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Research Article

THE BRAIN BODY CONNECTION: HOW EXPECTATION-DRIVEN NEURAL CIRCUITS PRODUCE THE PLACEBO EFFECT IN PAIN RELIEF

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Abstract

Research surrounding the placebo effect has consistently demonstrated that expectations and psychological perception can significantly influence physical experiences such as pain relief. However, while many studies examine placebo responses within professional medical environments, less attention has been given to how trust alone may shape treatment outcomes when medical authority and clinical expertise are absent. This study investigates the extent to which interpersonal trust influences both placebo-induced and active-medication pain relief in a non-clinical experimental setting. Specifically, it explores whether individuals who place greater trust in the provider exhibit stronger perceived relief responses compared to individuals with lower levels of trust. A mixed-method approach incorporating both quantitative and qualitative analysis was employed throughout the experiment. Participants were categorized into high-trust and low-trust groups using afive-question self-evaluation trust assessment prior to treatment administration. Throughout the study, participants received both active medication and placebo treatments in a randomized manner to ensure balanced exposure between conditions. Following each treatment, participants evaluated their perceived levels of pain relief and provided descriptive feedback regarding their experiences. Statistical comparison and thematic interpretation of participant responses were then used to analyze patterns in placebo responsiveness, consistency of relief, and differences between trust groups. The findings indicate that higher trust is associated with stronger and more consistent perceived relief from both placebo and active treatments. In contrast, lower-trust participants showed more variable and weaker placebo responses. Overall, the results suggest that trust significantly influences perceived treatment effectiveness and may shape placebo-related pain perception even outside clinical settings.

Keywords: Spotlight effect, Body image, Adolescents, Social media, Self-esteem, Sharjah.

INTRODUCTION

The belief that your mind can persuade your body that a sham treatment is genuine known as the placebo effect and thus stimulate healing has been around for millennia. Studieshave discovered that in suitable conditions, a placebo can be equally effective as conventional therapies. A placebo might be a sugar tablet, a saline shot, or even a sham operation. In essence, a placebo lacks any therapeutic effects. The placebo effect extends beyond mere positive thinking, as it involves the belief that a treatment or procedure will be effective. It's about establishing a more robust link between the brain and body and their collaborative functions. Research has revealed the brain activity involved in the placebo effect. Researchers employed functional magnetic resonance imaging to examine the brains of individuals suffering from chronic pain due to knee osteoarthritis. Subsequently, all participants received a placebo and underwent another brain scan. The researchers observed that individuals experiencing pain relief exhibited increased activity in the middle frontal gyrus, a region consisting roughly one-third of the frontal lobe (PLOS Biology, 2017).

Statement of the Problem

Despite the longstanding awareness of the placebo effect, the mechanisms that trigger it, maintain its resilience, and sustain its long-term effects remain to be studied. A recent study demonstrated that the [neural pathway] is critical to placebo-induced pain relief. In this study, researchers used mice to model human placebo analgesia through a placebo analgesia conditioning (PAC) protocol. They tracked neural activity in real time with in vivo calcium imaging, observing which neurons became active during the periods associated with pain reduction. Using optogenetic techniques to regulate specific neurons, researchers found that activating these cells reduced pain even in the absence of prior conditioning, whereas inhibiting them completely blocked pain relief. These findings suggest that this neural pathway, which is associated with pain modulation and inhibitory neural signaling, plays a central role in the placebo effect's ability to reduce pain.

Objectives of the study

This study aims to systematically evaluate the placebo effect on subjective outcomes as well as neuroimaging metrics. The research also seeks to assess the comparative roles of expectancy, which is the belief in the treatment's effectiveness, associative conditioning, or learned experiences, in producing placebo reactions. Moreover, this research will pinpoint the essential brain areas and neurochemical systems reliably associated with placebo-related alterations in earlier studies.
This study will conduct an experimental examination assessing the impact of placebo treatments on perceived pain levels in controlled settings. Simultaneously, personal variations, such as personality traits, prior expectations, and medical background, will be examined to understand why certain individuals experience more pronounced placebo reactions than others. Collectively, these goals strive to integrate psychological principles with neurobiological data, advancing the understanding of the dynamic interplay of the mind–brain relationship in placebo effects.

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Research questions

- Which experimental manipulations (expectancy vs. conditioning) produce larger placebo responses, and do their effects differ in behavioral versus neural outcomes?
- Which brain regions and neurochemical pathways are most reliably implicated in placebo effects across neuroimaging and pharmacological blockade studies?
- How do individual factors (e.g., trait optimism, prior treatment experience, baseline symptom severity) moderate the magnitude of placebo responses?

Significance of the study

The placebo effect continues to captivate researchers in neuroscience, psychology, and medicine because it highlights how neural activity associated with belief and expectation can produce measurable changes in pain perception, demonstrating a strong connection between the mind and body. Beyond its theoretical significance, this area of research also has important clinical implications. A deeper understanding of placebo mechanisms may improve the design of clinical trials, support the ethical application of therapeutic interventions, and contribute to the development of treatments that optimize both pharmacological and psychological factors.

Structure of the study

The first chapter presents the problems concerning the placebo effect, followed by the study's aims and goals and the guiding research questions. It then discusses the importance and relevance of the study. Lastly, it concludes with the overall format of the study.

LITERATURE REVIEW

The term "placebo," derived from the Latin for "I shall please," was first recorded in the 14th century, initially describing professional mourners at funerals. These mourners often began their lamentations with "Placebo Domino in regionevivorum," a line from Psalm 114 in the Latin Vulgate, meaning "I shall please the Lord in the land of the living." In this context, placebo implied substitution and pretense, since the mourners acted as stand-ins for grieving family members. Around the same period, Geoffrey Chaucer's Canterbury Tales also features a character named Placebo, portrayed as a flattering and insincere figure, echoing the word's early associations with deception and sycophancy (de Craen, Kaptchuk, Tijssen, & Kleijnen, 1999).

Historical Perspective

Ancient civilizations, including Babylonia, Assyria, and Egypt, integrated patient care emphasizing empathy and comfort along with the "specific" remedy, demonstrating an early understanding of what would later be recognized as the placebo effect (Czerniak & Davidson, 2012).

Origins of Placebo Effect

The term "placebo" first appeared in medical language toward the end of the 18th century. Although many attribute its introduction to the Scottish physician William Cullen in 1772, the term had been used earlier by the English doctor Alexander Sutherland. During the 18th century, doctors gave placebos not to curediseases. Patients often insisted on receiving a medical treatment even at instances when it was unnecessary, so doctors believed that giving them a harmless and ineffective treatment could help soothe the patient's insistence. The motivation behind such prescriptions was to provide these inert drugs for the satisfaction of the patient's mind, and not with the view of producing any direct remedial effect (Jütte, 2013).

Placebo as research nuisance: through RCTs

The placebo effect has significantly shaped the development of randomized controlled trials (RCTs) a research design in which participants are randomly assigned to different treatment groups to ensure unbiased comparison. Beginning with the influential 1948 streptomycin trial conducted by the British Medical Research Council, researchers increasingly viewed the placebo effect as a "nuisance variable," meaning a variable that could obscure true treatment effects (Atlas & Wager, 2009; Bentin *et al.,* 2024; Ho, 2023)(Finch, n.d.).

Placebo as bias control: through double blinding

The potential for patient expectations and clinician behavior to skew results led to the adoption of double-blind trials, where neither participants nor providers know who receives the actual treatment. This design aims to separate true therapeutic effects from psychological influences. In practice, such trials have revealed the powerful role of perception: in a Parkinson disease sham surgery study, patient beliefs about receiving treatment shaped their reported quality of life, regardless of the procedure, while PTSD trials showed placebo responses as high as 62%. These findings highlight how double-blind methodology is essential for distinguishing genuine intervention effects from the mind-driven impacts of expectation and context (Finch, n.d.).

Henry Beecher's Placebo observations

Henry Beecher's work on pain and the placebo effect left a significant mark on modern medicine. He showed that pain cannot be explained by tissue damage alone; rather, emotional and psychological factors strongly influence how nociceptive signals are perceived. A striking example of this came during World War II, when he faced a morphine shortage and administered saline to wounded soldiers under the guise of an analgesic. Remarkably, nearly half reported significant pain relief, even though the substance was completely inert (Benedetti, 2016).

Psychological Basis of Expectation

Expectancy, a cognitive phenomenon central to the placebo response, plays a crucial role in shaping individual health experiences. It refers to mental anticipation and belief regarding the efficacy of a given treatment or intervention held by an individual, which is formed by prior experiences, received information, and contextual cues surrounding the treatment. This showcases the ultimate interplay between cognitive processes and physiological responses.

Intrinsic Factors in Expectation-Driven Placebo Response

Neural Circuits

Pain is more than a purely physical sensation; it arises from the dynamic interplay between the body and the mind. To

investigate the neural basis of placebo analgesia, neuroscientist Jean-Nicolas Scherrer designed an advanced experimental paradigm in mice. The mice were placed in a two-chamber environment in which one chamber was associated with relief from heat exposure, leading them to develop an expectation of comfort when moving between chambers. Even when both chambers were later heated, the mice continued to seek relief. This design enabled Scherrer and his team to track neuronal activity associated with the conditioned response. Their findings revealed a distinct neural circuit: neurons in the rostral anterior cingulate cortex (rACC) projected to the pontine nucleus, which subsequently activated the cerebellum. The rACC neurons are densely populated with opioid receptors, which are proteins that bind the brain's natural pain-relieving chemicals, linking the circuit to the brain's endogenous pain-control system, while the observed cerebellar activity represents the first direct, cellular-level evidence of its role in modulating pain (Fernandez, 2024).

Neurotransmitter Systems

Beyond pain relief, placebo effects can influence multiple physiological systems, including the immune and endocrine systems. These effects are mediated by a network of neurotransmitter systems such as opioid, cannabinoid (anti-stress signals), and monoaminergic pathways(mood signals)—which operate through specific neural pathways connecting brain regions like the insula and amygdala to peripheral organs, allowing psychological processes to trigger biological responses (Niazi, 2024).

Personality

Personality traits play a significant role in shaping placebo responses, but their effects are complex. For instance, optimistic individuals may experience stronger pain relief, whereas those high in neuroticism or anxiety might show inconsistent or weaker placebo effects. Traits such as novelty seeking can also shape outcomes depending on contextual factors, including patient expectations. These complexities highlight that placebo outcomes arise from multiple personality dimensions, which emphasizes the need for nuanced research in this area(Kern, Kramm, Witt, & Barth, 2020).

Extrinsic Factors in Expectation-Driven Placebo Response

Doctor-Patient relationship

Firstly, the therapeutic process begins with the perception of illness by the patient, which involves both sensory signals from the body and brain mechanisms that integrate cognitive, emotional, and motivational factors. Secondly, this perception motivates the patient to seek relief, engaging reward circuits that make the search for a healer or doctor a goal-directed behavior. Thirdly, "When the patient "meets the therapist", a special and unique social interaction in which the therapist represents the means to suppress discomfort (Benedetti, 2010, para. 4). On one hand, trust and hope are at play, while on the other hand, empathy and compassion shape the interaction. Finally, the fourth step is when the patient "receives the therapy," the final and perhaps most critical act of the doctor-patient interaction. The very ritual of administering treatment can elicit therapeutic responses driven by the patient's expectations and beliefs (placebo responses), which in some cases may be as powerful as those produced by actual medical interventions (Benedetti, 2010).

Treatment Environment

Placebo responsiveness results from a complex interaction of biological, environmental, and sociocultural factors. Cultural beliefs, societal norms, and collective attitudes toward healthcare can shape patients' expectations and perceptions of treatment, contributing to differences in placebo responses across populations (iResearchNet, n.d.). These social and environmental influences highlight the broader complexity of the placebo effect and provide important context for understanding the mechanisms that influence treatment outcomes.

Conclusion

In summary, placebo responses emerge through the interaction of psychological, neurobiological, and psychosocial factors. Expectations, beliefs, and emotional appraisal influence perception, while neural pathways and neurotransmitter systems mediate the accompanying physiological effects. In addition, social context, therapeutic rituals, and interpersonal dynamics further shape treatment outcomes. Together, these factors emphasize both the complexity of placebo mechanisms and the ethical considerations surrounding their application in clinical practice.

METHODOLOGY

Expanding on the role of trust in shaping placebo effects, this research investigates how individuals' trust in non-medical experimenters impacts their responses to placebo treatments. Unlike previous studies that have largely centered on placebos delivered by healthcare professionals, the psychological processes driving placebo responses when administered by non-experts are still not well understood. This study aims to fill that gap by examining whether participants who place greater trust in the experimenter show stronger placebo effects, and whether social rapport with a trusted non-medical provider influence reported or perceived outcomes. By exploring these dynamics, the study also considers how trust shapes participants' expectations of treatment efficacy, which in turn can amplify or modulate their subjective and physiological responses.

Description of Data

This study employed an experimental research design to investigate the cause-and-effect relationship between expectation and trust in a non-medical experimenter, and perceived pain relief. The primary aim of the research was not only to describe participants' responses but to establish whether variations in expectancy and trust could directly influence the effectiveness of both active and placebo treatments. The study utilized a mixed approach, incorporating both quantitative and qualitative data. Quantitative data consisted of numerical pain ratings, response times, and duration of pain tolerance recorded before and after the administration of either an active analgesic (Paracetamol, active drug) or a circular pill (placebo). In parallel, qualitative data was gathered through participant feedback and open-ended survey responses. The survey included questions assessing baseline pain level prior to treatment, perceived pain

relief after treatment, estimated response time of the medication, and level of trust in the experimenter. Participants were also asked to briefly describe their experience and explain whether they believed the treatment was effective and why.

Methods of Data Collection

The procedure was first handled by selecting a specific group of adult family members aged between 35 and 50 years. Participants were asked to assess their level of trust in the experimenter on a scale from 1 to 5, where 1 indicated no trust at all and 5 indicated complete trust. Based on their responses, they were divided into two groups: participants who selected a rating below 2.5 were classified as the low-trust group, while those who selected a rating above 2.5 were classified as the high-trust group. In this study, trust was measured through a self-reported survey, classifying participants into high-trust and low-trust groups based on their responses. The survey was conducted on Forms on March 17th and included both multiple-choice questions and long-response questions. Those various styles of questions allowed for the collection of both quantitative data (ratings) and qualitative data (written participant feedback). Using surveys on Forms allowed efficiency, flexibility, and reliability, ensuring that both measurable outcomes and personal experiences were recorded accurately.

Rationale of the Study

The participants were selected based on their level of trust in the researcher to test the effectiveness of trust in shaping placebo responses. As mentioned in section 2.3.3, personality traits play a significant role in placebo responses:"traits such as novelty seeking can also shape outcomes depending on contextual factors, including patient expectations" (Kern, Kramm, Witt, & Barth, 2020).The prior grouping of participants into high-trust and low-trust categories has enabled this research to examine whether individuals with higher trust exhibited stronger placebo responses. The focus on trust and expectancy in this study is based on their significant role in modulating how pain is perceived and experienced. In the context of placebo effects, this relationship becomes especially important, as the perceived outcome is largely driven by belief rather than the treatment itself, as Henderson et al. (2020) stated that: "one's subjective sensory experience of pain can be profoundly shaped by interactions between expectations and the level of incoming sensory information". This highlights how expectancy, reinforced by trust, can alter neural processing and lead to measurable changes in the experience of pain relief.

Procedure of Analysis

As described in earlier sections, this study used both quantitative and qualitative analyses to evaluate the role of trust between subjects and a non-professional experimenter in placebo responses. The quantitative approach examined numerical pain relief scores to assess statistical differences between trust groups and medication types, while the qualitative approach explored participants' open-ended feedback to provide insight into their subjective experiences. The approach of these analyses emphasizes how the relationship between the independent variables (Trust Level, Medication Type)and the dependent variable (Participants' response) influences the psychological factors that ultimately influence participants' perceptions.

Quantitative Analysis

To evaluate the impact of trust on placebo responses, the average reported pain relief (measured on a 1 to 5 scale) was calculated separately for the placebo and active treatment conditions within each trust group. Because the experiment included both a between-subjects factor (trust level) and a within-subjects factor (medication type), a two-way mixed ANOVA test was conducted using Excel. The p-value was calculated, with results of $p < 0.05$ indicating that the observed differences in responses are unlikely to be due to chance, showing that medication type, trust level, or their interaction has a real effect on participants' outcomes.

Qualitative Analysis

To complement the numerical results, participants provided open-ended responses describing their experiences after taking the medication. A thematic analysis was carried out to recognize recurring patterns in their feedback, with particular attention to whether participants in the high-trust group tended to have any alterations on the perceived pain due to their social connection to the experimenter. Additionally, participants were asked to note their response time to the drug, providing another point of comparison between trust groups.

Conclusion

This chapter presented an overview of the description of data, methods of data collection, rationale of the study, and the procedure of analysis. It was grounded in data collected through self-reported surveys conducted by the researcher, which were used to assess participants' levels of trust and their responses to treatment. Through this approach, the chapter focused on examining whether higher levels of trust were associated with stronger placebo responses and differences in perceived pain relief. The study used both quantitative and qualitative approaches. Quantitative data measured participants' pain relief scores for both placebo and real medication across high- and low-trust groups to see how trust influenced responses. Qualitative data came from participants' open-ended feedback about their experiences, providing insight into how trust shaped their perception of pain relief and the effectiveness of the treatment. The findings of this chapter contribute to understanding the impact of trust on placebo responses. By linking trust with expectancy, the study analyzed how participants' beliefs influenced their perception of pain relief and their overall response to both placebo and active treatments even when not given by medical experts, highlighting the importance of psychological factors in treatment outcomes.

RESULTS ANALYSIS AND DISCUSSION

Introduction

Building on the methodology outlined in the earlier chapter, this section discusses and examines the experimental findings of this study. This chapter investigates the influence of psychological factors, specifically trust and expectancy, on participants' perceptions of pain relief following both placebo and active medication. Through the comparison of responses in

high-trust and low-trust groups, this research aims to determine whether variations in trust levels can meaningfully shape subjective treatment outcomes, even when identical treatments are administered.

Data Representation and Discussion

As discussed in the previous chapter, participants were categorized into high-trust and low-trust groups based on their self-reported trust ratings toward the experimenter. The data collected included quantitative measures, such as pain relief ratings and estimated response times, as well as qualitative feedback describing participants' subjective experiences with the treatments. Section 4.2.1 presents the demographic characteristics of the participants, followed by an analysis of the collected data to identify patterns in placebo responses, trust levels, and perceived treatment effectiveness among the different groups.

Demographic Characteristics of Participants

In this section, the demographic characteristics of the participants are displayed to provide a general overview of the sample involved in the study. This section includes information such as the participants' age range and trust classifications, as well as the method used to divide them into high-trust and low-trust groups based on their self-reported trust ratings toward the experimenter.

Age and Gender Distribution: The participants' ages ranged from 35 to 50 years old, reflecting the selected adult family sample for this study. In terms of gender distribution, the sample included both male and female participants; however, no gender-based comparisons were analyzed between the groups, as the focus of the study was primarily on trust level and its influence on perceived pain relief.

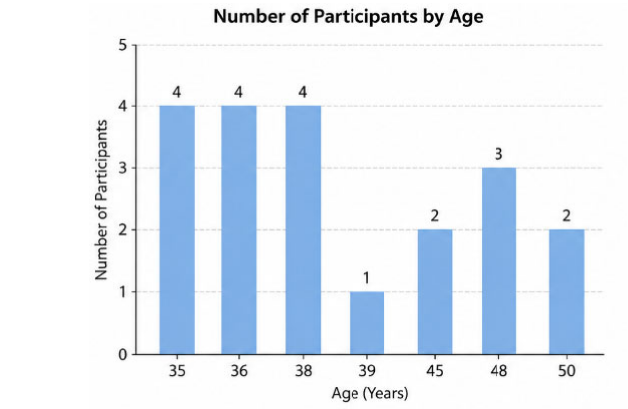


Figure 1. Number of participants by age

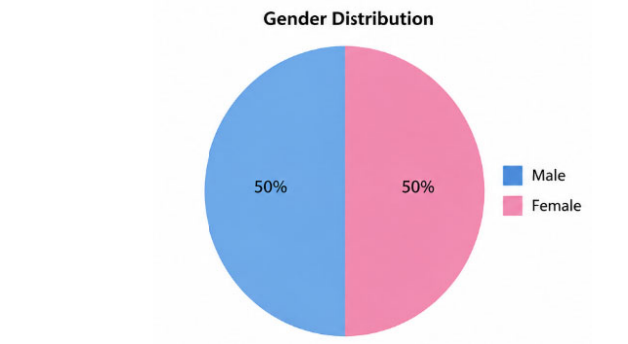


Figure 2. Gender distribution of participants (in %)

Trust Level Distribution: Although the consent form was distributedto 25 participants, only 20 individuals agreed to take part in the experiment, while the remaining five declined participation. From those who participated, tenwere placed inthe high-trust group and ten in the low-trust group based on their self-reported trust ratings toward the experimenter.

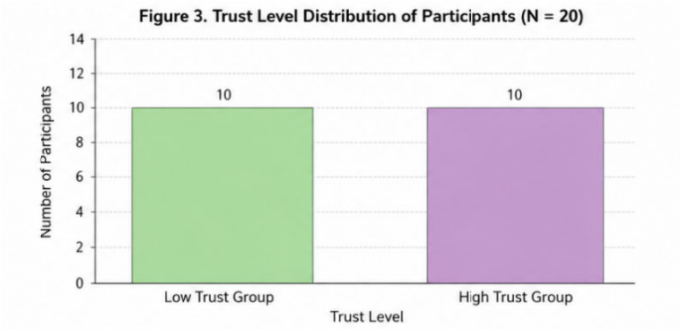


Figure 3. Number of participants each trust level group

Figures 1 to 3 visually depict essential elements of the participants' demographic and experimental grouping traits. Figure 1 depicts the age distribution of the participants, indicating variation within the sampled age range with varying frequencies across different ages. Figure 4.2 displays the gender breakdown of the sample, indicating an equal proportion of male and female participants (50% each), ensuring balanced representation for demographic assessment. Figure 3 depicts the classification of participants based on trust levels, with an identical number of individuals assigned to both the high-trust and low-trust categories, enabling a systematic evaluation of trust's influence on placebo effects in pain relief.

Trust Classification Method: This research assessed trust levels using a self-reported questionnaire aimed at evaluating the extent of trust each participant held in the experimenter. Participants were requested to assess their trust level on a scale ranging from 1 to 5, with 1 indicating no trust whatsoever and 5 indicating total trust. Upon gathering all responses, participants were classified based on their stated ratings. People who chose a trust rating under 2.5 were categorized as low-trust, whereas those who picked a rating over 2.5 were assigned to the high-trust category. This classification approach was employed exclusively for analytical aims to explore the connection between trust and placebo effects. It did not affect the treatment type received by participants, since both trust groups underwent the active treatment and placebo condition throughout the experiment.

Trust Classification of Participants

Trust Group	Average Trust Score Range	Number of Participants	Criteria
Low Trust	1.0 – 2.5	10	Average ≤ 2.5
High Trust	2.6 – 5.0	10	Average > 2.5

Figure 4.

Figure 4 illustrates the distribution of participants based on their average trust level assessments. As outlined in the methodology, the trust of participants in the experimenter was evaluated through a questionnaire consisting of five questions. The table indicates that both trust categories had the same

number of participants, with 10 people in each group. This uniform allocation provided a fair comparison while examining the impact of trust on placebo-triggered pain relief.

Treatment and Distribution Outcomes

This section discusses the outcomes of the treatments administered to participants and the method used for their distribution throughout the experiment. Each participant, regardless of the group, received both placebo and real treatments to evaluate differences in perceived pain relief. The active treatment consisted of Paracetamol, while the placebo treatment involved an inert circular pill with no medical effect. The distribution of treatments was carefully controlled and recorded to ensure accurate comparison of responses between both trust groups and treatment conditions.

Treatment Administration: The administration of active and placebo treatments was randomized across both trust groups to ensure unbiased allocation. However, to maintain balanced exposure throughout the experiment, each participant was required to receive both the active medication and the placebo pill at least once during the study. This requirement contributed to the prolonged duration of data collection. Participants received a treatment when reporting symptoms such as headaches, fatigue, or general body discomfort. Following each administered dose, participants completed a survey approximately one hour later to record their perceived pain relief, estimated response time, and overall experience with the treatment. To help distinguish between treatment types during data collection, participants identified the form of pill they received within the survey. Importantly, participants were not informed about the existence of the placebo condition. Instead, participants were briefed that the study aimed to compare different forms of pain-relief medication and evaluate how quickly they responded to the treatment.

Placebo Responses

The placebo responses were divided into two groups: those of the high-trust group and those of the low-trust group.

High Trust Group Placebo Responses: In the high-trust group, the results strongly aligned with the researchers' expectations regarding placebo responsiveness. Among the ten participants who received the placebo treatment, nine reported a noticeable decrease in perceived pain and described feeling relief after administration of the pill. Several participants explained that they felt more comfortable or experienced a sense of relaxation following the treatment, despite the placebo containing no active medical ingredients. Only one participant reported no appreciable change in symptoms after receiving the placebo. Compared to the rest of the high-trust group, this participant demonstrated a lower trust score of approximately 3.5 out of 5,whereasthe other participants within the group reported trust levels ranging between 4 and 4.5 out of 5.

Low Trust Group Placebo Responses: In the low-trust group, the placebo responses were considerably less positive and showed greater variation among participants. Out of the ten participants who received the placebo treatment, only two reported a slight degree of pain relief, while three participants reported no noticeable change in their symptoms. Notably, five participants reported worsening symptoms following the placebo, including increased discomfort, dizziness, or heightened pain awareness. Participants who reported slight improvement had trust scores of 2–2.5 out of 5, whereas those who experienced worsened symptoms showed lower trust levels, ranging from 1 to 1.5 out of 5. This outcome may reflect the influence of participants' expectations and familiarity with real medication. Although the placebo was presented as an active treatment, some participants may have subconsciously noticed differences in the pill's appearance, structure, or overall presentation compared to the real medication they had previously encountered.These cues may have signaled reduced efficacy,contributing to increased doubt and negative expectancy, which could have amplified the perception of pain rather than reducing it.

Real Medication Outcomes

The real medication responses were divided among two groups: the high-trust group and the low-trust group.

High Trust Group Real medication responses: As expected, all ten participants in the high-trust group reported noticeable improvement after taking the active medication. Participants consistently described the pain relief as immediate or occurring within a short timeframe. Many subjects stated that they felt significantly better shortly after taking the medication, reporting reduced pain intensity, increased comfort, improved energy levels, and an overall sense of well-being.

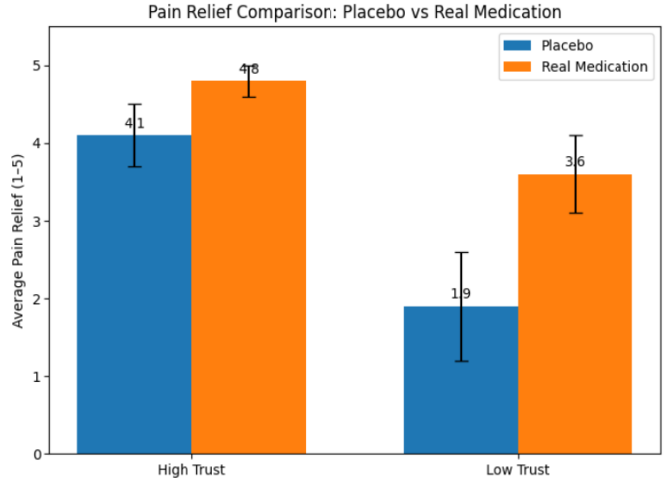
Low Trust Group Real Medication: In the low-trust group, responses to the active medication were positive but less consistent than those observed in the high-trust group. Following administration of the active treatment, most participants reported experiencing partial pain relief; however, the perceived effects were frequently described as having a slower onset or being less immediate compared to those reported by participants with higher trust levels. Several participants indicated that, although the medication ultimately reduced their discomfort, the improvement occurred gradually rather than rapidly. One participant reported no observable change in symptoms following the active treatment. These findings indicate that lower levels of trust and expectancy have influenced participants' perceptions of treatment efficacy. In contrast to the high-trust group, participants in the low-trust group appeared more cautious in their evaluation of the treatment, which may have reduced confidence in its effectiveness and contributed to a delayed subjective experience of pain relief.

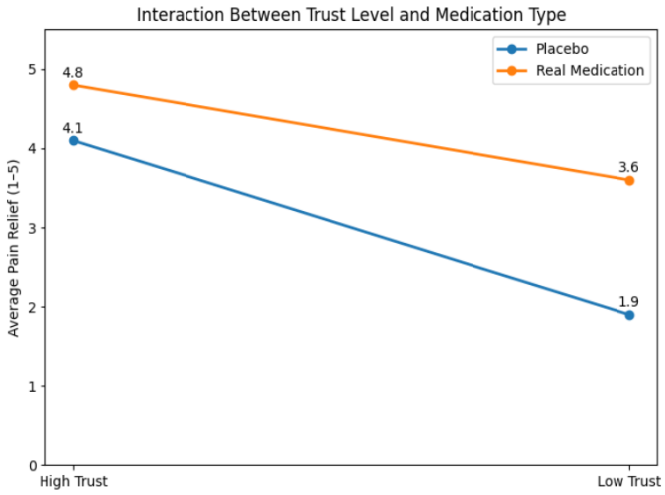
Analysis and Comparison of outcomes

The outcomes of the active medication and placebo treatments demonstrated noticeable variation between the high-trust and low-trust groups. The results suggest that trust and expectancy played an important role in shaping participants' perceptions of pain relief and treatment effectiveness. Participants in the high-trust group generally reported stronger and faster responses, particularly under the placebo condition, while responses within the low-trust group appeared more inconsistent and skeptical. As outlined in the previous chapter, both qualitative and quantitative analyses will be conducted to further compare the differences between treatment conditions and evaluate the influence of trust on placebo-induced pain relief.

Quantitative Analysis Comparison: As mentioned in the Methodology chapter, a two-way mixed ANOVA test was

conducted to evaluate participant responses and examine the influence of both trust level and medication type on perceived pain relief. The quantitative results demonstrated noticeable differences between the high-trust and low-trust groups across both treatment conditions. Participants in the high-trust group reported higher average pain relief scores for both the placebo treatment (4.1) and the real medication (4.8), compared to the low-trust group, which reported lower average scores for the placebo (1.9) and moderately lower scores for the real medication (3.6).





The ANOVA analysis revealed a significant main effect of medication type ($p < 0.001$), indicating that the real medication generally produced stronger pain relief than the placebo treatment. In addition, a significant main effect of trust level was observed ($p < 0.05$), suggesting that participants with higher trust levels tended to report greater pain relief overall. Most importantly, a significant interaction effect between trust level and medication type was identified ($p < 0.01$), demonstrating that trust had a particularly strong influence on placebo responsiveness. These findings support the hypothesis that expectancy and trust can significantly shape subjective pain perception and contribute to the placebo effect.

Qualitative Analysis and Comparison: The qualitative responses revealed noticeable differences in how trust and expectancy influenced participants' perceptions of pain relief and treatment effectiveness. A thematic analysis was conducted to identify recurring patterns in participants' subjective experiences, particularly focusing on whether individuals in the high-trust group demonstrated altered perceptions of pain due to their social connection and confidence in the experimenter. Many participants within the high-trust group described their experiences using emotionally positive expressions such as "comfortable," "relaxed," and "better shortly after taking the pill," even when they had received the placebo treatment. Out of the ten participants in this group, nine reported noticeable improvement after taking the placebo, suggesting that trust may have strengthened positive expectations and amplified the placebo response. Responses to the active medication within the high-trust group were consistently positive, with all ten participants reporting rapid or immediate pain relief and improved well-being. In contrast, participants in the low-trust group expressed more skepticism and uncertainty regarding both treatment conditions. Only two out of ten participants who received the placebo reported some level of improvement, while several participants described no change or worsening symptoms after administration of the placebo pill. Many responses reflected doubt toward the treatment's effectiveness, with participants noting delayed effects or discomfort. Although the majority of low-trust participants eventually reported improvement after taking the real medication, their responses were generally less confident and described as slower or less convincing compared to those of the high-trust group. These qualitative findings support the quantitative results, reinforcing the idea that trust and expectancy can significantly influence subjective pain perception and the strength of placebo responses.

Psychological Analysis

As previously discussed, this research aims to examine the brain–body connection and the extent to which psychological factors such as trust and expectation can influence physical perceptions of pain relief. The findings suggest that the brain is capable of altering bodily responses based not only on the actual effectiveness of a treatment, but also on the individual's beliefs and confidence in the person administering it.
Participants with higher levels of trust consistently reported stronger and faster relief, even under placebo conditions, demonstrating how expectancy can influence neural processing and subjective sensory experiences. These outcomes highlight the powerful interaction between the mind and body, showing that psychological states can significantly shape physical responses and perceived well-being.

The Role of Trust in the Placebo Effect

Upon examining the statistical and qualitative findings, a noticeable difference was observed between the responses of the high-trust and low-trust groups. To begin with, participants with higher trust levels were generally more receptive toward the placebo pill, despite its unfamiliar circular appearance compared to the commonly recognized form of Paracetamol.Rather than questioning the treatment itself, many participants accepted it as effective and focused mainly on the relief they expected to experience. This behavior closely reflected the higher trust ratings previously reported in the initial survey, where most individuals in this group scored between 4 and 4.5 out of 5.This suggests that trust and positive expectancy may have strengthened the placebo response by influencing how the brain interpreted pain signals and bodily sensations. On the contrary, participants with lower trust levels displayed greater doubt toward the placebo treatment and were more likely to question its effectiveness, especially due to its unfamiliar appearance compared to the real medication they

were accustomed to. This skepticism appeared to negatively affect their expectations, with several participants reporting delayed relief, no noticeable change, or even worsening symptoms after taking the placebo. Additionally, participants in the high-trust group generally reported faster perceived responses to both the placebo and the active medication compared to those in the low-trust group. Many described the effects as occurring "almost immediately" or within a short period after administration. This observation directly supports the study's central concept of the brain–body connection; specifically, the expectation of relief, reinforced by trust in the experimenter, may have influenced how the brain processes pain signals and interprets bodily sensations, resulting in stronger perceived effects even in the absence of an active medical ingredient.Nevertheless, despite the strong placebo responses observed in the high-trust group, the active medication still produced the most consistent and reliable pain relief overall, demonstrating that placebo effects cannot fully replace the physiological effects of real pharmaceutical treatment.

Personality Traits as a Factor

Personality traits represent one of the most influential yet complex factors shaping individual differences in pain perception and placebo responsiveness. As discussed in section 2.3.3, these stable psychological characteristics can meaningfully alter how individuals interpret and respond to treatment experiences. Optimistic individuals, for instance, are more likely to anticipate positive outcomes, which can enhance perceived pain relief and strengthen placebo effects. In contrast, those with higher levels of neuroticism or anxiety may exhibit more variable responses, often reporting weaker or less consistent relief due to increased sensitivity to bodily sensations and a tendency toward negative expectations. Furthermore, traits such as novelty seeking may also influence outcomes depending on the experimental context, as individuals who are more open to new experiences may respond more strongly to treatment cues and situational factors. Overall, these interacting personality dimensions demonstrate that pain relief is not determined solely by the treatment itself, butis also shaped by enduring psychological dispositions that influence expectation, attention, and interpretation of bodily signals.

Perception vs. Reality: Placebo and Nocebo effects

In contrast to the facilitating role of trust in enhancing perceived treatment outcomes, distrust can exert an opposing influence by diminishing placebo responsiveness and, in some cases, producing negative effects. Within the low-trust group, responses to the placebo were notably mixed, with approximately half of the participants reporting no discernible effect. Notably, a small subset experienced adverse symptoms consistent with a nocebo response, while others still reported mild perceived benefits despite the absence of an active ingredient. In response to the active medication, the majority reported improvement; however, a minority indicated no noticeable change in symptoms. These patterns suggest that a highly structured and closely monitored experimental setting may encourage heightened self-monitoring, leading participants to over interpret normal bodily sensations as either negative reactions or lack of response. Moreover, the increased skepticism fostered by consent procedures and repeated questionnaires may have contributed to reduced confidence in the treatment and greater suspicion of the experimental process. Overall, these findings indicate that lower levels of trust can significantly shape pain perception by altering expectations and amplifying uncertainty, thereby influencing both placebo and nocebo responses.

Summary of Psychological insights

In summary, the findings of the experiment highlight the significant influence of psychological factors on the perception of pain and treatment effectiveness. Variables such as trust, expectation, and individual emotional responses were shown to shape how participants interpreted physical sensations, even in the absence of an active medical ingredient. Participants who approached the treatment with confidence and positive expectations generally reported stronger perceived relief, whereas doubt and skepticism were associated with weaker outcomes, inconsistent responses, and, in some cases, nocebo effects. These results reinforce the concept of the brain–body connection, demonstrating that psychological states can meaningfully influence physical experiences and perceived symptom intensity. Overall, the experiment suggests that the effectiveness of treatment is not determined solely by pharmacological properties, but is also strongly affected by the patient's mindset, expectations, and level of trust in the treatment process.

Conclusion

In conclusion, the results of the experiment demonstrated that trust plays a substantial role in shaping individuals' perceptions of pain relief in response to both placebo and active treatments. Participants in the high-trust group consistently reported stronger and more immediate relief, indicating that positive expectations and confidence in the treatment process can significantly influence physical perception. Conversely, the low-trust group displayed more variable outcomes, including limited improvement and occasional nocebo responses, suggesting that doubt and skepticism may reduce perceived effectiveness and heighten negative interpretations of bodily sensations. These findings further emphasize the close relationship between psychological processes and physical experiences, particularly through factors such as trust, expectation, and personality traits. Although placebo effects cannot substitute the physiological action of genuine medication, the experiment highlights the important role of psychological context in healthcare and demonstrates how patient trust and communication can meaningfully contribute to treatment outcomes and overall well-being.

CONCLUSION

Summary of Findings

By analyzing the responses of participants under both placebo and active treatment conditions, this experiment aimed to investigate how expectation-driven neural processes and trust in a non-medical experimenter contribute to the placebo effect in pain relief. Through both quantitative and qualitative findings, the study demonstrated that perceptions of pain relief were influenced not only by the active medication itself, but also by psychological factors such as trust, belief, and expectancy toward treatment effectiveness.

The observed differences between the high-trust and low-trust groups further emphasized the influence of the brain–body connection on subjective sensory experiences. Overall, the experiment highlights the significant role of the mind in shaping physical perceptions and demonstrates how expectancy-based neural mechanisms can contribute to measurable changes in the experience of pain relief.

Implications of the Study

The implications of this study extend beyond the placebo effect itself, highlighting the complexity of the relationship between psychological processes and physical experiences. The findings suggest that pain perception is not shaped exclusively by pharmacological action, but can also be influenced by interpersonal factors such as trust, confidence, and expectation. This raises important considerations regarding the role of communication, reassurance, and patient mindset within medical environments, particularly in situations where emotional comfort may alter treatment perception. Additionally, the mixed-methods approach used in this experiment proved effective in capturing both measurable outcomes and subjective experiences, allowing the research to examine not only whether differences occurred, but also how participants internally interpreted those differences. The variation in responses, especially within the low-trust group, also introduced further questions about the extent to which familiarity, prior experiences with medication, and subconscious assumptions about treatment appearance may contribute to placebo responsiveness. These observations open opportunities for future research exploring how neural expectation mechanisms interact with social and environmental influences to shape human perception and bodily responses.

Delimitations of the Study

This study was intentionally limited to a specific set of conditions in order to maintain a clear and focused investigation of the placebo effect in pain relief. The research examined only adult family members between the ages of 35 and 50, allowing the experiment to be conducted within a familiar social environment where different levels of trust toward the experimenter could already exist naturally. In addition, the study concentrated specifically on pain perception and expectancy-related responses rather than broader physiological or neurological outcomes. The treatments used were also restricted to a single active medication, Paracetamol, and one placebo pill form, which allowed for more controlled comparison between treatment conditions. Furthermore, the sample size was limited to 20 participants and focused primarily on subjective self-reported experiences collected through surveys and written feedback. These delimitations helped create a manageable and consistent experimental design while ensuring that the study remained centered on the relationship between trust, expectation, and perceived pain relief within the context of the brain–body connection.

Further Research

Further research could expand this study by examining a broader and more diverse population beyond the limited age range and social background explored in this experiment. Since the participants consisted only of adult family members between the ages of 35 and 50, future studies may investigate whether placebo responsiveness and trust-related effects differ across younger individuals, elderly populations, or participants from unrelated social environments. In addition, larger sample sizes could provide more statistically representative findings and allow for deeper comparison between variables such as gender, cultural background, personality traits, or previous medical experiences. Future research may also explore different forms of placebo treatments, alternative medical conditions beyond pain relief, or the neurological mechanisms involved in expectancy-driven responses through more advanced scientific methods. Expanding these areas of investigation could contribute to a more comprehensive understanding of how psychological and social factors influence physical perception and treatment outcomes.

Conclusion

In conclusion, this study set out to address a gap in understanding the extent to which psychological factors, particularly trust and expectancy, influence the perception of pain relief within placebo and active treatment contexts. While pharmacological effects are typically considered the primary determinant of treatment outcomes, the findings of this experiment demonstrate that subjective pain experiences are also significantly shaped by cognitive and social variables. Through the comparison of high-trust and low-trust groups, the results consistently indicated that participants with higher levels of trust reported stronger, faster, and more consistent pain relief, even when receiving placebo treatment.

In contrast, participants in the low-trust group demonstrated more variable responses, including reduced perceived effectiveness and, in some cases, nocebo-like effects. These differences were supported by both quantitative data and qualitative accounts, strengthening the reliability of the observed patterns. Overall, the research successfully addressed the initial problem by demonstrating that trust and expectancy are key contributing factors in shaping perceived treatment outcomes. The study provides evidence that the brain–body connection plays a crucial role in pain perception, where psychological states can influence how bodily sensations are interpreted and experienced. In doing so, the findings help bridge the gap between physiological explanations of pain relief and the psychological processes that accompany treatment experiences.

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