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RESEARCH ARTICLE

CORRELATION OF PAIN SENSITIVITY AND SWEET TASTE IN HEALTHY MALE ADULTS

Priya SA , Savitri Siddanagoudar, Shobha C Nallulwar, Neelam D

SDM College of Medical Sciences and Hospital (SDMCMSH), Dharwad, Karnatakas, India

Correspondence
Priya SA
(drpriyasa@gmail.com)

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Background: Many studies have established a relationship between the administration of small amounts of sweet-tasting (sucrose) solution to the tongue and analgesia in rat pups and human infants. Hence, we intended to study the relationship between pain sensitivity and sweet taste in healthy male adults.
Aims & Objective: To measure and compare duration of pain onset and duration of pain tolerance when nothing was placed in the mouth, when water was placed in the mouth, and when sugar was placed in the mouth.
Materials and Methods: A total of 40 healthy male adults of the age group 20–30 years participated in this study. The cold pressor task (CPT) using cold water (7 ± 5 °C) was administered on each subject with nothing in mouth, and duration of the pain onset (in seconds) and pain tolerance (in seconds) was recorded using a stopwatch. Similar CPT and recordings were obtained when the subjects had distilled water (25 ml) and 25% of sucrose solution (25 ml) in their mouths, after 10-min rest between each intervention.
Results: A paired *t*-test was conducted to compare the pain onset and pain tolerance duration in the three conditions, which revealed that the mean scores of both pain onset (in seconds) and pain tolerance (in seconds) for the sugar-in-mouth condition were higher than those with nothing-in-mouth condition ($P < 0.001$).
Conclusion: The study results suggest that sugar-in-mouth condition does have an effect on pain onset and pain tolerance, showing a reduced sensitivity to pain when the subjects placed sugar in the mouth. It shows a relationship between sweet-tasting solution and analgesia in adults also. Probably endogenous opioids may also play a role.

INTRODUCTION

In human beings, pain and taste perception are two major sensory inputs. Taste sensation is most directly related to the taking of food and to the rejection or avoidance of some noxious substances. Thus, taste leads to one of two responses—acceptance or rejection. Pain is a protective mechanism. Sherrington defined pain as "the psychical adjunct of an imperative protective reflex." Pain is a subjective affair. It occurs whenever tissues are being damaged and causes the individual to react to remove the pain stimulus.[1] Pain can be helpful in diagnosing a problem. Without pain, one might seriously get hurt without knowing it, or might not realize the medical problem that needs treatment. Once the problem is taken care of, pain usually goes away. However, sometimes pain goes on for weeks, months, or even years. This is called chronic pain. Sometimes chronic pain is due to an ongoing cause, such as cancer or arthritis, and sometimes the cause is unknown. Fortunately, there are many ways to treat pain. Long-term use of pain killers has its own adverse effects.

Administration of intraoral sucrose is found to have analgesic effect in newborns[2,3] and also in rat pups[4]. Oral sucrose is an effective, safe, convenient, and immediate-acting analgesic for reducing crying time and significantly decreasing biobehavioral pain response following painful procedures in infants. Because it can be prepared at home, it is easily accessible and also cost-effective. This study aimed at understanding the analgesic effect of sucrose, if it exists in adults. Thus, the objective of the study was to compare pain onset and duration of pain tolerance when nothing was placed in mouth, when water was placed in mouth, and when sugar was placed in mouth.

MATERIALS AND METHODS

The study was conducted at the physiology department of SDM Medical College (Dharwad, Karnataka, India). In this study 40 adults aged between 20 and 30 years were selected from SDM College of Medical Sciences and Hospital (including staffs and medical students). Inclusion criteria were age group 20–30 years—Young male normotensive

adults were taken as subjects. Exclusion criteria were mouth ulcers, hypertension, any type of pain, substance abuse, cardiovascular disorders, respiratory disorders, and neurological disorders. Individuals having fever, cold, or on any medication were excluded from the study. Ethics clearance was obtained from the institutional ethical committee, and informed consent was obtained from each subject after the procedure was clearly explained to the subject in an understandable language. The procedure was explained and demonstrated to allay any apprehension. Sphygmomanometer, stethoscope, water tub along with ice cubes to perform cold pressor task (CPT), thermometer, stirrer, towel, stopwatch, sucrose solution in the concentration 25% (w/v), distilled water, which were available in physiology department, were used.

After taking anthropological parameters, subjects were asked to immerse their hand in the cold water tub maintained at 70±50 °C. Meanwhile the duration was recorded by a stopwatch. The subjects were asked to indicate or tell when they initially felt the pain by pointing at the visual analog scale showing anchor "pain" using their other hand that was not immersed in the cold water tub. This duration was recorded as the duration of onset of pain. The subjects were asked to take out their hand if they cannot tolerate pain any further, and this time interval recorded from the beginning was taken as the duration of pain tolerance. Subjects were asked to wipe their hand using the towel provided. Each subject was asked to rest until the temperature of his hand returned to room temperature (usually 10 min). Likewise, the duration of pain onset and that of pain tolerance were recorded under three conditions: (1) with nothing in mouth, (2) with water in mouth, and (3) with sugar (25%, w/v) in mouth in of each subject, with a gap between the two, sufficient enough for the temperature of the hand to return to normal. During the procedure, the water and sugar solution had to be kept in the mouth itself and the subjects were not supposed to swallow it. The temperature of water was maintained at 70 ± 50 °C throughout the procedure by using a stirrer and also by adding additional ice cubes whenever required. The data so obtained were suitably tabulated and paired *t*-test was carried out to compare the three conditions for pain onset and pain tolerance using IBM SPSS, version 20. A *P*-value < 0.001 was considered statistically significant.

RESULTS

Forty adult men aged between 20 and 30 years were recruited for CPT in the form of pain onset and pain tolerance in response to when was nothing in the mouth, water in mouth, and sugar in mouth. The following are the results (Figure 1). The percentage subjects between 20 and 24 years is 95% and between 25 and 30 years is 5% (Figure 1).

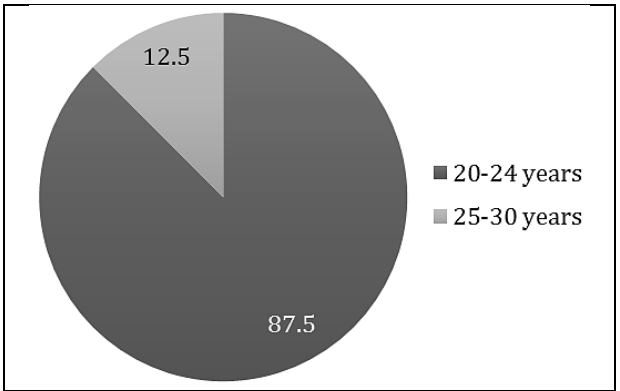

Figure 1: Percentage distribution of the subjects with respect to age

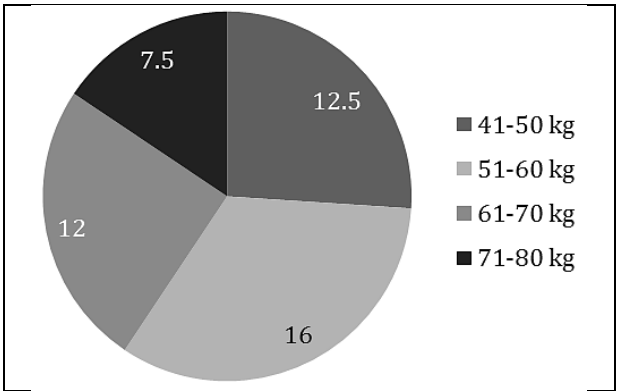

Figure 2: Percentage distribution of the subjects with respect to weight

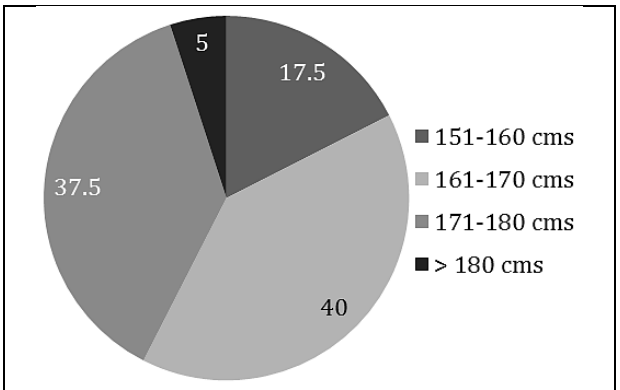

Figure 3: Percentage distribution of the subjects with respect to height

The percentage of weight of the subjects between 41 and 50 kg is 22.5%, between 51 and 60 kg is 40%, between 61 and 70 kg is 30% and that of subjects having weight between 71 and 80 kg is 7.5%. The percentage of subject with height between 151 and 160 cm is 17%, between 161 and 170 cm is 40%, between 171 and 180 cm is 37.5%, and that of subjects having height more than 180 cm is 5%.

DISCUSSION

Many studies have shown the analgesic effect of intraoral sucrose in newborn infants, for example, Blass and Hoffmeyer,[3] Barr et al.[2], and Carbajal et al.[5] Very few studies have been conducted to investigate the effect of intraoral sucrose on thermal pain in adults. The present study addressed the question whether intraoral sucrose exerts analgesic effects in adults. The study found a significant effect of intraoral sucrose on pain onset and duration of pain tolerance. Holding 25% (w/v) sucrose in mouth, the subjects took a longer time to report pain (pain onset) than when they held nothing and water in their mouth. This study did not corroborate with the study by Lewkowski et al.[6] In their study, the author found that intraoral sucrose did not produce any effect on pain onset because the subjects were asked to immerse their hand in cold water after 2 min of holding the sucrose solution in their mouth. Pain onset is a sensory discriminative aspect and intraoral sucrose might have produced latency in pain onset in our study because the subjects might have been distracted by holding sugar solution in their mouth as they were asked to immediately immerse their hand in cold water while holding sucrose solution in their mouth. But, then this is questionable because the subjects even held water in their mouth, which could have caused distraction. The pain onset reported was longer when the subjects held water than when they held nothing, but the difference was not significant. Thus, we can say that the concentration of sucrose (i.e., 25%, w/v) could have hedonic value that made the subjects to report time of pain onset longer, which is consistent with the study by Pepino and Mennella.[7] The duration of pain tolerance was also reported longer when the subjects held sugar in their mouth. Our study, very much corroborated with that by Lewkowski et al.[6] Pain tolerance is a motivational affective domain, so endogenous opioids might have played a role in reporting pain tolerance for a longer duration when the subjects held sucrose solution their mouth. The evidence of the role of the endogenous opioids in pain tolerance was shown by Blass et al.[8] and Blass and Shah,[9] emphasizing that sweet taste is thought to stimulate opioid activity in human infants. Another possibility of sucrose-induced analgesia might be the involvement of centrally mediated analgesia, that is, sucrose might stimulate descending pain modulation. This is shown by Anseloni et al.[10] in neonatal rats. One limitation of our study is that it did not directly measure endogenous opioid levels in the participants.

Overall, the subjects took a longer time to report pain, and duration of pain tolerance was also longer when the subjects held sucrose (25%, w/v) solution in their mouth when compared to those had nothing in mouth and water in mouth, suggesting that sucrose exerts analgesic effects even in adults, especially in men. This finding is consistent with that reported in the study by Lewkowski.[6] However, study carried out by Pepino and Mennella[7] did not show the analgesic effects of sucrose in adults. But their study included only women, so their findings cannot be generalized to all adults. Gender moderation on intraoral sucrose-induced analgesia was not tested in our study. Hence it can be taken up for future research.

CONCLUSION

The study results suggest that sugar-in-mouth condition does have an effect on pain onset and pain tolerance, showing a reduced sensitivity to pain when the subjects placed sugar in the mouth. It shows a relationship between sweet-tasting solution and analgesia in adults also. Probably endogenous opioids may also play a role.

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