**Implicit Preferences of Healthy Food Choice in Adolescents with Different Time Perspective Traits**

**Abstract**

To explore the implicit preference of healthy food choice in adolescents with different time perspective (present-hedonistic, present-fatalistic and future) traits, we performed the classic IAT task on 91 middle school students (*M*age=15.43±1.78 years)**.** The results showed that: the implicit preference of adolescents with the trait of future time perspective was higher than the present-hedonistic and present-fatalistic time perspective; furthermore, the implicit preference of adolescents with trait of present-hedonistic was higher than the present-fatalistic time perspective. These results indicated that the trait of future time perspective of adolescents is beneficial to healthy food choices, while present-fatalistic trait is least helpful.

*Keywords:* time perspective traits, adolescents, food choice, implicit preference

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Time perspective (TP) refers to the unconscious cognitive representation of time that humans perceive life experiences according to their time orientation which focuses on the past, present or future (Holman & Zimbardo, 2009). According to the time perspective theory (Zimbardo & Boyd, 1999), TP contains five dimensions reflecting an individual’s attitudes toward three timeframes: Past-Positive (PP), Past-Negative (PN), Present-Hedonistic (PH), Present-Fatalistic (PF) and Future (FTP). PP and PN fall under the past TP, which means that individuals have a positive or negative emotional experience toward past events. PH and PF fall under the present TP, which focuses on the present and means that people in this category tend to pursue immediate satisfaction when developing a goal or taking actions. PH trait people enjoy things that bring them immediate pleasure and happiness, while PF trait people tend to be pessimistic and carry out self-destructive behaviors. FTP trait people are willing to accept delays of immediate gratification for long-term benefits. Different people may have different TP trait in the three frameworks related to the past, present, and the future. These TPs can psychologically inspire and influence individuals’ behaviors and goals (Huang, 2004; Zimbardo, 1999) and lay the psychological basis for them to choose and purse short-term or long-term goals (Carstensen et al., 1999).

Previous studies have found that present and future TP are closely associated with individual preferences (Lv & Huang, 2004, 2005), for example, PH and PF trait people prefer things that may cause addictions (Keough et al., 1999; Mckay et al., 2013); PH trait college students significantly higher proportion to choose unhealthy food than FTP trait (Wang, 2016); Researchers found that compared with FTP trait adolescents, PH trait adolescents are more likely to choose and have implicit preferences to junk food (Zhong et al., 2017). In contrast, the FTP trait adolescents are more likely to choose organic food (Bénard, et al, 2018) and care more about the nutrition elements of food (Tortora & Ares, 2018). These may be because PH trait adolescents prefer immediate gratification and tend to choose things that can bring them immediate satisfaction without considering the negative impact (Hall et al., 2015; Stahl et al., 2014). However, FTP trait adolescents who tend to be more rational choose based on the long-term benefits and thus have healthier behaviors (Frederick et al., 2002).

Implicit preference for healthy food is an individual’s tendency to unconsciously choosing them based on their past experiences and existing attitudes towards the foods. As a relatively stable psychological attitude, it reflects an individual’s tendency to approach certain health behaviors and can be used as an accurate indicator to predict individual dietary behaviors. Implicit attitudes can better reflect individuals’ “real attitudes” than explicit attitudes (Houwer et al., 2002). Most researches focus on the impact of explicit attitudes on healthy food choices and have few discussions on implicit attitudes. Also, they focus more on the relationship between health behaviors and the PH trait instead of between health behaviors and the PF trait. PH and PF traits pursue different types of immediate satisfaction. The former goes after immediate happiness while the latter after self-destruction. Therefore, it is likely that individuals with PH and PF have varying degrees of healthy foods. As of now, no research has studied the relationship between implicit preferences to food choice and PH, PF, and FTP.

Diet is a decisive factor that can decide whether adolescents have obesity and chronic diseases or not. The dietary habits developed during adolescence have lasting effects until adulthood and even late adulthood (Rakowski, 1986). Studies also found that adolescents who have poor diet self-control tend to be less FTP (Piko & Brassai, 2009). Adolescents extend their attention from being focused on present immediacy to the long-term outcomes of the future (Bortner et al., 1972). To being higher FTP can help them make choices beneficial to their health and then develop healthy behavior models.

**Present study**

In this study, with middle school students as the research subjects used the implicit association test (IAT) to explore the implicit preferences with different TP traits (PH, PF and FTP) to healthy food choice. We hypothesized that FTP trait adolescents have more positive implicit preferences to healthy food choice than PH and PF traits adolescents, PH trait adolescents have more positive implicit preferences to healthy food than PF trait adolescents.

**Methods**

**Measures**

**The Zimbardo Time Perspective Inventory (Chinese version)**. Based on the PH, PF, and FTP in the Zimbardo Time Perspective Inventory **(**Zimbardo & Boyd, 1999; Tao et al., 2015), 37 questions were presented to the students. The retest reliability index of each factor of this inventory was between 0.70-0.80 for four weeks. In this study, Cronbach's alpha of three subscales were 0.76, 0.71 and 0.72, the overall fit indices of a CFA denoted goodness of fit (*X2*/*df*=2.69，CFI=0.92，TLI=0.91，SRMR=0.04).

**Participants**

Sampled 160 middle school students (80 boys, 80 girls; mean age: 15.18±1.59 years) from a middle school in Urumqi, Xinjiang, China and gave them the Zimbardo Time Perspective Inventory. The k-means clustering algorithm was used to classify the 160 students into PH, PF, and FTP trait groups. After the screening of the clustering results and the average score of the three types of adolescents are shown in the Table1. All participants are right-handed. The present study was approved by the Research Ethics Committee at XX University. After the experiment, every participant was compensated for 20 RMB (approximately $3) for their participation.

Table1 Cluster analysis results of the subjects

|  |  |  |  |
| --- | --- | --- | --- |
|  | PH group  （*n* =32, boys=15） | PF group  （*n* =30, boys=17） | FTP group  （*n* =31,boys=15） |
| PH | 4.32 | 3.23 | 3.41 |
| PF | 2.96 | 4.45 | 2.89 |
| FTP | 3.07 | 2.39 | 4.26 |

**Materials**

The acquisition process of IAT test materials are: (1) 24 pairs of pictures of common healthy and unhealthy foods were collected (these pictures all went through standardized processing); (2) 40 students were asked to score these pictures based on their health degree(1= very unhealthy, 7= very healthy) and select 12 pairs of healthier and unhealthier food pictures; (3) another 40 students were asked to score these 12 pairs food pictures based on their familiarity (1= very unfamiliar, 7= very familiar) and its deliciousness degree(1= very unpalatable, 7= very delicious). (4) according to the scoring results, five pairs of healthy and unhealthy food pictures were finalized (milk, eggs, walnut, sweet potato, fruit salad, coke, potato chips, Spicy dry tofu, Fried chicken leg, The instant noodles) (Paired sample t-test results showed that the familiarity and deliciousness indicators showed no significant differences between the healthy and unhealthy food pairs *t*familiarity=0.87, *t*deliciousness=1.45, *pall* >0.05), they were used as the formal concept stimuli. The attributive stimuli (positive and negative emotion) were selected from the *Chinese Affective Picture System (CAPS*).

**Experimental design**

This study adopted the single-factor between-subjects design, where the independent variables are the types of TP (PH vs. PF vs FTP), and the dependent variable is the implicit preference to pictures of healthy and unhealthy food, with the D-score in IATs used as an indicator (Karpinski & Steinman, 2006).

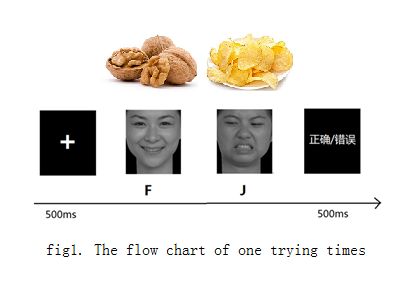
**Procedures**

Before the experiment, all subjects were asked to use the 7-point scale to evaluate their hunger level and mood state (1=very hungry/unpleasant, 7=very full/pleasant) for the exclusion of the impact of subjective psychological states. Then the three groups of subjects were asked to take an IAT individually. The test program was shown in table 2.

Procedures of the IAT: (1) Subjects were first asked to take 20 button-pressing exercises on target concept pictures (healthy/unhealthy food). If an error occurred during an exercise, the “error” information would be prompted in the middle of the screen (the same for the following steps except Step 4 and Step 7). (2) Subjects were asked to take 20 button-pressing exercises on target attributive pictures (positive/negative emotion). (3) Subjects were asked to take 20 button-pressing exercises on compatible tasks (health food – positive emotion/unhealthy food – negative emotion). (4) Subjects were asked to take a formal experiment of 20 button-pressing exercises on compatible tasks, the same as those in Step 3, and the button-pressing reaction time (RT) of subjects was recorded. (5) The left and right buttons were reversed, and subjects were asked to respond inversely on target concept words. (6) Subjects were asked to take 20 button-pressing exercises on incompatible tasks (unhealthy food-positive mood/healthy food-negative mood); (7)Subjects were asked to take a formal experiment on incompatible tasks, the same as those in Step 6, and the button-pressing reaction time (RT) of subjects was recorded. An example of a test procedure is shown in fig 1.

Table2 IAT Test Program

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Step | Role | Times | Reaction Key | | | | |
| F Key |  | | | J Key |
| 1 | exercise | 20 | healthy food | |  | unhealthy food | |
| 2 | exercise | 20 | positive emotion | |  | negative emotion | |
| 3 | exercise | 20 | Healthy food + positive emotion | |  | Unhealthy food + negative emotion | |
| 4 | test | 40 | Healthy food + positive emotion | |  | unhealthy food + negative emotion | |
| 5 | exercise | 20 | unhealthy food | |  | healthy food | |
| 6 | exercise | 20 | unhealthy food + positive emotion | |  | unhealthy food + negative emotion | |
| 7 | test | 40 | unhealthy food + positive emotion | |  | unhealthy food + negative emotion | |



**Data Analyses**

Descriptive statistics and One-way ANOVA was conducting on IAT data using SPSS23.0 and CFA was performed on the scale data with Mplus7.0 (Muthén & Muthén, 1998-2015).

We analyzed the scoring results of the hunger level and mood state of the subjects, the scores of the two indicators show no significant difference among the three groups of subjects(*F*mood state= 1.62, *H*unger level= 2.17, *P* >0.05). Therefore, the effects of subjective psychological state on the reaction time of subjects were excluded when the subjects were classified based on their TP traits.

Based on Greenwald’s (1998) method of data processing for IAT results, we adopted Microsoft Excel pre-processing for the IAT results of all subjects: (1) RT records that higher than 3,000 milliseconds were treated as 3,000 milliseconds and RT records that lower than 300 milliseconds were treated as 300 milliseconds. (2) The data of the first two formal experiments in Step 4 and Step 7 were removed. (3) The data with an error rate of 20% were excluded to avoid the effects of arbitrary responses. (4) The average reaction time and accuracy rate of subjects in the compatibility task and incompatibility task of every trail were calculated. Based on this processing method, the valid subjects of 91 students (*M*age=15.43±1.78 years) were obtained, including 30 in the PH group (16 boys), 30 in the PF group (17 boys) and 31 in the FTP group (15 boys).

Table 3 shows the average reaction time of every group of subjects in the compatibility and incompatibility tasks, total standard deviation and their D-scores of each group.

Table3 IAT effect of healthy/unhealthy food-positive/negative emotion

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | TP | Compatible task  *M*±*SD* | incompatible task  *M*±*SD* | total standard deviation | *D* |
|  | PH | 867.84±296.76 | 1482.03±447.92 | 767.19±358.48 | 0.82±0.33 |
|  | PF | 990.84±402.92 | 1491.46±671.89 | 893.76±505.35 | 0.55±0.43 |
|  | F | 823.77±229.08 | 1775.56±720.93 | 941.64±559.43 | 1.01±0.21 |

We first performed a paired sample t-test for the average reaction time of the compatibility and incompatibility tasks of each group, the results showed a significant IAT effect in all three groups of subjects, namely the reaction time of all three groups being significantly faster for the compatibility task than the incompatibility task (*t*PH=-8.42, *t*PF=-3.96, *t*F=-9.72, *p*ALL=0.000). These indicate that on the whole, subjects have implicit preferences. Specifically, in the concept network of the subjects, healthy food was associated with positive emotions, and unhealthy food was associated with negative emotions.

To analyze the implicit preferences of adolescents with different TP traits to healthy food, One-way ANOVA was performed to the implicit preferences of healthy food choice in three groups of subjects, with the main effect of TP traits group being significant *F*=13.98, *p*=0.0001. Post-hoc analysis showed that the D-score of the FTP group was significantly higher than the PH (*MD*=0.19, *p*=0.033) and PF groups (*MD*=0.46, *p*=0.000); the D-score of the PH group was significantly higher than the PF group (*MD*=0.27, *p*=0.003). These indicated that compared with the PH and PF traits adolescents, FTP trait adolescents have more positive implicit attitudes toward healthy food and more negative implicit attitudes toward unhealthy food; compared with the PF trait adolescents, PH trait adolescents have more positive implicit attitudes toward healthy food and more negative implicit attitudes toward unhealthy food.

**Discussion**

This study has explored the implicit preferences of the traits of PH, PF and FTP adolescents to healthy food choice. The results showed that compared with the traits of PH and PF adolescents, the trait of FTP adolescents have stronger implicit preferences to healthy food choice, while PH trait adolescents have more positive implicit preferences to healthy food choice than PF trait adolescents. These results consistent with previous studies that future-oriented individuals can make rational decisions for long-term benefits and thus are more likely to choose positive health behaviors(Hall & Fong, 2003; Henson et al., 2006; Mahon et al., 1997), while present TP traits are associated with immediate satisfaction and negative health behaviours (Guthrie et al., 2014). This difference may because FTP trait individuals make plans and take actions based on their long-term goals, while PH and PF traits individuals make objectives based on the present time, and go after immediate gratification and negatively accept what will happen to them in the future. Therefore, PH trait and PF trait adolescents take a relatively negative attitude when deciding whether to perform health behaviors that bring them benefits in the long run. It was also found that PH trait adolescents have stronger implicit preferences to healthy food than PF trait, which may have something to do with PF trait adolescents taking more negative attitudes towards the future, as they think that current behavior cannot change the future and care less about the implications of their current behavior as a result.

In conclusion, TP is an important factor that affects people’s health behaviors. Understanding the differences between individuals with different TP traits in choosing healthy food can help us explore the potential reasons behind an unsuccessful choice of unhealthy food and prevent various diseases and harm. Previous studies have shown that compared with adults, adolescents think less about the future and are less likely to have actions that help achieve health goals (Hoppmann & Fields, 2010). Thus, it is suggested that we should help individuals develop FTP traits in their early life stage, which can help them develop healthy behaviors that can last until their adulthood and even late adulthood once developed (Rakowski, 1986).

**Conclusion**

The results of this study indicate that adolescents with FTP traits are more likely to promote healthy food choices compare with PH and PF traits, adolescents with PF traits are more likely to detrimental to healthy food choices compare with FTP and PH.

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