensity to engage in risky behaviors. Notably, the review corroborates and extends existing evidence, shedding light on the nuanced dynamics of this relationship.

Consistent with the MMH, the findings reveal that negative emotional states, such as fear and sadness, tend to elevate individuals' risk-taking tendencies. For instance, studies by Conte et al. (2016) and Raghunathan and Pham (1999) demonstrated that individuals experiencing negative emotions exhibit heightened inclinations towards risk-taking, driven by a desire to alleviate or alter these negative affective states. Moreover, the review highlights the role of positive emotional states in tempering risk-taking behaviors, in line with the principles of MMH. Studies by Isen (Isen & Patrick, 1983, Isen & Geva, 1987) and Hu et al. (2013) indicate that positive emotional states promote risk aversion, as individuals strive to maintain their positive affective states.

Conversely, the Affect Infusion Model posits that positive emotional states amplify risk-taking tendencies, while negative emotional states foster risk aversion. The review provides empirical support for AIM principles, with studies by Chou et al. (2007), Wang et al. (2010), and Yang et al. (2020) consistently demonstrating that individuals in positive emotional states exhibit greater propensities for

Table 4 Characteristics of the study findings for the studies included to the systematic review

Authors	Finding	Conclusion
Bradley, 2018	Risk-taking differed between those induced with negative affect ($M = 28.66$, $SEM = 1.68$) and positive affect ($M = 24.80$, $SEM = 1.51$). No significant interaction between mood and warning messages ($F(1, 99) = 0.25$, $p = 0.62$, $\eta^2 = 0.003$) was found, indicating no significant differences in risk-taking among positive affect with warnings ($M = 26.24$, $SEM = 2.27$), positive affect without warnings ($M = 23.36$, $SEM = 2.27$), negative affect with warnings ($M = 28.98$, $SEM = 2.23$), and negative affect without warnings ($M = 28.35$, $SEM = 2.32$)	Contrary to hypothesis, individuals induced with negative affect exhibited slightly higher risk-taking tendencies than those induced with positive affect. This unexpected finding aligns with the Mood-Maintenance Hypothesis which suggests that people in a positive mood are often more risk averse as they seek to preserve their positive emotional state
Chou et al., 2007	In older participants, risk-taking increased from sad to neutral to happy moods. Significant differences were seen between positive and neutral moods ($M = 29.33$, $p = 0.01$), positive and negative moods ($M = 50.14$, $p = 0.01$), and negative and neutral moods ($M = 20.81$, $p = 0.01$) In younger participants, differences were significant between positive and negative moods ($M = 10.71$, $p = 0.01$) and negative and neutral moods ($M = 12.62$, $p = 0.01$). But there was no significant difference in risk-taking between positive and neutral moods ($M = 1.90$, $p = 0.80$)	Results show that people tend to take more risks when they are in a happy mood compared to when they are in a sad mood, and this holds true for both young and older participants which support the theory of Affect Infusion Model
Conte et al., 2016	All emotions (joy, sadness, fear, anger) significantly increased risk-taking compared to the neutral group ($p \leq 0.049$ for all). Fearful and angry individuals are more inclined to take risks than those induced with joy and sadness, except for the comparisons between joy and sadness ($p = 0.718$) and fear and anger ($p = 0.794$)	The finding that individuals experiencing joy are less risk-averse than those in a neutral emotional state offers some backing for the affect infusion model. Conversely, individuals feeling sadness, fear, or anger tend to be more inclined to take risks compared to those in a neutral emotional state, aligning with the MMH
Deldin & Levin, 1986	The study found a notable impact of mood induction on responses to the back operation scenario ($F(2,54) = 4.43$, $p < 0.02$). Risk-taking scores were highest in the positive mood condition, lowest in the negative mood condition, and intermediate in the neutral mood condition, with a statistically significant linear trend ($p < 0.01$) and no significant deviations from linearity	While individuals experiencing positive mood are more risk-seeking, individuals in negative mood conditions are more risk-averse. Thus, this finding supports the theory of AIM
Devos et al., 2018	The main hypothesis was confirmed, showing a significant group difference in persistence during the slot machine task ($t(58) = 2.632$, $p = 0.011$; Cohen's $d = 0.7$). Specifically, participants in the sadness condition exhibited higher persistence compared to those in the control condition	Participants in the sadness group demonstrated greater endurance while playing the slot machine simulation which support the idea of MMH
Hu et al., 2013	Driving Risk Perception: When it came to driving risk perception, the four groups exhibited significant differences ($F(3,214) = 2.68$, $p < 0.05$, $g^2 = 0.04$). Post-hoc analysis showed that the concern level in the traffic-unrelated negative group was notably higher than both the positive group ($p < 0.05$) and the control group ($p < 0.05$) Driving Risk Attitude: The influence of driving risk perception on driving risk attitude was observed as positive and statistically significant, but only in the two negative emotion groups. For the traffic-related negative group, $t(69) = 1.941$, $p = 0.056$, $g^2 = 0.05$, and for the traffic-unrelated negative group, $t(54) = 2.270$, $p = 0.027$, $g^2 = 0.09$	When individuals were in a negative emotional state, their perception of high risk made them more inclined toward risky behavior. In Study 2, a stronger negative mood led to increased risk perception, a more favorable attitude towards risky driving, and a higher self-reported engagement in risky driving. This trend was not observed in the positive emotion or control groups Having a more favorable attitude toward risky driving was associated with higher driving speeds in a task where participants could choose their speed, indicating a greater tendency for risky driving behavior. The result p supported the idea of MMH for negative induced mood participations
Isen & Geva, 1987	Subjects in a positive state were more risk-averse in high-risk situations ($p < 0.05$), and there was a significant interaction between emotional state and the level of risk ($p < 0.04$)	The study's findings suggest that when people experience positive emotions, they tend to be cautious when the risk is moderate to high, but they become more willing to take risks when the potential loss is low. In summary, positive affect is linked to risk aversion or caution in high-risk situations and risk-seeking behavior in low-risk situations which supports the idea of MMH

Table 4 (continued)

Authors	Finding	Conclusion
Isen & Patrick, 1983	(Study 1) Subjects in positive group showed significantly higher betting activity in low-risk situations compared to control subjects ($t(23)=2.38$, $p<0.025$). However, in high-risk betting scenarios, those who in positive affect condition wagered less than the control group ($t(18)=1.77$, $p<0.05$) (Study 2) A significant main effect related to the level of risk was observed ($F=5.26$, $p<0.005$). Participants' responses were primarily influenced by the level of risk presented in the scenarios, rather than their emotional state. In general, participants expressed a higher willingness to take low risks compared to moderate or high risks ($t(39)=2.90$, $p<0.01$)	(Study 1) Positive affect would be associated with increased risk taking where risk is low, but not where risk is high There was no observed interaction between affect (emotional state) and the level of risk (Study 2) Instead, the primary factor influencing participants' hypothetical risk-taking judgments was the level of risk itself. As the level of risk increased, participants, regardless of their affective state, expressed a decreased willingness to take risks
Raghu-nathan & Pham, 1999	(Study 1): Participants in the sadness condition showed the strongest inclination towards the high-risk/high-reward option ($M=3.94$), whereas those in the anxiety condition exhibited the least preference for it ($M=2.84$) (Study 2): Individuals experiencing sadness displayed a pronounced preference for Job A, the option with higher risks and higher rewards ($M=5.39$), whereas those experiencing anxiety were less inclined towards this choice ($M=3.28$) (Study 3): In the self-condition, a higher percentage of participants feeling sad (59%) opted for the high-risk/high-reward choice compared to those feeling anxious (27%) ($z=2.13$, $p<0.02$) However, in the agent condition, where participants made choices on behalf of someone else, both sad and anxious participants showed a lower inclination towards the high-risk/high-reward option (sad=29%, anxious=20%) ($z=0.76$, $p<0.22$)	(Study 1): Anxiety inclined participants towards lower-risk options with smaller rewards, whereas sadness made them more inclined towards options with larger rewards but also higher risks (Study 2): Anxious participants placed greater importance on job security, while sad participants placed more importance on differences in pay. Therefore, the result partly supports the by showing sadness cause to select the high-risk option
Treffers et al., 2012	In the group experiencing sadness, risk aversion is significantly higher ($M=2.02$, $SD=1.80$) compared to the joy group ($M=1.28$, $SD=1.78$, $p=0.04$, $d=0.41$), the fear group ($M=1.40$, $SD=1.75$, $p=0.07$, $d=0.35$), and the control group ($M=1.18$, $SD=1.98$, $p=0.02$, $d=0.44$). It is worth noting that neither joy nor fear appear to have a significant impact on risk preferences	Findings support the idea that sadness, in line with the AIM, induces risk aversion due to increased cognitive processing. However, neither the AIM nor the competing MMH can explain the lack of significant effects for joy and fear in our study
Wang et al., 2010	The main effect of emotion on risk-taking was statistically significant ($F(2, 68)=3.56$, $p<0.01$), and similarly, the main effect of gender also reached statistical significance ($F(1, 68)=3.12$, $p<0.01$)	The study revealed significant main effects for both emotion and gender on risk decision making. Participants experiencing positive emotions tended to be more inclined toward risk-seeking behaviors, while those with negative emotions showed a preference for risk aversion. Additionally, gender had a significant impact on risk decision making, with females demonstrating a greater inclination toward risk aversion compared to males. The result of the study supports the idea of AIM
Yang et al., 2020	There were significant variations in arousal scores across different emotional conditions, including happy (4.22, $SD=0.87$), angry (4.21, $SD=0.79$), fearful (4.00, $SD=0.62$), and neutral (1.67, $SD=0.44$) conditions. A statistical analysis ($F(3, 87)=145.575$, $p<0.001$) confirmed these differences. In terms of decision-making, participants in the angry (52%, $S.D.=19\%$) and happy conditions (52%, $S.D.=20\%$) made a higher average ratio of risky choices compared to those in the fearful condition (47%, $S.D.=17\%$, $p<0.05$)	The fearful condition led to more risk-avoidant behavior compared to the angry, happy, and neutral conditions. This suggests that fear is associated with perceptions of uncertainty and a sense of limited control over the situation, which in turn promotes a preference for risk-avoidance. This result partially supports the theory of AIM showing happiness cause more risk-seeking behavior
Yuen & Lee, 2003	A significant difference in risk-taking tendencies among three conditions ($F(2,51)=8.19$, $p=0.01$). Specifically, those in a positive mood took more risks (mean=53.56, $S.D.=12.26$) than those in a neutral mood (mean=48.61, $S.D.=9.90$) or a negative mood (mean=37.64, $S.D.=13.77$). Analysis revealed significant differences between positive and negative mood conditions ($p=0.01$) and between negative and neutral mood conditions ($p=0.02$). However, there was no significant difference in risk-taking tendencies between the positive and neutral mood groups ($p=0.44$)	Those induced into a depressed mood were more conservative in risky decision-making compared to those in a neutral mood, while those induced into an elated mood did not significantly differ from those in a neutral mood which support the theory of Affect Infusion Model

risk-taking. Additionally, findings from studies like Treffers et al. (2012) suggest that sadness correlates with increased risk aversion, aligning with AIM tenets.

However, the nuanced findings revealed by the systematic review underscore the complexity of emotional influences on risk propensity. For instance, the study by Devos et al. (2018) suggests that negative emotional states may lead to prolonged engagement in risk-taking activities as individuals seek to perpetuate these emotional states. Similarly, Yang et al. (2020) found that while participants in angry and happy states exhibited preferences for riskier options, those in a fearful situation tended to avoid risk, indicating the multifaceted nature of emotional influences on risk-taking.

Within the corpus of research examined in this systematic review, a notable trend emerges concerning the measurement of risk-taking behaviors and attitudes. The majority of the studies, apart from the studies that investigate risk-taking across specific domains, employ methodologies that rely heavily on self-evaluation as a means of gauging participants' inclinations towards risk. This often involves scenarios presented to participants, where they are tasked with making decisions that entail varying degrees of risk. Additionally, the evaluation of these scenarios based on a risk-value scale is a prevalent technique for assessing participants' risk perception. While self-evaluation has helped us understand risk-taking, it's crucial to explore its strengths and weaknesses. Future research should consider other methods to get a complete and more accurate picture of how both negative and positive emotions impact how people take risks in different situations.

The intricate relationship between mood and risk-taking behavior, as explored in this systematic review, cannot be fully understood without considering the cultural context within which individuals operate. Cultural factors significantly shape emotional expressions, interpretations, and responses, which in turn influence decision-making processes, including risk-taking behavior.

Cultural norms and values significantly influence the contexts in which emotions and risk-taking behaviors occur. For example, in cultures that place a high value on individual achievement and innovation, such as the United States, positive mood states are often encouraged and celebrated. In these cultures, individuals experiencing positive emotions might be more inclined to take risks, as they pursue personal success and innovative ventures with confidence and optimism (Markus & Kitayama, 1991). Conversely, in cultures that prioritize social stability and collective well-being, such as Japan, the expression of positive mood states may be more subdued. Individuals in these settings might be motivated to adopt more conservative approaches to ensure they do not disrupt social harmony or collective cohesion, even when they are in a positive mood (Kim & Markus,

1999). In another study conducted by Wang and colleagues (2022), the interactions between mood, optimism, and risk-taking behavior among American and Chinese college students were examined. The results, consistent with the AIM, revealed that positive moods were associated with a higher likelihood of risk-taking among American participants, while among Chinese participants, positive moods were linked to lower tendencies of risk-taking. Additionally, it was found that optimism had different effects on each group and that the cultural context played a significant role in shaping risk-taking decisions. These findings highlight the cultural differences in how mood and optimism influence risk-taking behavior.

Interpreting studies on mood and risk-taking behavior requires a deep understanding of cultural context. Cross-cultural research should focus on distinguishing the impact of mood from cultural influences by using methodologies that are sensitive to cultural differences and by taking cultural dimensions into account in their analyses. For instance, Markus and Kitayama (1991) found that cultural differences in self-construals influence emotional expression and decision-making. In individualistic cultures, people emphasize personal autonomy and openly express emotions, while in collectivist cultures, individuals prioritize social harmony and regulate emotions to fit group norms, impacting their decision-making and risk-taking behaviors. Briefly, the relationship between mood and risk-taking behavior is profoundly influenced by cultural contexts. It is essential to acknowledge and consider these cultural differences to fully understand how mood affects risk-taking across various populations. Future studies should further investigate these cultural aspects to offer a more detailed and global view of the interplay between mood and risk-taking behavior.

The impact of mood on risk-taking tendencies is a complex issue, and both the Affect Infusion Model and Mood-Maintenance Hypothesis theories approach this effect from different perspectives to understand it. Findings show that negative emotional states generally increase risk-taking tendencies, while positive emotional states can reduce or change risk-taking tendencies. However, it is important to remember that this relationship is not a strict rule and may vary from context to context. These studies provide an important basis for developing risk management strategies and better understanding individuals' risk-taking behaviors. Emotional states can influence people's decision-making processes and risk preferences, but more studies are needed to fully understand these effects. In conclusion, these studies highlight the complexity of emotional states on human behavior. It appears that emotional states may influence risk-taking tendencies, but more research is needed to understand the complexity of this effect. This effect may vary depending on the person's emotional state, the type and intensity of the

emotion, as well as the decision-making context. For example, negative emotional states may increase the propensity to take risks in some situations, while leading to risk aversion in other situations. Similarly, positive emotional states can also influence risk preferences, but this effect appears to depend on circumstances.

This may be a finding that may indicate that risk-taking can be influenced by many factors and is not solely dependent on mood. Furthermore, this review highlights the need for future research to adopt more nuanced approaches in investigating the complex dynamics of emotional influences on risk propensity. Longitudinal studies tracking individuals' emotional states and risk behaviors over time may provide valuable insights into the temporal dynamics of this relationship. Additionally, experimental studies incorporating diverse decision-making contexts and measuring multiple dimensions of risk-taking could offer a more comprehensive understanding of the multifaceted nature of risk propensity.

These results could be a crucial step in helping us understand the relationship between risk taking and mood. The implications of findings extend beyond theoretical insights, may offer practical implications for various domains, including clinical psychology, public health, and organizational management. By understanding the complex interplay between emotional states and risk-taking behaviors, practitioners and policymakers can develop targeted interventions to mitigate risky behaviors and promote more adaptive decision-making. Further research will help to understand better under what conditions certain emotional states may increase or decrease risk-taking propensity. Continuing research in this field will contribute to understanding human behavior and making more effective decisions.

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Data availability While creating this systematic review study, the data style used in research or experimental studies was not used. In the systematic review, the effect of emotional state on risk-taking behavior was examined by scanning the literature, as explained in the method section of the study. A conclusion was drawn from the appropriate experimental studies. The articles that we used and reviewed on have

been added as data on OSF system. To examine it in detail, you can visit the link: https://osf.io/8axq6/?view_only=e8c06e1027ce45ff8a6451d7a6b311ac.

Declarations

Consent to publish We declared that the study in submission described here has not been published previously or not in a submission or evaluation process. As a Corresponder Author, I confirm that the manuscript has been read and confirmed by all authors.

Conflict of interests The authors report there are no competing interests to declare.

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