

RESEARCH ARTICLE

A study to assess effectiveness of game-based health education on knowledge and practices regarding oral hygiene among children in selected schools

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Abstract: **Background:** Health education is a key strategy to achieve well-being of the community. Considering growing needs and interest of children there is need to adopt new approaches of learning. Literature suggest Combining game with traditional method of teaching bring desired changes in behaviour more effectively. The objective is to assess the knowledge scores and practices in control and experimental group before and after intervention, compare the pre intervention and post intervention knowledge scores and practices within both the groups and compare the post intervention knowledge scores and practices in both the group. **Methodology:** This study employed Quantitative research approach and utilized a Quasi experimental pre-test post-test with control group design. The sample consist of 120 children between age group 10-12 years old studying in schools (60 in control group and 60 in experimental group). Children in experimental group received game-based health education. Tool adapted was self-structured questionnaire for knowledge and self-reported checklist for practices. **Results:** In the control group, the majority 56.67% (34) of children were 11 years old, while in the experimental group, 51.67% (31) were 12 years old. Girls were predominant in both groups, comprising 51.67% (31) in control and 58.33% (35) in experimental groups. Children studying in 5th standard were more in number, with 43.33% (26) in control and 36.67% (22) in experimental groups. Comparison of pre- and post-test results showed a significant improvement in knowledge and practices in the experimental group ($P < 0.05$), whereas no significant change was seen in the control group ($P > 0.05$). Post-test comparison confirmed significant differences between groups ($P < 0.05$). **Conclusion:** Hence it was proved that game-based health education is effective in gaining knowledge and improving practices. It is a convenient and easy method which can be implemented in clinical, school and also home setting.

Keywords: Assess, Effectiveness, Game based health education, Knowledge regarding oral hygiene, Practices, Children.

INTRODUCTION

Health education is a key strategy to achieve well-being of the community, by providing them knowledge and education. [1]The most common illness impacting children globally is dental caries. The usage of increasingly processed food and beverages that include refined sugars is the cause of this rise in prevalence. Health education is crucial in teaching children about the prevention of oral health issues since lifestyle changes and habits are developed early in life.[2]The WHO Global Oral Health Status Report (2022) states that oral illnesses have an impact on nearly 3.5 billion of population worldwide. Primary dental caries affects 514 million children globally, while permanent tooth caries affects 2 billion people globally.[3,4]

According to the Global Burden of Disease Study, 60–90% of kids have primary tooth caries. Children's poor oral health can have serious consequences, such as discomfort, periodontal diseases, tooth caries, stunted growth, and a compromised quality of life. Childhood oral health issues can have a lasting influence on an adult's general condition and oral health. Conventional approaches like lectures, demonstrations, and written

content have been the mainstay of oral health education for a long time. Even though these techniques are popular and somewhat effective, young students may not always be interested in or engaged by them. Children have different learning styles and demands, so it's critical to look into creative ways to teach oral health concepts in a way that is both interesting and fun. [5]

School is the place which gives so many opportunities for children to learn. Most of the school look after the physical mental and spiritual well-being of children, thus it also focuses on play and recreation.[6] Even though school arrange many health check-up and health education for children, people prefer traditional method of health education by which knowledge can be provided but retention of knowledge can be difficult. Hence health educational program for children should be interesting and attractive. It can be achieved only by game-based activities which can help not only to attract students towards learning but also retention of knowledge.[7]

Dental caries prevalence was 54.16% overall, whereas prevalence for particular ages was 52% among patients

between 3–18 years of age and 62% among patients aged ≥ 18 years. Mixed. dentition has the highest prevalence which has entire percentage (58%). Western India had a higher region-wise prevalence (72%).[8]

Gaining oral hygiene knowledge and understanding its practices is among the most crucial elements of preserving excellent dental health. Knowledge imparted throughout a child's formative years will last throughout their lives. School age is a time of physical and mental development that shapes a youngster into a potential adult. These health practices will be retained throughout adulthood, old age, and even later generations. Therefore, schoolchildren's health education is essential for preventing oral health issues.[9]

Children's oral health status can be improved by carrying out oral health promotion in schools in an engaging and thorough way. Conventional techniques, such as lectures, have always been demonstrated to have less of an impact on children's dental health when used to raise awareness. Therefore, education and entertainment can be effectively combined to make learning enjoyable for them. As a result, learning through games is a relatively new method that shows promise and relies on experience.[10] Dental racing game (Fig. No.1) is a self-designed game which is structured considering children's need, interest, level of understanding and grasping of knowledge. It also includes activities which will allow fun based learning for children. This study will be helpful for the children to gain knowledge about oral health among children through game-based education. Game based education will be helpful to create interest in learning and maintain attention and focus of children towards education. It will also help to reduce incidence of dental caries and other diseases among children. This game can be adapted by schools and home where they can make children learn better about oral hygiene.



Fig No.1. Dental Racing Game.

METHODOLOGY

The present study aims to assess the effectiveness of game based health education on knowledge and practices regarding oral hygiene among children. A Quantitative

research approach and pre-test post-test with control group design was used. The independent variable was the game based health education dependent variable was knowledge and practices regarding oral hygiene. The study was conducted at selected schools. The target population included children aged 10-12 years old attending school. Sample size was determined using power analysis. 120 children between age group 10-12 years old were selected (60 in control group and 60 in experimental group). Sampling technique used was simple random sampling method. Tool used was self-structured questionnaire for knowledge and self-reported checklist for practices. The inclusion criteria was Children attending school, Children between age group 10-12 years, Parents of respected children willing for written consent, child willing for assent, Children who are able to read and write, Marathi or English language. The exclusion criteria was children who are on Dental treatment and children having fixed orthodontic appliances.

Procedure for data collection

Ethical permission was obtained from IEC (Institutional Ethics Committee). Permission was obtained from the concerned authorities of selected schools. Written consent was taken from the parent of the children with all explanation. Assent was taken from the children with all explanation. Sample collection was done as per inclusion and exclusion criteria. All the children who fulfilled the eligible criteria were selected in the study. Children were randomly assigned in experimental and control group. Base line data was collected for all participants.

Pre intervention knowledge was assessed through self-structured questionnaire. Pre intervention practices were assessed through self-reported practice checklist. Children in experimental group received health education through game-based teaching on 1st day. Children in control group received routine teaching from the school. Game was played by two participants A & B. The game started with square number 1 and went up to 22. The participants were instructed to read and demonstrate the activities in each square & answer the questions asked by the researcher. Researcher asked both participants to choose their favourite car and one colour from the spinning wheel which had 2 colour coding along with a pointer at the centre. The participants sat on the opposite sides of the game board. Researcher spined the spinning wheel which had 50% probability for both children to get the turn to play the game. It was ensured by the researcher that wheel spins freely without any obstacles. When the wheel stopped spinning, pointer indicated the colour coding of chosen participant who got the chance to move forward to the next square. The participant unable to perform activities correctly remained on the same square until next turn. The participant who reached the finishing square first was declared the winner. The game was monitored by coordinator and

researcher. The participant who finished the game with comprehending demonstration of activities with correct technique was given a token of appreciation. All participants in control and experimental group

gave post-test on 8th day

RESULTS

Table No.1 Frequency and percentage distribution of demographic variables in control group. n = 60

Sr. No	variable	groups	Control group		Experimental group	
			frequency	Percentage (%)	frequency	Percentage (%)
1.	Age in years	10	7	11.67	5	8.33
		11	34	56.67	24	40
		12	19	31.66	31	51.67
2.	Gender	Boys	29	48.33	25	41.67
		Girls	31	51.67	35	58.33
3.	Studying in	5 th	26	43.33	22	36.67
		6 th	18	30	17	28.33
		7 th	16	26.67	21	35

The finding shows that out of 60 children in control group, 7 (11.67%) children were 10 years old, 34 (56.67%) children were 11 years old and 19 (31.66%) children were 12 years old. There were 29 (48.33%) boys and 31 (51.67%) girls in the control group. Out of 60 children in control group 26 (43.33%) children were studying in 5th standard, 18 (30%) children were studying in 6th standard, and 16 (26.67%) children were studying in 7th standard whereas out of 60 children in experimental group, 5 (8.33%) children were 10 years old, 24 (40%) children were 11 years old and 31 (51.67%) children were 12 years old. There were 25 (41.67%) boys and 35 (58.33%) girls in the control group. Out of 60 children in experimental group, 22 (36.67%) children were studying in 5th standard, 17 (28.33%) children were studying in 6th standard, and 21 (35%) children were studying in 7th standard.

Table No.2 Comparison between pre-test & post-test knowledge score in control group and experimental group. n = 60+60

	Test	Mean	S.D.	t- value	p- value	Significance
Control group	Pre- test	8.1833	3.0224	0.645	0.5214	Insignificant
	Post- test	8.35	2.6859			
Experimental group	Pre- test	7.7	2.5063	11.6067	0.00001	significant
	Post- test	11.833	2.8828			

The findings show that in control group, pre-test mean knowledge score of children was 8.1833 with S.D of 3.0224 and post-test mean knowledge score of children was 8.35 with S.D. of 2.6859. t- value was 0.645 and p- value was 0.5214 which is greater than 0.05 at 5% level of significance. Hence, we reject alternative hypothesis. There is no difference in knowledge scores regarding oral hygiene among children in control group.

The findings show that in experimental group, pre intervention mean knowledge score of children was 7.7 with S.D of 2.5063 and post intervention mean knowledge score of children was 11.833 with S.D. of 2.8828. t- value was 11.6067 and p- value was 0.00001 which is less than 0.05 at 5% level of significance. Hence, we accept alternative hypothesis. There is difference in knowledge scores regarding oral hygiene among children in experimental group after giving game-based education.

Table No.3 Comparison between pretest & posttest practices in control group and experimental group. n = 60+60

	Test	Mean	S.D.	t- value	p- value	Significance
Control group	Pre- test	9.1666	2.1005	1.3014	0.1981	Insignificant
	Post- test	9.3666	1.5066			
Experimental group	Pre- test	9.2833	1.6579	11.2099	0.00001	Significant
	Post- test	12.25	1.9539			

The findings show that in control group, pre-test mean practices score of children was 9.1666 with S.D of 2.1005 and post-test mean knowledge score of children was 9.3666 with S.D. of 1.5066. t- value was 1.3014 and p- value was 0.1981 which is greater than 0.05 at 5% level of significance. Hence, we reject alternative hypothesis. There is no

difference in practice scores regarding oral hygiene among children in control group. The findings show that in experimental group, pre-test, mean practices score of children was 9.2833 with S.D. of 1.6579 and post- intervention mean practices score of children was 12.25 with S.D. of 1.9539 the t- value was 11.2099 and p- value was 0.00001 which is less than 0.05 at 5% level of significance. Hence, we accept the alternative hypothesis. There is difference in practices scores regarding oral hygiene among children in experimental group after giving game- based education.

Table No.4 Comparison between knowledge score after intervention in control and experimental group. n=60+60

Post- test	Mean	S.D.	t- value	p- value	Significance
Experimental group	11.833	2.8828	- 6.8478	0.00001	Significant
Control group	8.35	2.6859			

Comparison between knowledge score after intervention in control and experimental group was done by using unpaired t test. The findings show that in experimental group, post -test, mean knowledge score of children was 11.833 with S.D. of 2.8828 and in control group, post- test, mean knowledge score of children was 8.35 with S.D. of 2.685, t- value was P– 6.8478 and-value was 0.00001 which is less than 0.05 at 5% level of significance. Hence we accept alternate hypothesis There is difference in knowledge scores regarding oral hygiene among children in experimental group after giving game- based education.

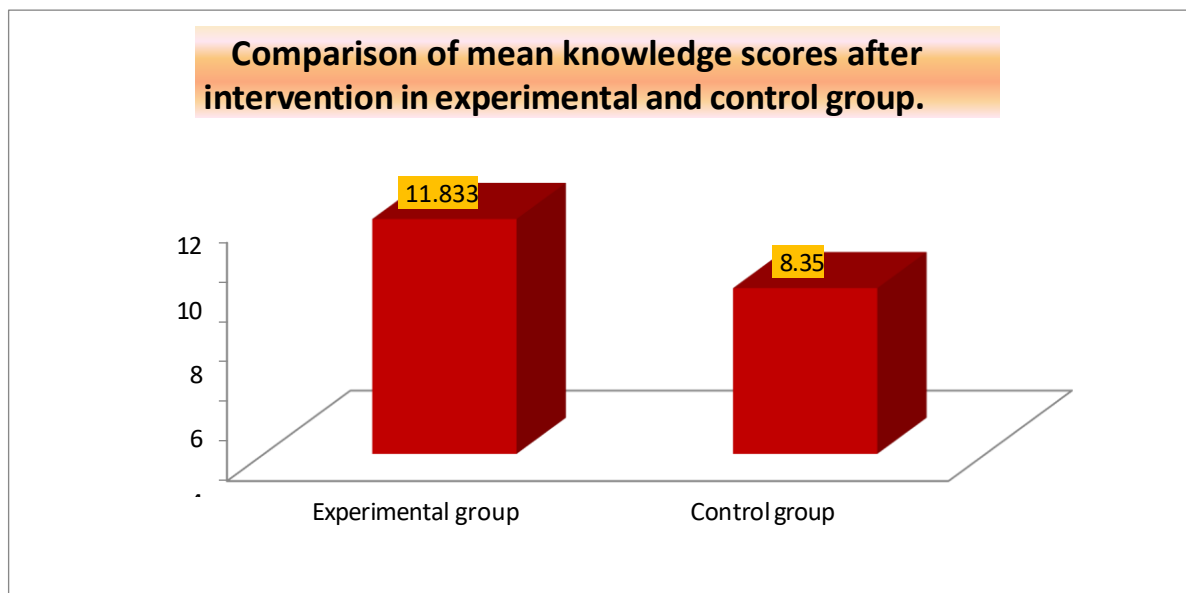
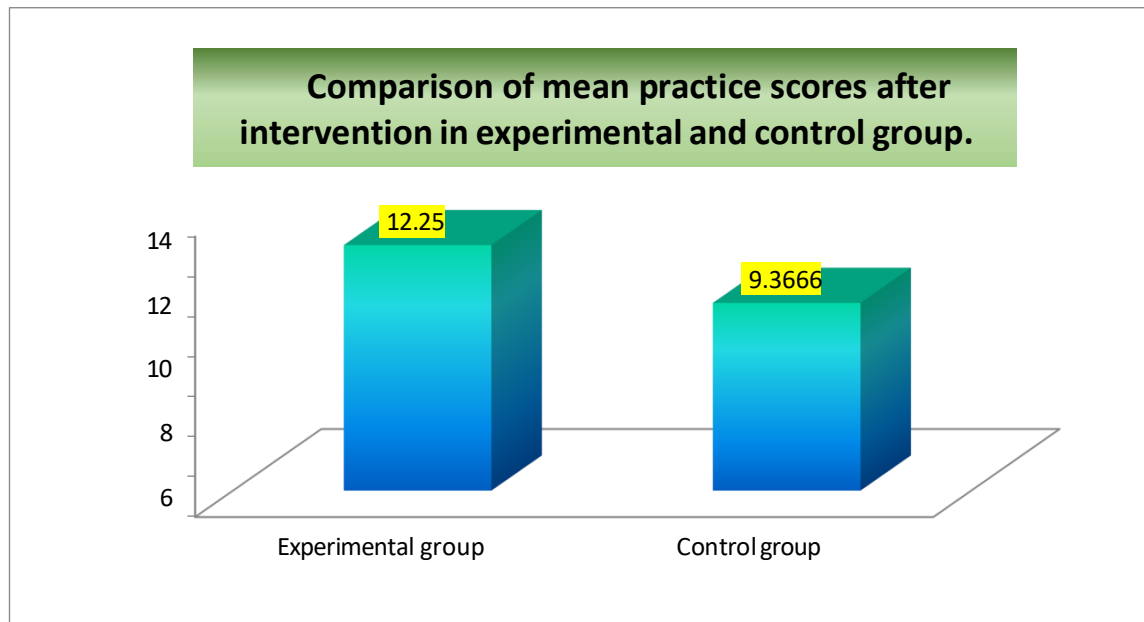


Table No. 5 Comparison between practice score after intervention in control and experimental group. n=60+60

Post- test	Mean	S.D.	t- value	p- value	Significance
Experimental group	12.25	1.9539	- 9.0518	0.00001	Significant
Control group	9.3666	1.5066			

Comparison between practices after intervention in control and experimental group was done by using unpaired t test. The findings show that in experimental group, post-test, mean practice score of children was 12.25 with S.D. of 1.9539 and in control group, post -test, mean practice score of children was 9.3666 with S.D. of 1.5066, t- value was – 9.0518 and p- value was 0.00001 which is less than 0.05 at 5% level of significance. Hence we accept alternative hypothesis. There is difference in practice scores regarding oral hygiene among children in experimental group after giving game- based education.



DISCUSSION

The findings of the study are discussed in reference to the hypothesis and objectives. It was found in control group 11.67 % children were of 10 years old, 56.67 % children were of 11 years old and 31.66 % children were of 12 years old whereas in experimental group 8.33 % children were of 10 years old, 40 % children were of 11 years old and 51.67 % children were of 12 years old. In control group 48.33 % were boys and 51.67 % were girls in the group whereas in experimental group 41.67 % were boys and 58.33 % were girls in the group. In control group 43.33% children were studying in 5th standard, 30% children were studying in 6th standard and 26.67 % children were studying in 7th standard whereas in experimental group 36.67% children were studying in 5th standard, 28.33% children were studying in 6th standard and 35 % children were studying in 7th standard. A similar study was conducted by Zulfan MU, Heriyanto Y, Ningrum N, Nurnaningsih H. The Effect of Educational Games on Tooth Brushing Skills in Preschool Children. In present study age distribution in the control group showed 11.67% of children were 10 years old, 56.67% were 11 years old, and 31.66% were 12 years old, while in the experimental group, 8.33% were 10 years old, 40% were 11 years old, and 51.67% were 12 years old. In comparison, the reference study by Zulfan et al. (2024) reported 7.69% of children were 9 years old, 51.92% were 10 years old, 36.54% were 11 years old, and 3.85% were 12 years old. This indicates that the present study included a higher proportion of older children, whereas the reference study had a younger age distribution with most respondents being 10 years old. Gender distribution in present study was balanced, with 48.33% boys and 51.67% girls in the control group and 41.67% boys and 58.33% girls in the experimental group, while Zulfan et al. (2024) reported more females (57.69%) than males (42.31%). Despite these demographic variations, both studies suggest that game-

based education is effective across diverse age groups and genders.[11]

In the present study, pre-test findings in the control group showed that 81.6% used a soft brush with a tongue cleaner, 80% washed the brush before use, and 58.33% used fluoride toothpaste. Only 38.33% held the brush at a 45-degree angle and 33.33% followed the modified Bass technique. While 90% brushed daily, 70% brushed before breakfast and after dinner, 66.67% cleaned their tongue daily, and just 20% flossed. Proper rinsing after meals was done by 86.6%, and 60% brushed within two minutes. Regarding diet, 71.6% consumed healthy foods, 46.6% limited junk food, and 45% avoided sugary drinks. Regular dental visits were reported by 70%. These findings reflect good daily habits but poor techniques, flossing, and dietary practices that needed improvement through intervention.

In the experimental group, pre-test findings showed that 73.3% used a soft brush with a tongue cleaner, 83.3% washed the brush before use, and 53.3% used fluoride toothpaste. Only 35% held the brush at a 45-degree angle and 15% followed the modified Bass technique. Most children (98.3%) brushed daily, 88.3% brushed before breakfast and after dinner, 70% cleaned their tongue daily, but only 13.3% flossed. Proper rinsing after meals was reported by 88.3%, and 61.6% brushed within two minutes. Regarding diet, 85% consumed healthy foods, 53.3% limited junk food, and 46.6% avoided sugary drinks. Regular dental visits were reported by 63.3%. These findings indicate good daily oral hygiene and dietary practices, but poor brushing techniques, flossing, and sugar control required improvement.

In the post-test control group, 85% used a soft brush with a tongue cleaner, 88.3% washed the brush before use, and 58.33% used fluoride toothpaste. About 50% held the brush at a 45- degree angle and 35% followed the modified Bass technique. Daily

brushing remained at 90%, with 71.6% brushing before breakfast and after dinner. Tongue cleaning increased to 70% and flossing to 36.67%. Proper rinsing declined to 80%, while 63.33% brushed within two minutes. For diet, 65% consumed healthy foods, 38.33% limited junk food, and 41.67% avoided sugary drinks. Regular dental visits decreased to 58.33%. These findings show improvements in brushing techniques, tongue cleaning, and flossing but a decline in rinsing, diet, and dental visits, highlighting the need for reinforced oral health education. In the post-test experimental group, 95% used a soft brush with a tongue cleaner, 93.3% washed the brush before use, and fluoride toothpaste use increased to 88.3%. Proper brushing improved markedly, with 91.6% holding the brush at a 45-degree angle and 61.6% following the modified Bass technique. Daily brushing remained high at 98.3%, with 85% brushing before breakfast and after dinner. Tongue cleaning rose to 78.3%, and flossing showed a major improvement to 71.6%. Proper rinsing increased slightly to 90%, while 83.3% brushed within two minutes. Regarding diet, 90% consumed healthy foods, 60% limited junk food, and 60% avoided sugary drinks. Regular dental visits also improved to 78.3%. These findings demonstrate significant gains in brushing techniques, flossing, tongue cleaning, and dietary practices, highlighting the effectiveness of the intervention.

At the time of pre-test in control group 33.33% children had poor knowledge score, 56.67 % children had average knowledge score and 10 % children had good knowledge score. In experimental group 33.33% children had poor knowledge score, 65 % children had average knowledge score and 1.67 % children had good knowledge score. At the time of post-test in control group 28.33% children had poor knowledge score, 58.33 % children had average knowledge score and 13.33 % children had good knowledge score. In experimental group 5% children had poor knowledge score, 46.67 % children had average knowledge score and 48.33% children had good knowledge score.

The comparison between pre-test and post-test knowledge score in control group was done using paired t test the findings show, pre-test mean knowledge score of children was 8.1833 with S.D of 3.0224 and post-test mean knowledge score of children was 8.35 with S.D. of 2.6859. t- value was 0.645 and p- value was 0.5214 which is greater than 0.05 at 5% level of significance. Hence there was no significant difference in knowledge score. The comparison between pre-test and post-test knowledge score in experimental group was done using paired t test. The findings show, pre intervention mean knowledge score of children was 7.7 with S.D of 2.5063 and post intervention mean knowledge score of children was 11.833 with S.D. of 2.8828. t- value was 11.6067 and p- value was

0.00001 which is less than 0.05. Hence there was significant difference in knowledge score.

The comparison between pre-test and post-test practice score in control group was done using paired t test. The findings show that, pre-test mean practices score of children was 9.1666 with S.D of 2.1005 and post-test mean knowledge score of children was 9.3666 with S.D. of 1.5066. t- value was 1.3014 and p- value was 0.1981 which is greater than 0.05 at 5% level of significance. Hence, there was no difference in practice scores. The comparison between pre- test and post-test practice score in experimental group was done using paired t test. The findings show that, pre-test, mean practices score of children was 9.2833 with S.D. of 1.6579 and post-intervention mean practices score of children was 12.25 with S.D. of 1.9539 the t- value was 11.2099 and p- value was 0.00001 which is less than 0.05 at 5% level of significance. There was difference in practices scores.

In present study comparison between knowledge score after intervention in control and experimental group was done by using unpaired t test. The findings showed that in experimental group, post -test, mean knowledge score of children was 11.833 with S.D. of 2.8828 and in control group, post-test, mean knowledge score of children was 8.35 with S.D. of 2.685, t- value was - 6.8478 and p- value was 0.00001 which is less than 0.05 at 5% level of significance. There was difference in knowledge scores regarding oral hygiene among children. Comparison between practices after intervention in control and experimental group was done by using unpaired t test. The findings showed that in experimental group, post -test, mean practice score of children was 12.25 with S.D. of 1.9539 and in control group, post-test, mean practice score of children was 9.3666 with S.D. of 1.5066, t- value was - 9.0518 and p- value was 0.00001 which is less than 0.05 at 5% level of significance. There was difference in practice scores.

CONCLUSION

It was observed that game-based health education produced a significant difference in knowledge scores regarding oral hygiene ($t = - 6.8478$, $p = 0.00001 < 0.05$) and in practice scores ($t = - 9.0518$, $p = 0.00001 < 0.05$) among children in selected schools of the Sangli- Miraj- Kupwad Corporation area. Hence it proved Game-based health education is an effective strategy to enhance knowledge and improve practices regarding oral hygiene among children in selected schools of Sangli- Miraj- Kupwad corporation area.

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