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Research report

Increasing fruit and vegetable intake. “Five a day” versus “just one more” ☆



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ABSTRACT

The present randomized controlled intervention study tested the hypothesis that a personally adaptable and realistic “just 1 more” goal would be more effective for increasing fruits and vegetables (FV) intake compared to the common “5 a day” goal. Study participants ($N = 84$ students, 85% female) consumed less than 4 servings of FVs per day at recruitment. During the 1-week intervention, participants randomized to the 5aday-group were asked to eat 5 servings of FVs/day; participants of the just1more-group were asked to eat 1 serving more of FVs than they usually did, and participants of the control group were instructed to eat as usual. Measurements were taken before (T1), directly following (T2), and 1 week after (T3) the intervention. Participants in the 5aday-group increased their average FV intake significantly by about one serving from 2.49 at T1 to 3.45 servings/day at T3. At T3, only the 5aday-group—not the just1more-group—had a significantly higher FV intake than the control group. Contrary to the hypothesis, the “5 a day” goal was more effective than “just 1 more” for increasing FV intake. Results of our study support the rationale of the “5 a day” campaign, at least in the short term.

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Introduction

A diet high in fruit and vegetables (FVs) is recommended for men and women to reduce the risk of many chronic diseases. The World Health Organization recommends that adults consume at least 400 g of FVs a day (World Health Organization, 2003). The “5 a Day for Better Health Program” was initiated in 1991 in the United States (US) to modify dietary behaviors of American adults. Goal of the program is to encourage people to eat at least 5 servings of FVs every day. The “5 a day” campaign was initiated jointly by the National Cancer Institute and the Produce for Better Health Foundation (Heimendinger, 1993). Subsequently, several countries have adapted the recommendations of the program and started similar “5 a day” campaigns (Naska et al., 2000).² The most recent trend in several countries is to further increase the recommended

servings per day. For example, in the US “5 a day” was replaced by the “Fruits and Veggies—More Matters” campaign in 2007, in which a daily consumption of 7–13 servings of FVs is recommended (see Erinosh, Moser, Oh, Nebeling, & Yaroch, 2012).

Despite these exhortations, studies show that most adults still consume far less than 5 servings per day (Blanck, Gillespie, Kimmons, Seymour, & Serdula, 2008; Guenther, Dodd, Reedy, & Krebs-Smith, 2006; Hilbig et al., 2009; Rabenberg & Mensink, 2011). It is suggested that many adults are not aware of the recommendation to consume at least 5 servings of FVs/day (Erinosh et al., 2012). However, the clear increase in awareness that was observed between 2000 and 2005 in the United Kingdom has not been accompanied by behavioral changes. Only a small number of adults claim to have increased their FV intake to 5 or more servings/day (Herbert, Butler, Kennedy, & Lobb, 2010). The main question that inspired our research was: Is the common “5 a day” goal an effective goal for making people increase their FV intake?

Self-Determination Theory by Ryan and Deci (2000) is a theory of motivation that has been applied in many different settings, among others in the field of health behavior (Ryan, Patrick, Deci, & Williams, 2008). It assumes that people have to initialize values and experience self-determination to increase and maintain health behaviors. According to this theory, externally set goals only motivate people when these are translated into personal goals. There is some evidence that “5 a day” is not a personal goal for many people.

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² Some examples of official web pages of the “5 a day” campaigns are: France: <http://www.fraichattitude.com>; UK: <http://www.nhs.uk/Change4Life/Pages/five-a-day.aspx>; New Zealand: <http://www.5aday.co.nz>; Germany: <http://www.5amtag.de/>.

A survey of 282 people in a German supermarket (mean age of 40 years) revealed that 96% of the men and 73% of the women did *not* intend to eat five servings of FVs in the future (Keller, Kreis, & Huck, 2001). Likewise, in a more recent survey 482 German university students were explicitly asked how many servings of FVs they would like to eat per day. Results revealed that female students wanted to eat 3 servings, male students 2 servings of FVs a day (this represented an increase of less than one serving daily compared to their actual intake) (Sieverding & Scheiter, 2012).

Next to personal relevance, realism has been proposed as another main characteristic of a good goal. Realistic goal setting was defined as one of the gold standards for interventions in clinical psychology (King & Ollendick, 2006), and to be realistic is one of the key issues in the popular concept of S.M.A.R.T. goals (Wade, 2009), which stands for Specific, Measurable, Attainable, Relevant, Time-bound goals³. The most recent data from Germany reveals that men and women between 20 and 50 years of age consume on average only 2 (men) and 2.6 (women) servings of FVs daily (Rabenberg & Mensink, 2011). Among younger people and university students, FV intake is even lower. A survey of German students found an average intake of only 1.2 servings of FVs among men and 1.6 among women (Quellenberg & Eissing, 2008). A recently published survey with university students showed a consumption of 1.4 servings by men and 2.2 by women (Sieverding & Scheiter, 2012).

Considering this actual FV intake of most people and their own personal goals, the “5 a day” goal might be too high for many people, especially for young adults. Meta-analyses have shown that the average increase in interventions promoting FV intake is 0.6 (Ammerman, Lindquist, Lohr, & Hersey, 2002), and in another study, 0.1–1.4 servings/day for healthy adults (Pomerleau, Lock, Knai, & McKee, 2005). Thus, one serving more than usual might be a more realistic goal with regard to FV intake.

The current study was designed to investigate the question: Which goal is more effective for increasing a person’s actual FV intake? Two goals were compared and tested against a control group: the “5 a day” goal versus a more realistic “just 1 more” goal, which asks people to eat one serving of FVs more than they usually do. Participants were requested to follow one of these goals strictly during a 1-week intervention period. We hypothesized that the more realistic “just 1 more” goal would be more effective than the very ambitious “5 a day” goal.

Concretely, the current study tested the following two hypotheses: (1) people in the just1more-group will increase their FV intake more than those in the 5aday-group between baseline and follow-up, and (2) people in both intervention groups (just1more and 5aday) will increase their FV intake more than those in the control group between baseline and follow-up.

Method

Design

The randomized controlled intervention study compared two experimental groups (5aday and just1more) to a control group. The study consisted of a 1-week intervention accompanied by a food diary and three measurement points: T1 (pretest, before the intervention), T2 (posttest, directly after the intervention), and T3 (follow-up, 1 week after the intervention).

Procedure

The study took place at the Institute of Psychology of the University of Heidelberg, Germany. Participants were recruited in lec-

tures, and via posters and flyers. The invitation text was as follows (translated from German): “We are looking for participants for a nutrition study that will focus on the intake of FVs. Participants will be asked to document their dietary behavior for 1 week and should be open to eventually increasing their FV intake during this period.” Participants who took part in all parts of the study were offered an incentive of either course credits or a 20 Euro voucher for a grocery store.

Participants who signed up for the study and gave their informed consent filled out a pretest questionnaire (T1), which assessed socio-demographic and health-related variables as well as their current FV intake. After T1 assessment participants were randomized⁴ into either the 5aday, the just1more, or the control group, and they were personally instructed by study personnel on the study proceedings. They (a) were told their FV instructions, (b) were trained to estimate the sizes of FV servings, and (c) were given a FV diary and details regarding how to use the diary. The FV instructions for the respective groups were as follows (translated from German): 5aday-group, “Eat five servings of FVs a day, please—if possible, three servings of vegetables and two servings of fruit”. Just1more-group, “Eat one more serving of FVs a day than you usually do, please”. Control group, “Eat as usual during the next week”.

Participants were told that they had to follow the FV instructions for 1 week and to fill out a food diary during the intervention period. The intervention lasted 7 days and started on the same day for every participant. After the intervention, participants returned the diaries personally and filled out the posttest questionnaire (T2). The follow-up questionnaire (T3) was filled out 1 week afterwards.

Participants

Altogether, $N = 135$ students participated in the study. We only included participants who ate less than four servings of FVs a day at baseline (T1) ($N = 90$ at randomization) in our analyses. The rationale for including only these people was as follows: For participants who already ate four servings of FVs a day, the “5 a day” intervention would be identical to the “just 1 more” intervention. Participants already consuming five or more servings of FVs at T1, already met the recommendation and were not the focus of public-health campaigns like “5 a day.” Additionally, six participants who did not participate in all parts of the study were excluded; thus, data of $N = 84$ participants were included in the following analyses (5aday-group = 28; just1more-group = 27; control group = 29). Randomization checks, consisting of analyses of variance (ANOVAs) for continuous and X^2 -tests for categorical measures, showed no a priori differences regarding sex, age, or FV intake before intervention. Most participants were female (85%) psychology students with a mean age of 23.43 ($SD = 4.73$) years.

Measures

Questionnaires at T1, T2, and T3 assessed FV intake. First, an introductory text explained how a serving of FVs is defined according to the recommendations of the German “5 a day” society (<http://www.5amtag.org/>) and examples were provided (a medium sized apple, a small cup of salad, a cup of vegetables as side dish (100–125 g), a glass of orange juice (0.2 l)).⁵ The participants were asked

³ There are also other words associated with each letter of this acronym (Wade, 2009).

⁴ We used a simple random allocation: Participants were assigned to the groups by picking randomly the material of one condition before the next participant entered the room and signed up for the study.

⁵ As the definitions of serving sizes differ in the different countries of the “5 a day” campaign, the recommendation of the country in which the study took place was used.

how many servings of FVs they eat per day with three items in the questionnaire, to increase the reliability.⁶ First, they were asked separately about (a) fruits and (b) vegetables (these scores were summed up when entering the data), and in a third item (placed in another part of the questionnaire), they were asked about FVs together (the sum of FVs). The mean of these two FV sum-scores (Cronbach's $\alpha = .96$) was used for the analyses of this article. At T1, the items referred to their current eating habits (e.g. "How many servings of FVs do you *currently* eat on an average day?"); at T2 and T3, the items referred to the week before (e.g. "How many servings of FVs did you eat on an average day during the diary period [T2]/during the last 7 days after the posttest? [T3]"). The self-reported data from the questionnaire was validated by the food diary,⁷ which participants had to fill out for 7 consecutive days during the intervention period. The T2 items from the questionnaires, which assessed FV intake during the intervention period, were highly correlated ($r = .71, p < .001$) with the FV diary data (averaged across the week).

Statistical analysis

The intended equality of compared groups at T1 due to random assignment of participants to the treatments was checked using ANOVAs for continuous and χ^2 -tests for categorical dependent variables. Intervention effects on FV intake were evaluated using a 3×2 mixed ANOVA with condition (5aday vs. just1more vs. control group) as a between-subject factor and time (t1 vs. t3) as a within-subject factor. Different changes in FV intakes from T1 to T3 between compared groups imply a significant condition by time interaction in the ANOVA. When the interaction was significant, the group means were compared using *t*-tests to evaluate the two hypotheses. We used eta squared (η^2) as an indicator for the effect size with ANOVA. It can be interpreted as the variance in the dependent variable that can be explained by knowing the group membership on the independent variable (see [Vacha-Haase & Thompson, 2004](#)). Eta squared can take values between 0 and 1; following recommendations by [Cohen \(1988\)](#), .01 indicates a small, .06 a medium, and .14 a large effect. All analyses were run with IBM SPSS Statistics 20 and *p*-values $< .05$ were considered statistically significant.

Results

FV intake before intervention (at T1)

Participants of the selected subsample ($N = 84$) ate 2.48 servings of FVs a day before the intervention at T1 on average. No difference in FV intake between groups was observed at T1 ($M_{5aday} = 2.49, SD_{5aday} = 0.63; M_{just1more} = 2.45, SD_{just1more} = 0.76; M_{control} = 2.50, SD_{control} = 0.66; F(2,81) = 0.03, p = .97$).

FV intake during the intervention period (T2)

T2 data, assessed immediately after the intervention, was used to verify whether participants from the experimental groups were able to follow the FV instructions. During the intervention,

⁶ The internal consistency – one form of reliability – of a scale is dependent of the number of items included in the scale: "α increases as the test is lengthened" ([Cronbach, 1951, p. 323](#)).

⁷ The data of the study presented here were collected from the participants who completed the diary during intervention correctly. Two independent raters evaluated the diaries for correct completion. The adherence was very good: Only 6 of 135 (4%) did not fill in the diary correctly. Participants were asked to fill in the diary every evening and to document FV intake in size and content as precisely as possible by using gramme and millilitre indications. Participants were also kindly asked to estimate the corresponding number of servings. Additionally, participants had to complete 7 items on health topics per day (e.g. physical activity).

Table 1

Changes in fruit and vegetable intake of the three groups between T1 and T2, T2 and T3, T1 and T3.

Changes	5aday-group			Just1more-group			Control group		
	<i>A</i>	<i>SDA</i>	<i>p</i>	<i>A</i>	<i>SDA</i>	<i>p</i>	<i>A</i>	<i>SDA</i>	<i>p</i>
T1–T2	2.51	0.69	<.001	0.96	0.72	<.001	0.77	1.29	.003
T2–T3	–1.55	0.82	<.001	–0.69	0.84	<.001	–0.30	1.23	.199
T1–T3	0.96	1.14	<.001	0.27	0.59	.024	0.47	0.98	.016

Note. $N = 84$; mean fruit and vegetable intake at T1 is $M = 2.49$ in the 5aday-group, $M = 2.45$ in the just1more-group and $M = 2.50$ in the control group; *A*: change; T1: before the intervention; T2: during the 1-week intervention; T3: 1 week after T2.

participants in the 5aday-group ate on average 5 servings of FVs a day ($M_{T2} = 5.00, SD_{T2} = 0.70; \Delta M_{T1-T2} = 2.51$). In the just1more-group, participants ate $M_{T2} = 3.41 (SD_{T2} = 0.96)$ servings/day during the intervention (compared to 2.45 servings/day at T1, $\Delta M_{T1-T2} = 0.96$). Although not explicitly asked to change their FV intake, participants in the control group also increased their FV intake during intervention $M_{T1} = 2.50$ to $M_{T2} = 3.27 (SD_{T2} = 1.38, \Delta M_{T1-T2} = 0.77)$ (Table 1).

Intervention effects on FV intake at T3

One week after the intervention ended, T3 data were assessed. Participants of the 5aday-group increased their FV intake the most ($\Delta M_{T1-T3} = 0.96$), whereas the just1more intervention had only a weak effect ($\Delta M_{T1-T3} = 0.27$), similar to that of the control group ($\Delta M_{T1-T3} = 0.47$). A corresponding 3×2 mixed ANOVA showed the following effects. Firstly, there was no statistically significant difference between groups if the FV intake was averaged across T1 and T3: $M_{just1more} = 2.97, M_{5aday} = 2.59, M_{control} = 2.73$. Thus, the main effect of the between-subjects factor condition was not significant: $F(2,81) = 1.85, p = .16, \text{partial } \eta^2 = .04$. Secondly, participants in every group increased their FV intake between T1 and T3 (compare Table 1), which implies a significant main effect of time: $F(1,81) = 30.62, p < .001, \text{partial } \eta^2 = .27$. Thirdly, the FV intake in the three conditions developed differently over the time (see Fig. 1), i.e., the condition by time interaction was significant: $F(2,81) = 3.98, p = .02, \text{partial } \eta^2 = .09$.

A detailed analysis of this interaction effect reveals that hypothesis 1 – that the just1more-group is more effective than the 5aday-group in increasing FV intake between T1 and T3 – must be clearly rejected. As Fig. 1 shows, the FV intake of the just1more-group in the post-intervention phase (T3) was unexpectedly lower compared to the other conditions: $M_{just1more} = 2.72 (SD = 0.84)$ versus $M_{5aday} = 3.45 (SD = 1.10), t(53) = 2.72, p = .01; M_{just1more} = 2.72 (SD = 0.84)$ versus $M_{control} = 2.97 (SD = 1.10), t(54) = 0.92, p = .37$. Comparing the 5aday-condition with the control group revealed that the "5 a day" nutrition recommendation caused a significantly higher increase in FV intake (difference between T3 and T1): $M_{5aday} = 0.96 (SD = 1.14)$ versus $M_{control} = 0.47 (SD = 0.98), t(55) = 1.75, p = .04$. Thus, the last finding partially confirmed the second hypothesis: people in the 5aday-intervention group (but not in the just1more-group) increased their FV intake more than those in the control group between baseline and follow-up. In contrast to the other conditions, participants in the 5aday-group managed to increase their average FV intake by one whole serving/day.

Further analyses

Forty individuals who ate 4 or more servings/day before the intervention were excluded from the reported analyses (see rationale given in section "participants"). For exploratory reasons we

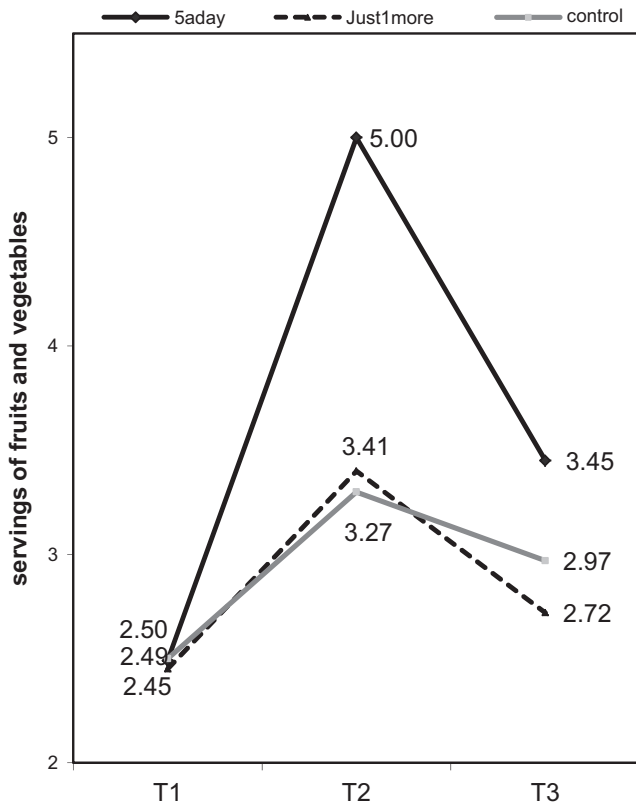


Fig. 1. Fruit and vegetable intake in the three conditions (5aday, just1more, and control group) over time (T1 = pretest, T2 = during the 1-week intervention, T3 = follow-up, 1 week after intervention).

additionally calculated a mixed ANOVA for the full sample set, including individuals who already consumed 4 or more servings/day before the intervention. This analysis was done with $N = 124$ participants (students who participated in all parts of the study and completed the FV-diary during intervention correctly). The corresponding 3×2 mixed ANOVA revealed (a) a nonsignificant main effect of the between-subjects factor condition, $F(2, 121) = 1.75, p = .18$, partial $\eta^2 = .03$; (b) a significant main effect of time, $F(1, 121) = 9.74, p < .01$, partial $\eta^2 = .07$; and (c) a nonsignificant condition by time interaction, $F(2, 121) = .04, p = .96$, partial $\eta^2 < .01$. Thus, participants of all three conditions changed their FV intake over the time, but there were no specific intervention effects.

We assumed that the FV intake at baseline has influenced the effects of the intervention. People eating a high amount of FV before baseline might have reacted differently regarding the intervention than people with a low FV intake at T1. To analyze this possible moderator effect, we calculated a further ANOVA with the additional factor “FV-status before intervention” (less than 4 or ≥ 4 servings of FV a day at T1). A significant interaction term of an ANOVA can support the moderation hypothesis. Results from the corresponding $3 \times 2 \times 2$ mixed ANOVA showed exactly this moderation pattern: a significant time \times condition \times status interaction: $F(2, 118) = 7.42, p = .001$, partial $\eta^2 = .11$. To explain this interaction we did a separate analysis for the “high-consumers” (4 or more servings of FV a day at T1). For this subgroup we observed a significant time by condition interaction ($F(2, 37) = 3.51, p = .04$, partial $\eta^2 = .16$), but the direction was contrary to the effects for the “low-consumers” described above. Participants who already consumed 4 or more FV servings before the intervention and were allocated to the 5aday-group significantly *decreased* their average FV intake between T1 and T3.

Discussion

We had hypothesized that the more realistic “just 1 more” goal would be more effective in increasing the FV intake than the “5 a day” recommendation. However, results show a contrary picture for low consumers: the “5 a day” goal was most effective in increasing FV intake. During the 1-week intervention, participants were required to strictly follow the “5 a day” or the “just 1 more” goal or eat as usual (control group). In the week following the intervention (T3), participants in all groups ate significantly more FVs than at baseline, but only the 5aday-group—not the just1-more-group—had a significantly higher FV intake than the control group. Participants of the 5aday-group were able to increase their FV intake by one whole serving.

We restricted our main analysis to participants who reported a FV consumption of less than 4 servings a day before intervention. For the “high consumers” with 5 or more servings at T1 we did not expect any effect through the intervention. The reason for not including participants with a prior intake of 4 servings was that for them both interventions would have been identical. In an additional analysis with the full sample set we found that participants in the 5aday-group, who already consumed 4 or more FV a day before intervention, *decreased* their FV-consumption in the post-intervention phase (T3) in comparison to T1.

Several explanations for this finding can be made. The 5aday-group included some participants with a FV consumption that was higher than 5 servings at T1. (The participants were randomized to the groups after they had reported their usual FV intake in the T1 questionnaire, therefore the fact that in the 5aday-group individuals had a higher FV intake at baseline compared to the other groups was by chance.) These individuals had to reduce their FV intake when eating according to the 5aday instruction during the intervention period. It might be that for high-consumers the 5aday intervention was possibly demotivating. Another possibility could be an effect of regression to the mean. Our data do not allow us to determine which factor might have been responsible for the post-intervention decrease in FV intake among high consumers. Altogether, the additional analyses hint to FV intake at baseline as a moderator of the intervention. However, the moderation analysis described above has some limitations regarding the assumptions of statistical testing.⁸ Therefore, additionally to the above mentioned arguments regarding the rationale of including only participants with less than 4 servings of FVs/day, also statistical reasons underline our main analysis approach with 3 groups with comparable N and FV consumption at T1 (with regard to means and variances). The results with $N = 84$ participants are more reliable and meaningful.

In our study the mean FV consumption before intervention was rather low compared to recent studies from other countries. In the full sample set (with 135 students at T1) the average self-reported FV consumption at T1 was $M = 3.2$. Other studies in Germany with university students found even lower average FV intake (Quellenberg & Eissing, 2008; Sieverding & Scheiter, 2012). Recent studies from other countries with university students of a comparable age found that the average self-reported FV consumption was much higher, for example in a US-student-sample about 5 servings (Blanchard et al., 2009) or in an Australian students sample 4.4 servings (Kothe, Mullan, & Butow, 2012) per day were found.

⁸ It does not meet the required normal distribution (Kolmogorov–Smirnov Test: $p = .009$; Shapiro–Wilk–Test $p < .001$) and differences of variances existed between the three groups at T1. The reason for the differences in variance lies in the fact that the 5aday group had more participants who ate 4 or more servings of FV a day at T1 (17 compared to 13 in the just1more-group and 10 in the control group). In contrast, the amount of participants who ate less than 4 servings of FV at T1 was comparable between the three groups (28 in 5aday, 27 in just1more, 29 in control group).

One reason for this difference in FV consumption could potentially be that the 5aday-recommendation of the German Society of Nutrition (DGE) and the definition of what counts as a serving, is very strict (<http://www.5amtag.org/>). Only one glass of fruit juice per day can be counted, potatoes do not count, and, additionally, the grams per serving in Germany are higher than in most countries (125 g per serving instead of 80 g per serving in most other countries). This means that it is more difficult to reach the 5aday-goal in Germany than in most other countries (a consequence of German “perfectionism”?).

Some limitations of our study should be noted. FV intake was assessed by retrospective self-reports, which might lead to biases. However, the retrospective self-reports at T2 were validated by diary reports that were assessed daily during the intervention. Another limitation lies in the selected sample. Because the study was advertised as a nutrition study, only people who were interested in this topic and were open to increasing their FV intake took part. This assumption is supported by the fact that the participants in the control group increased their FV intake as well. Furthermore, most participants were female psychology students. For both of these reasons, the results of this study are not transferable to the general population. The most important limitation lies in the fact that the present study assessed only short-term changes in FV intake. Statements about the effectiveness of the “5 a day” intervention in the long run cannot be made. Further research with long-term follow-ups is needed to strengthen the results of our study.

Notwithstanding these limitations, our study supports the persisting evidence (Ammerman et al., 2002; Pomerleau et al., 2005) that an increase of one serving of FVs per day is a realistic goal. Interestingly, however, when people were directly asked to follow this goal (just1more-group), they did not maintain this behavior in the week after the intervention. On the other hand, people who were required to follow the more challenging “5 a day” goal increased their FV intake by exactly one serving in the post-intervention period (T1–T3). Thus, only the 5aday-group achieved the “just 1 more” goal at T3, but not the “5 a day” goal. Goal Theory (Locke & Latham, 1990), which states that goals should be high and specific, can potentially explain this result. “5 a day” is for most people more ambitious than “just 1 more,” and it is also more specific, so it might be more motivating.

As mentioned in the introduction, more recent guidelines have increased the number of recommended servings a day in some countries. For example, in the US there are currently seven to 13 servings recommended (Erinosho et al., 2012) and in Australia seven (Kothe et al., 2012). Results of our study support this recent trend for higher goals. It has been shown that the higher and more ambitious “5 a day” goal is more effective than the more realistic “just 1 more” goal. Thus, higher goals in recent guidelines might be even more motivating. Goal Theory states that goals should be set at the most challenging level possible. But behind this threshold, when the goal is not attainable anymore, the performance goes down rapidly. Furthermore, Locke and Latham emphasize in “New Directions of Goal-Setting Theory” (2006) that difficult goals that are seen as a threat may not be effective. Further research has to examine were this threshold is in the context of FV consumption. For example, are nine servings still ambitious or is it no longer motivating? How many servings are regarded as threatening for which people?

Conclusion

The “5 a day” goal used in nutrition campaigns in many countries is far higher than the actual FV intake of most people.

Although difficult to maintain, it seems to be effective in increasing people’s FV intake, at least in the short-run.

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