

A Study of Weight Management Based on Intrinsic Incentives

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Abstract: This paper plans to design a behavioral economics experiment to study the influence of incentive mechanisms including intrinsic and extrinsic incentives on weight control. The experiment adopts ways such as increasing the sense of honor as internal incentive measures. Compared with external incentives such as bonuses, the long-term effect of internal incentives on weight management is unclear and deserves further study.

Keywords: external incentives, internal incentives, the hierarchy of model of motivation, exploratory study.

1. Introduction

The direction of this research is the use of incentive mechanisms in weight management. First, there is a lot of evidence and data that obesity is going to be a major health challenge in modern society [1]. Obesity not only affects one's own health, but also a series of chronic diseases caused by obesity will consume a lot of medical resources and funds every year [2]. At the same time, obesity is not a special problem in developed countries. Some studies show that even in developing countries, the obesity rate is increasing year by year [3]. There are many measures to reduce obesity rates. In the field of behavioral economics, this article wants to use incentives to increase people's willingness to control their weight and form long-term exercise habits. There are a lot of literature studying at the impact of motivational mechanisms on weight management. Research has found that in the short term, incentives can increase people's exercise time and engagement, but this treatment effects decay over time [4]. In order to find a more effective incentive mechanism, this article focuses on the direction of intrinsic motivation. In the field of education, giving students a sense of honor will also have positive effects. Students even perform better after the experiment [5]. Therefore, our project

wants to compare the long-term effects of monetary incentives and honor incentives in order to find a more effective incentive mechanism.

An innovation of this paper is the establishment of two types of incentives, including external incentives, namely bonuses and lotteries, and internal incentives, namely honors. After the end of the experiment, the project will also conduct return visits and surveys to the experimental participants in some future periods. The long-term effects of different incentives can be found through post-experimental investigations. This is also one of the purposes of our experiment. The experiment attempted to help participants form some long-term healthy habits and predicted improvements in other areas such as sleep quality and income. Incentives for weight management may have a range of potential effects that are worth investigating.

2. Literature Review

2.1. Extrinsic Incentive

There is a lot of research on the interaction between weight management and various forms of incentives, and this section will help you sort through and evaluate external and internal incentives and motivation models in preparation for the next experimental design. Financial incentives are rewards intended to offset the physical or physiological costs of shifting one's behavior to achieve weight control goals [6]. Literatures show that the association of financial incentives with behavioral economics is effective: on the one hand, failure in weight management implies an overemphasis on immediate enjoyment and weakens the impact of delayed gratification; on the other hand, behavioral economics can be utilized to gain insight into people's irrational tendencies to adjust external financial interventions to achieve more desirable outcomes [6]. Rather than restricting incentives to magnitude, the experimental incentives in this study are based on behavioral economics and research on two common external incentives: savings contracts and lotteries-based experiments. However, research has shown that both types of external motivation can assist obese persons in losing weight, but only in the short term.

2.2. Intrinsic Incentive

In addition to physical exercise to raise basal metabolism, intrinsic motivation can aid with weight control by influencing appetite and psychological characteristics such as self-efficacy, self-confidence, and mood [7]. The strength of the causal link between internal motivation determines the quality of the spillover effect of motivation; it is not a result of external continuous control or pleasing others [7]. In the future, more emphasis might be focused on weight management's multifactorial synergy [8]. Overall, constant external control or constraints has a shorter and less enduring effect than more autonomous drive and internal motivation.

2.3. The Hierarchy Model of Motivation

The hierarchical model of incentives suggests that incentive transferability is achievable, and there are dynamic interactions between different levels of incentives [9]. An example of the synergistic effects of eating habits and exercise behaviors may influence weight management outcomes.

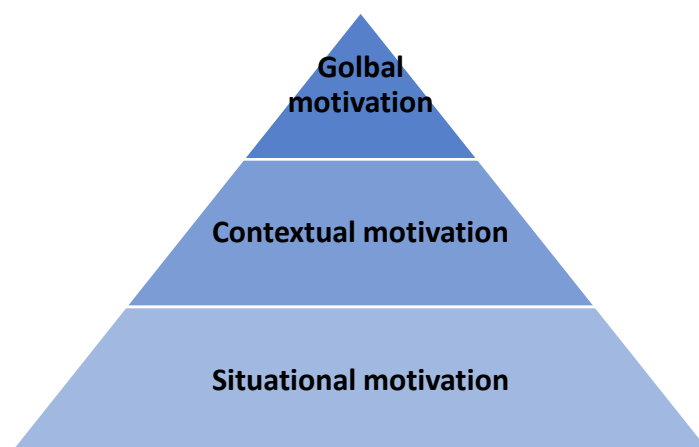


Figure 1: The hierarchical model of incentives.

Based on research of Mata et al. in 2009, the situational motivation here relates to a concrete scene, such as “I am going to prepare a smoothie for dinner”; they suggested that the contextual motivation relates to a living context, such as the exercise activity itself; as for the global motivation, it is a more generic construct, which refers to whether one's motivation is more internal or external [7].

2.4. Using Extrinsic and Intrinsic Incentives

Self-determination theory states that the same behavioural goal (e.g., self-monitoring one's diet or exercise routine) can be done with different regulatory/motivational features, from externally driven (e.g., to avoid criticism from a health professional) to partially internalized regulation (e.g., “the people in my weight loss group all keep exercise diaries; I really feel like I should do it too”), all the way to autonomous regulation.

However, extrinsic incentives seem to work more effectively in the short term while intrinsic incentives are more important in the long term. Motivation may decrease as time passes by. For instance, though financial incentives may let the weight fall in the short run, it appears to be ineffective in the long run. According to self-determination theory, if you want to change a behaviour, it is independent of obeying external demands for change. Instead, the proportion of adjusting behaviour as your own according to the rule is the determinant. Therefore, one method to deter the decrease in motivation, in the long run, is to internalize the regulation of relevant behaviours, for example, relating the regulation with their objectives and sense of honour [9].

2.5. Conclusion

The experiments engaged topic could tend to be outcome-orientated instead of process-orientated. Therefore, when analysing the experiment, it may overlook the importance of the process. Such neglect may undermine the effect. For instance, though some people may not lose too much weight, their diet and exercise habits may be improved during the experiment. Though their outcome is not obvious during the test, the improved habits may help them to lose weight more easily after the test [10]. Apart from that, though doing sports is exhausting, many sports tend to provide great pleasure and a source of optimal challenge, to the point of being regulated primarily by intrinsic motivation [11]. Therefore, though the outcome is important, we should put some attention to the process.

Once goals are achieved, people may find no reasons to continue keeping good exercise and diet habits, so there is a possible risk that their weight may gradually increase after achieving goals. This may be because the time of the experiment is too short. If the study could be longer, it could be designed with a mechanism to form a good habit. Another possible solution could be to internalize the goals. It may be necessary to put some mechanism for raising habits in the study.

3. Methodology

3.1. Study Sample

The recruitment of participants is mainly through online channels. Specifically, the main pathway to recruit participants for this hypothetical experiment is through publication of a questionnaire on high-traffic webpages and front pages of popular social media including Twitter, Facebook and TikTok. These paths supply a sufficient sample base to allow a certain level of drop-out in the research period.

The envisioned number of participants is 300 in total at the initial stage (150 males and 150 females). This figure is larger enough to demonstrate differences between groups and can limit the excessive cost during the research to some extent. Several physical and incidental requirements are included in the recruitment information:

(1) Age range: Between 16 and 45(inclusive), this is according to the UNESCO's definition of the age of youth, and which reduces the potential errors caused by metabolic level difference due to a relatively large age gap. (2) Body fat rate: approximate 20% for male/ 25% for female, these levels are medically regarded as mild obesity, which ensure a certain need and capacity for weight management. However, this index is only used as a measure to select proper participants, while percentage change in weight is the primary benchmark in the study process. (3) Career: Except professional athletes, fitness instructors or other sports staff to minimize the interference factors caused by unbalanced experience and skills. (4) Other Possible Limitations: 1) Ability to use smart phones 2) Literate 3) No criminal record 4) No history of severe heart disease or psychosis 5) Possession of an accurate weighing scale.

3.2. Study Methods

A questionnaire about application testing will be pushed on the mentioned websites to seek for willing participants, which is an effective measure to collect information from willing participants. All the willing participants will be able to fill relevant personal information in an online questionnaire. Those meet above requirements will then become formal participants after selection which is followed by a grouping process (as shown in Figure 2).

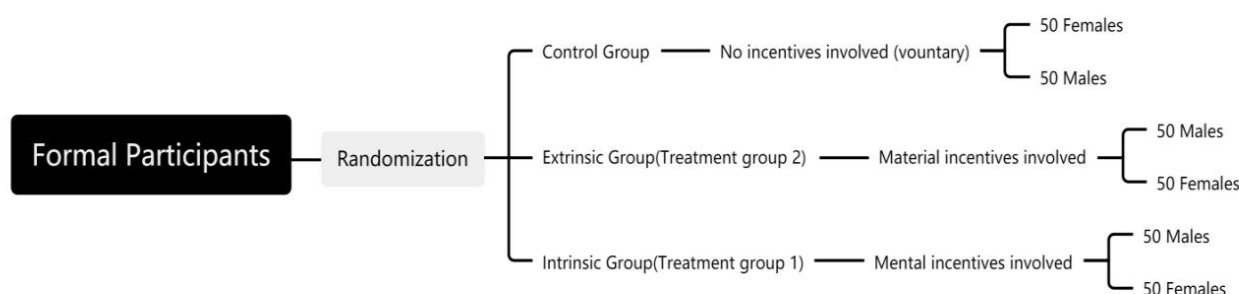


Figure 2: The Grouping Process.

After randomization, the formal participants are streamed into three groups. For the control group, the members are recruited as volunteers, therefore the access to test a new application in advance acts as the motivation. The formal participants of extrinsic group and intrinsic group are respectively informed to take part in a ‘health challenge’ and a ‘health competition’ and are aware of potential material or mental incentives.

The overall research period will be set at 5 weeks (4 formal weeks and 1 final week) to observe the effectiveness of incentives in an approximate one-month period. Members of the groups will be given accounts of a mobile health app where health experts are available for online consultation about weight loss plans and healthy recipes. For accounts of the extrinsic group and the intrinsic group, a ‘milestone’ applet will be opened. The participants from the non-control groups may record their weights every Saturday evening before dinner and upload the data to the online platform. A video also needs to be uploaded to discourage cheating. According to the percentage loss in weight compared to last week, the participants will be able to get a small reward at the end of each week.

At the end of the research period, the ‘milestone’ applet will accumulate the total percentage of weight loss of each participant and determine whether a grand prize is offered. Participants from the two treatment groups will be informed about the exact weekly and final tasks they need to finish to win the prizes. The specific mechanism of each treatment group is introduced below:

Extrinsic Group: \$10 of weekly prize is offered if managed to lose 2% in weight in each of the four formal weeks, \$100 of grand prize is offered if managed to lose 10% in total in weight till the end of the final week. The amount of 100 USD is based on research about incentives on weight management, which demonstrated a positive result when set this amount of money as an incentive in a lottery system.

Intrinsic Group: Based on the ranking (regardless of the gender as the benchmark of percentage change minimizes the interference due to gender difference) of percentage loss in weight, participants in the group will be sorted in three tiers:

- *1st Tier: The top 10 members, each wins 10 marks.
- *2nd Tier: The 11th to 30th place, each wins 5 marks.
- *3rd Tier: The 31st to 60th place, each wins 3 marks.

An online leader board will be published on the front page of the application, where the group members are ranked by highest to lowest percentage reduction in weight. The top 10 male and female members (20 in total) will be elected as ‘Weekly Members of Excellence’ and whose photos will be displayed on the frontpage to get attention. At the end of the final week, the cumulative mark for each participant is tallied and compared. The members with the top five highest cumulative

marks will be elected as the platform's lifetime Health Ambassadors who will be promoted on other platforms to gain visibility.

3.3. Exploratory Study

The participants who win at least one weekly prize will be sent a questionnaire via the app or phone messages one year after, which aims to collect information about the number of prize winners who adhere to the habit of weight management in the relatively long term. Researchers will then analyse these data and compare the two sets of numbers to find out if there is any correlation. The result may be presented in a table as shown in the appendix 1, where \bar{X} is the mean (average number) of weight, which is calculated by total weight in kilograms divided by the number of respondents (the data is only collected from the respondents).

4. Results

When thinking about the losing weight, the effectiveness is significantly important for a person who wants to have perfect body size. The effectiveness in financial motivation in the process of people losing weight is the rate of participation in weight loss exercises by the target population.

When it comes to people's own motivations, like the weight they want to lose or maintain and the body image goals they want to achieve in the beginning. When such formulation people are more clear about their goals, they will have positive feedback on the results, and after receiving positive feedback and reaching their goals, people will receive monetary rewards, and under this condition, the number of participants and the efficiency of the process will be listed subsequently. Under the influence of socioeconomic characteristics, like income, gender and interpersonal competition, people will react differently in different environments. In the first group, among participants of different genders, many experiments have shown that men tend to be more efficient and less lazy in the weight loss process than women because their physical and muscular strengths make the process easier and the rewards they receive stimulate them to work harder to reach their goals. The second group of participants with different incomes, because the difference between high and low income makes people feel different about the importance of rewards. People with high incomes tend to enjoy the relaxation and pleasure of exercise, and are not very interested in monetary rewards, so they are less motivated and less serious about participating, and instead do activities according to their own preferences. But on the contrary, low-income people tend to be more goal-oriented to exercise, which improves their efficiency, but also in the monetary rewards prompted by the exercise gradually formed a good habit for them. So in different social contexts, monetary motivation can have very different effects on specific groups of people.

Two weight loss incentive methods. One is the direct incentive method. As long as the dieter completes the weight loss program, he or she will get a certain amount of bonus each day; the other is the deposit method. Weight-loss people give the designated person 1 cent to 3 dollars a day, if the end of the month cannot reach the predetermined weight loss goal, you cannot collect the money, if you reach the goal, not only can get back their money, but also additional bonuses. Borp said, "They [dieters] have a strong aversion to loss." This just might motivate them to try to lose weight to avoid losses. Researchers then found 57 obese people between the ages of 30 and 70 and asked them to lose 7.26 kg in four months. These people were divided into "incentive group" and "monitoring group" two groups. After 4 months, those in the "incentive group" who took the direct incentive method After 4 months, the average weight loss in the "incentive group" was 5.9 kg per person, the

average weight loss in the "deposit group" was 6.35 kg, and the average weight loss in the "monitoring group" was only 1.81 kg per person. The results showed that 50% of the dieters in the "incentive group" reached their intended weight loss goal, while only one tenth of the dieters in the "monitoring group" reached their weight loss goal. This type of monetary incentive is particularly effective for short-term weight loss. However, he also pointed out that once the bonus incentive was stopped, the dieters began to regain weight again.

So now the problem is how to get people to keep doing exercise without relying on monetary rewards as the ultimate goal. It is true that the monetary motivation will stimulate the participants to a great extent, but the use of self-initiative is also a very important factor. One of the most important factors is to get paid in a timely manner, because most of the participants are in the mindset of merit, and delayed payment will make them less credible about the reward mechanism. Second, different exercises and rewards should be used for different groups of people so that they can better achieve their goals. In the process, it is also important for researchers to promote the importance of weight loss and healthy living, which can largely increase their vigilance and thus be more responsible for their own bodies.

5. Discussion

5.1. Conclusion

Confronting the serious issue of obesity, the study introduced both intrinsic and extrinsic incentives in the field of weight management. In the section of literature review, the concept and functions of extrinsic and intrinsic incentives are given. Some of the former literature states that extrinsic incentives are more effective in the short run, but intrinsic incentives are more likely to take enduring effect in the long term. It also points out that those experiments concentrate more on the outcome rather than process during which the habits can be formed. And in this study, the experiment is designed to compare the effectiveness of extrinsic and intrinsic incentives by presenting two methods towards three groups of participants, including control group, intrinsic group and extrinsic group. \$10 of weekly prize is offered as extrinsic incentives, while the ranking system is applied as intrinsic incentives. Participants are asked to record their weight on the mobile health app, and the experiment lasted for 5 weeks.

The results show that for extrinsic incentives, financial motivation can have different effects on specific groups of people, but overall intrinsic incentives are possibly more effective than extrinsic ones. And the innovation point is that the experiment is held through online observation of data while both small and large incentives are given.

The result of this study can be used to improve weight loss programs. The government can apply the result to encourage residents in weight management through policies, which will be explained in the latter.

5.2. Policy Implications

For policy implications, our findings confirm that larger monetary incentive amounts will lead to higher reach of weight loss programs. But more importantly, we find out that intrinsic incentives are more effective than extrinsic ones in the long run. Therefore, the government can build ranking mechanisms among communities to encourage people to do more exercises. It can be done by offering subsidies to those technical firms like Tencent to develop the ranking system. Related

personnel can make residents realize this weight-loss event by posters or spread the information through online community group. People who want to lose weight can sign up and join in the activity.

Take communities in China as an example, the activity can be based on Wechat, a famous Chinese social app. The function of mini program on Wechat can be an appropriate platform, which can be used more simply and conveniently than apps. In fact, Wechat has already run the similar program which applies ranking system. But it focuses on everyday step number instead of weight. The drawback of it is that only when the phones are brought can data be collected. In our expected mini program of weight management, it only needs participants to upload photos of the scale to record data, and its processing mode is quite similar to that in the experiment, avoiding the necessity of phones compared with the previous one but ensuring the function of ranking system.

5.3. limitation

However, the study also remains limitations which is divided into three points. Firstly, the cost for the experiment may be large. Since the study is based on online platform, professional technicians are needed to design the program, maintain its operation and data processing. Besides, it is possible that the program has sudden technical problem leading to loss of data. This will break off the experiment and make previous data unavailing, which will also arise large opportunity costs. The costs also account in recruitment. It takes much time to gather people with satisfied condition probably due to requirements.

Secondly, the samples in our study may have other influence factors. It is unsure whether for our participants, the distance between home and sports facilities is long or not. For those who live far from gym or other sports facilities, it may reduce the effects of incentives compared with those who can get access to them easily and conveniently. In other words, due to existence of asymmetric information, functions of incentives may be underestimated when there is a long distance, leading to unreliability of data. Besides, metabolic rate is also an inevitable variable. Some people may have low metabolic rate, even though they are being stimulated by incentives and exercise well every day, their outcome is trivial compared with others. Although during recruitment the participants are ensured that they have similar body fat rate, there will still be differences in metabolic rates due to genetic reasons.

Lastly, there may be cheating in collecting data of their weight. Participants may cheat by putting hands on other supporters like chairs or desks so that the weight data shown on the scale will be less. Even though some measures are taken to prevent this situation by asking family members to take photos of them weighing on the scale, some people may not obey the condition. Possible behavior of cheating may affect results of experiment, and the problem is wished to be solved in the future study.

6. Conclusion

In conclusion, the study focuses on the topic of weight management, and reaches the result that both extrinsic and intrinsic incentives contribute to weight-loss program, with intrinsic incentives being more effective in the long run. The experiment is designed to compare both the effects of extrinsic and intrinsic incentives, which highlights in combining extrinsic and intrinsic incentives in the sense of behavioral economics with both small and large extent and looks into it in the relatively long run. The study is aimed to explore better methods for weight management which is becoming a global

issue. Hopefully in the future, the system of competition can be enhanced with more accurate and credible data collection and be promoted more widely.

7. Acknowledgement

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8. Appendix

Table a1: Data of respondents.

Group	Number of Respondents	\bar{x} of Weight at the Final Research Week (kg)	\bar{x} of Weight After one Year (kg)	Difference in The Two Average Number (%)
Extrinsic Group				
Intrinsic Group				
Control Group				

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