

Reliability and validity of a fruit and vegetable self-efficacy instrument for secondary-school students in the Netherlands

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Abstract

Objective: To develop a 'fruit self-efficacy' (FSE) instrument and a 'vegetable self-efficacy' (VSE) instrument for secondary-school students in the Netherlands and to test the reliability and validity of these instruments.

Design: Methodological research.

Setting: Seven secondary schools in the Netherlands.

Subjects: Students (11–19 years of age) completed the two instruments in the classroom (n 466). Out of the original subject group, 106 students completed the instruments a second time.

Results: The relevance of the twenty-two items of the two developed instruments was evaluated on two occasions by four experts. This procedure resulted in seventeen items for both instruments. Further analysis was carried out on the basis of the secondary-school students' answers. Factor analysis identified two unidimensional instruments. Cronbach's α was 0.94 for the FSE instrument and 0.95 for the VSE instrument. The intra-class correlation coefficient between the test and the retest for both instruments varied between 0.33 and 0.84 ($P < 0.05$), depending on how the tests were taken (during class or on the student's own initiative), and the order in which the tests were completed (started or finished with a different instrument used for similar research). The correlation between FSE and fruit consumption was 0.41 ($P < 0.01$) and between VSE and vegetable consumption was 0.32 ($P < 0.01$).

Conclusions: The two instruments are sufficiently reliable and valid to assess the FSE and VSE of secondary-school students in the Netherlands. Further research, in which the predominant ethnic minorities in the Netherlands are sufficiently represented, is required to confirm this conclusion.

Keywords
Self-efficacy instrument
Fruit
Vegetable
Secondary-school students
Reliability
Validity

The number of secondary-school students with overweight and obesity is increasing worldwide⁽¹⁾. During the years 2002–2004, in a survey of 15-year-old Dutch students, 20.1% of female and 16.8% of male students suffered from overweight, whereas 4.7% and 3.9%, respectively, were diagnosed with obesity⁽²⁾. Overweight and obesity in young people are diagnosed using the international BMI curves for age and sex⁽³⁾.

The increase in overweight and obesity is a worrying development because overweight, and particularly obesity, can have detrimental effects both at an early age and in the long term. Effects at a young age may include psychosocial stress, low self-esteem, skeletal abnormalities, fatigue and glucose intolerance. In the long term, the

consequences may be CVD, diabetes, arthritis, high blood pressure and cancer⁽⁴⁾.

Overweight and obesity are caused by insufficient physical activity and unhealthy dietary habits in more than 90% of cases^(5,6). One of the most unfavourable trends in the dietary behaviour of secondary-school students, a trend that exacerbates the problem of overweight, is the decreasing consumption of fruit and vegetables⁽⁶⁾. Less than half of secondary-school students in the Netherlands consume the recommended daily amount of fruit and vegetables⁽⁷⁾. Habits that develop during the secondary-school phase have an important role in the development of health-related behaviour in adulthood⁽⁸⁾. Cognitive motivational processes strongly influence secondary-school students' eating habits, whereas younger children choose foods mainly on the basis of their preferences⁽⁹⁾.

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Self-efficacy has a central role in the cognitive regulation of motivation⁽¹⁰⁾. Self-efficacy proves to be an important predictor of many health-related phenomena, such as smoking, weight control, diet, alcohol use and AIDS prevention^(11–17). The term ‘self-efficacy’ was used for the first time in 1977 by the American psychologist Albert Bandura⁽¹⁸⁾. Bandura described self-efficacy as ‘...people’s judgement of their capabilities to organise and execute courses of action required to attain designated types of performances’⁽¹¹⁾. This description shows that people’s self-efficacy is not of a general nature, but is related to specific situations⁽¹⁹⁾. A person can judge himself as competent to eat fruit at home, whereas he may not judge himself as competent to eat fruit at school.

The higher the level of self-efficacy, the higher the likelihood that people will be able to display the desired behaviour⁽¹¹⁾. The level of self-efficacy can be influenced by targeted interventions that are developed on the basis of the theoretical background. However, before interventions can be developed to increase self-efficacy with regard to fruit and vegetable consumption, it is important to know whether self-efficacy is actually a predictor of fruit and vegetable consumption among secondary-school students. A literature review proves that this cannot be ascertained yet. A significant positive relationship was found in three^(20–22) out of five studies^(20–24) among secondary-school students in which the relationship between self-efficacy and consumption of fruit and vegetables was studied. Neumark-Sztainer *et al.*⁽²¹⁾ are the only ones reporting a correlation coefficient. Between the ‘self-efficacy for making healthy dietary choices’ and ‘fruit and vegetable consumption’, a correlation of 0.18 was found.

Reliable and valid instruments are required to expand research on self-efficacy as a predictor of fruit and vegetable consumption and thus gain more insight into the relevance of developing interventions for increasing self-efficacy. No instruments were found in the literature for measuring self-efficacy for vegetable consumption among Dutch secondary-school students, and only one instrument was found for measuring the self-efficacy for fruit consumption. This instrument was made up of a single item⁽²⁴⁾. Thus, valid and reliable instruments for measuring ‘fruit self-efficacy’ (FSE) and ‘vegetable self-efficacy’ (VSE) among secondary-school students are lacking in the Netherlands. Because of the specificity of the self-efficacy concept, separate instruments must be developed for FSE and VSE⁽²⁵⁾.

The first aim in the present research was the development of two measurement instruments for the Dutch situation: one instrument to measure FSE among secondary-school students in the Netherlands, another to measure VSE among this target group. The second aim was to test the reliability and validity of the developed instruments.

Method

Design

The present research can be characterised as methodological research⁽²⁶⁾. The Lynn procedure⁽²⁷⁾ was followed in the development of the two self-efficacy instruments to achieve sufficient content validity. This procedure entailed that the dimensions of the concept that was to be measured were identified in the development phase. Items were then formulated for these dimensions. In the final phase, the content validity of the items and instruments were assessed.

After the instruments were developed, both instruments were assessed for construct validity (using factor analysis), internal consistency, temporal stability and predictive validity.

Developing the instruments

Dimensions of self-efficacy

Bandura⁽²⁸⁾ describes how self-efficacy can be measured in three dimensions, namely ‘generality’, ‘strength’ and ‘level’. ‘Generality’ refers to the degree to which self-efficacy is positively related within a behavioural domain, between different behavioural domains or in relation to time⁽¹³⁾. ‘Strength’ refers to how certain a person is of being able to perform a certain activity⁽²⁸⁾. ‘Level’ refers to the number of activities with an increasing difficulty level that a person thinks he/she can carry out⁽²⁸⁾. All three dimensions were measured in the present research, whereby the dimension ‘generality’ was measured within and between the behavioural domain ‘fruit’ and the behavioural domain ‘vegetables’.

To ensure a reliable assessment of the ‘strength’ dimension, the secondary-school students scored their own self-efficacy on a 4-point Likert scale. An asymmetrical 4-point scale was chosen for the present research: 1 = ‘uncertain’, 2 = ‘almost certain’, 3 = ‘certain’, 4 = ‘very certain’. This simple scale was chosen because of the target group of secondary-school students who could have poor reading skills. Furthermore, this asymmetrical answer scale has relatively more positive answers. Research has shown that, when people are asked to grade their self-efficacy, they are more likely to think that they ‘will’ be able to do something rather than that they ‘will not’⁽²⁹⁾.

In English, self-efficacy items are typically formulated with the phrase ‘How confident are you at...’. In Dutch, various formulations are used, because the Dutch language does not have an exact equivalent of the concept ‘confident’. Commonly used phrases in the Netherlands are: ‘I think I’m able to...’, ‘Do you succeed in...’, ‘To what extent do you estimate it realisable to...’, ‘I’m sure/certain that I can...’, or ‘I’m convinced I can...’⁽³⁰⁾. Six secondary-school students (preparatory secondary vocational education) were asked for their preference. The phrase ‘I’m certain that I can...’ was chosen on this basis.

Generating items

When measuring self-efficacy, difficult situations for the students to eat fruit or vegetables must be included in the instrument to ensure a reliable assessment of the dimension 'level'. Sufficient difficult situations must be included to preclude ceiling effects⁽³¹⁾. To reliably assess the dimension 'generality', the behavioural factors related to the behavioural domain 'fruit' and the behavioural domain 'vegetables' must be included⁽³¹⁾, such as buying and eating fruit and vegetables.

Two existing American instruments were used to identify behavioural factors and difficult situations that have a role in fruit and vegetable consumption^(32,33). On the basis of these instruments, twenty-three 'fruit items' and twenty-three 'vegetable items' were selected. To gain more insight into the difficult situations for secondary-school students in the Netherlands, these items were assessed in a pilot study for twenty-three secondary-school students using an opportunity sample (average age = 14.6 (SD 1.7) years). These students were asked to score the difficulty of carrying out the behaviour for each item using a 5-point Likert scale, from 1 = easy to 5 = difficult. One item was then removed from each of the instruments for which all the respondents gave the answer 'easy'. These two items had no discriminatory value.

Students were also asked to make suggestions for improvement of each item, and they could indicate whether items were lacking. Subsequently, on the basis of the students' feedback about the Dutch situation, three fruit and two vegetable items were removed, three fruit and two vegetable items were added and five fruit and six vegetable items were modified, as a result of which both the FSE and VSE instruments consisted of twenty-two items.

Assessing content validity

Thirteen Dutch and Belgian researchers were approached who had all published on self-efficacy in relation to school students' dietary habits. These experts were asked to score the twenty-two items of the FSE instrument and the twenty-two items of the VSE instrument for relevance in relation to the concept of 'self-efficacy' on a 4-point scale, from 1 = not relevant to 4 = very relevant⁽²⁷⁾. The experts were also able to make suggestions for improvement of each item, and they could indicate whether items were lacking.

Testing the instruments

Research participants

Twenty-three secondary schools throughout the Netherlands were approached to participate in the research. Seven schools were willing to cooperate, and were located in four cities in the middle and one city in the south of the Netherlands. The size of the schools ranged from about 650 students to 1850 students.

Eight teachers at the seven secondary schools were asked to participate. Students at these schools were recruited using

an opportunity sample. The teachers were able to indicate which class or classes they considered most suitable for participation. This increased the chances of an individual teacher being willing to participate. The research strove for as much variety as possible in class levels and years. A total of twenty-one classes participated. Both self-efficacy instruments were administered among these secondary-school students. The students simultaneously completed an 'alcohol self-efficacy' instrument for a similar research project. The order in which the students completed the three self-efficacy instruments varied. Students from four teachers started with the FSE and VSE instruments, students from the other four teachers started with the 'alcohol self-efficacy' instrument. This was to reduce the influence of completion order on the results; the students might, after completing one or two instruments, become less motivated to fill in a third.

The determining factor for the sample size was the factor analysis within the framework of the construct validation. The common rule of thumb, 'at least ten times as many respondents as items', was applied⁽³⁴⁾. Because the final versions of the two self-efficacy instruments consisted of seventeen items each (see 'Content validity' under 'Results' section), the minimum sample size was 170 students.

Fruit and vegetable consumption questionnaire

Fruit and vegetable consumption was measured to determine the predictive validity of the self-efficacy instruments. Consumption was measured by questioning students on how often they ate fruit and vegetables during a normal week. The seven response options of both questions ranged from 'never' to 'more than once per day'. These two questions were taken from the international questionnaire prepared by the Health Behaviour in School-aged Children organisation.

The test-retest reliability of the consumption questions was assessed in another study and was 0.68 for fruit and 0.59 for vegetables. The correlation between the above-mentioned questions and a 7 d diary was 0.34 for fruit and 0.48 for vegetables. A detailed description of the reliability and validity can be read elsewhere⁽³⁵⁾.

Procedure

The researcher and/or the students' teacher was present while the instruments were being completed in the classroom. Teachers could choose between a written and a digital version. This was to increase the chance of teachers participating.

To determine the temporal stability of both self-efficacy instruments, after 28 d the students were asked to complete the self-efficacy instruments again within a period of 2 weeks. The students of four classes completed the instruments in the classroom a second time. The students in the other seventeen classes were allowed to decide for themselves where and when they would complete the

instruments digitally, thus limiting the amount of time these schools had to invest.

Ethical aspects

All secondary-school students and the parents of students up to the age of 16 years received written information about the research. They could decline to cooperate before the research started. Students and parents were reassured that the anonymity of the students would be guaranteed. The Medical Ethical Assessment Committee of Utrecht University Medical Center gave permission for conducting the present research.

Statistical analysis

All data were analysed using the Statistical Package for the Social Sciences statistical software package version 16.0 (SPSS Inc., Chicago, IL, USA).

Content validity

Both the 'item-content validity index' (I-CVI) and the 'scale-content validity index' (S-CVI) were calculated. The I-CVI was determined by the proportion of experts who assessed an item as content valid (score: 3 or 4). The S-CVI was determined by the average proportion of items that scored 3 or 4⁽³⁶⁾.

Construct validity

Data were analysed using the Principal Components Analysis (PCA). The following criteria were used for determining the number of factors: factors must have an eigenvalue of >1.00; factors are included up to the point that their eigenvalue curve flattens (calculated with a screeplot)⁽³⁴⁾; and factor loadings must have an absolute value of >0.40⁽²⁶⁾.

Internal consistency

Cronbach's α was calculated to determine internal consistency.

Temporal stability

Stability was determined using the single-measure intra-class correlation coefficient (ICC; one-way random model). According to Cicchetti's guidelines⁽³⁷⁾, an ICC is poor when it has a value <0.40, fair when it is between 0.40 and 0.60, good >0.60 and excellent >0.75.

Predictive validity

Spearman's rank correlation was used to calculate the correlations between self-efficacy and consumption, as measured at the ordinal level.

Results

Content validity

Four out of thirteen experts scored the relevance of the items. According to Lynn's method⁽²⁷⁾, if there are four experts, then all of them must score an item as 3 or 4 to be

able to class that item as content valid. On this basis, eight items in the FSE instrument and seven items in the VSE instrument could not be classed as content valid. Of these, six items were removed from both instruments that, according to the experts, were not relevant to fruit or vegetable consumption, or were not related to self-efficacy. The other three non-content valid items were reviewed, and three items were added to each instrument on the basis of the experts' suggestions. Both instruments were then sent to the experts for re-assessment. After this re-assessment, both instruments still contained two items that could not be classed as content valid. The experts indicated that these two items were not relevant to fruit and vegetable consumption and these items were removed. The S-CVI of both instruments at the end of this procedure was 1.0, which is a

Table 1 Demographic characteristics of the research participants for time 1 (*n* 466) and time 2 (*n* 106)

Characteristics	Time 1		Time 2	
	<i>n</i>	%	<i>n</i>	%
Sex†				
Male	235	50.6	54	50.9
Female	229	49.4	52	49.1
Age (years)†				
11	1	0.2	0	0
12	42	9.4	12	11.3
13	121	26.9	30	28.3
14	113	25.2	19	17.9
15	67	14.9	19	17.9
16	52	11.6	16	15.1
17	40	8.9	8	7.5
18	12	2.7	1	0.9
19	1	0.2	1	0.9
School level†				
PSVE	119	25.7	51	48.1
PSVE/SGSE	64	13.8	17	16.0
SGSE	72	15.5	8	7.5
SGSE/PUE	80	17.2	13	12.3
PUE	129	27.8	17	16.1
Ethnic group†				
Dutch	373	80.7	86	81.9
Surinamese	7	1.5	1	1.0
Moroccan	18	3.9	4	3.8
Turkish	2	0.4	1	1.0
Antillean or Aruban	3	0.6	0	0.0
Other	59‡	12.8	13§	12.3
Fruit consumption†				
Never	15	3.2	4	3.8
Less than once weekly	31	6.7	2	1.9
Once weekly	57	12.3	10	9.4
2–4 d/week	130	28.0	34	32.1
5–6 d/week	61	13.1	15	14.2
Every day, once daily	100	21.6	25	23.6
Every day, more than once	70	15.1	16	15.1
Vegetable consumption†				
Never	4	0.9	0	0.0
Less than once weekly	0	0	0	0.0
Once weekly	8	1.7	5	4.7
2–4 d/week	68	14.7	11	10.4
5–6 d/week	130	28.0	22	20.8
Every day, once daily	216	46.6	56	52.8
Every day, more than once	38	8.2	12	11.3

PSVE, preparatory secondary vocational education; SGSE, senior general secondary education; PUE, pre-university education.

†Some items are not equal to *n* 466 or *n* 106 because of missing values.

‡Forty ethnic groups.

§Eleven ethnic groups.

reliable content validity score⁽³⁶⁾. The final version of each instrument contained seventeen items.

Results of testing the instruments

Research participants

In the present research, 466 students took part (Table 1). Only one student did not take part because his parents objected to his participation.

The students were 11–19 years of age, and 50.6% were male students. All secondary-school levels recognised in the Netherlands were included. The majority of respondents were ethnic Dutch (80.7%). This percentage is in line with the percentage of ethnic Dutch secondary-school

students in the 2007–2008 school year (79.2%). However, other widely represented ethnic minorities in the Netherlands were strongly under-represented in this sample. These include Surinamese, Moroccan, Turkish, Antillean and Aruban students⁽³⁸⁾.

Both self-efficacy instruments were completed a second time by 106 out of 466 students. Fifty-eight students completed the instruments again in the classroom, forty-eight students completed them at their own initiative.

Construct validity

The PCA of the FSE and VSE instruments produced an eigenvalue of >1.00 for the first two factors (Tables 2

Table 2 Factor structure and item scores for the fruit self-efficacy instrument

Item <i>I am certain that I can...</i>	Loadings		Mean score†	sd
	Factor 1	Factor 2		
1. ... eat fruit as a snack	0.83	-0.14	3.46	0.81
2. ... eat fruit if I have to prepare it myself	0.80	-0.05	3.38	0.91
3. ... eat fruit during lunch	0.80	-0.19	3.29	0.92
4. ... eat fruit if my parents are not there	0.78	-0.28	3.61	0.71
5. ... eat fruit as a snack instead of a biscuit	0.77	0.46	2.87	1.14
6. ... eat fruit during a meal at home	0.74	-0.26	3.33	0.92
7. ... eat fruit during breakfast	0.74	-0.24	3.07	1.11
8. ... eat fruit even if no one else is eating fruit	0.73	-0.14	3.42	0.82
9. ... eat fruit as a snack instead of a candy bar	0.72	0.59	2.73	1.16
10. ... eat fruit when eating together with my friends	0.72	-0.31	3.46	0.81
11. ... eat fruit as a snack instead of crisps	0.69	0.55	2.67	1.18
12. ... eat two or more pieces of fruit per day	0.67	0.25	2.86	1.13
13. ... eat fruit in social situations, such as at a party, if it is available	0.65	-0.14	3.17	1.02
14. ... eat fruit as dessert after a hot meal	0.64	-0.18	3.20	1.04
15. ... remember to take fruit to school as snack	0.64	0.24	2.67	1.16
16. ... buy fruit if there is none in the house	0.62	-0.01	3.14	1.08
17. ... ask someone in my family to buy fruit	0.45	-0.13	3.69	0.63
Eigenvalue	8.55	1.43		
% Explained variance	50.3	8.4		

†Response options were 1 = uncertain, 2 = almost certain, 3 = certain, 4 = very certain.

Table 3 Factor structure and item scores for the vegetable self-efficacy instrument

Item <i>I am certain that I can...</i>	Loadings		Mean score†	sd
	Factor 1	Factor 2		
1. ... eat vegetables as a snack	0.83	-0.33	2.53	1.23
2. ... eat vegetables even if no one else is eating vegetables	0.81	0.08	3.01	1.06
3. ... eat vegetables during lunch	0.81	-0.05	2.76	1.19
4. ... eat vegetables if I have to prepare them myself	0.81	-0.09	3.03	1.09
5. ... eat vegetables if my parents are not there	0.80	0.22	3.23	0.99
6. ... eat vegetables when eating together with my friends	0.79	0.16	3.10	1.01
7. ... eat vegetables as a snack instead of a biscuit	0.78	-0.49	2.18	1.23
8. ... eat vegetables in social situations, such as at a party, if available	0.77	-0.09	2.75	1.17
9. ... eat vegetables as a snack instead of crisps	0.77	-0.48	2.18	1.22
10. ... eat vegetables as a snack instead of a candy bar	0.76	-0.50	2.19	1.21
11. ... remember to take vegetables to school as snack	0.76	-0.27	2.29	1.22
12. ... buy vegetables if there are none in the house	0.70	0.08	3.02	1.14
13. ... ask someone in my family to prepare vegetables for a hot meal	0.66	0.49	3.48	0.85
14. ... eat vegetables during a meal at home	0.64	0.45	3.52	0.87
15. ... eat four or more serving spoons of vegetables per day	0.61	0.09	2.88	1.11
16. ... ask someone in my family to buy vegetables	0.59	0.40	3.52	0.81
17. ... eat vegetables during a hot meal	0.54	0.57	3.65	0.74
Eigenvalue	9.17	1.93		
% Explained variance	53.9	11.4		

†Response options were 1 = uncertain, 2 = almost certain, 3 = certain, 4 = very certain.

and 3). However, for the first factor, all factor loadings had a value of >0.40. Moreover, only one item (in the VSE instrument) had a higher factor loading for factor 2 (0.57) than for factor 1 (0.54). On the basis of screeplots, one factor proved to be a suitable choice for both instruments. Both instruments can therefore be characterised as unidimensional scales, which means that both instruments measure a single construct. The first factor accounts for 50.3% of the variance in the FSE instrument and 53.9% of the variance in the VSE instrument.

Internal consistency

The Cronbach's α of the FSE instrument was 0.94 and of the VSE instrument 0.95. On the basis of the analysis of items at the item level, according to the 'alpha if item deleted' procedure, removing an item did not have a great influence on the α level (maximum increase of 0.001).

Further research on the inter-item correlation is required to properly interpret the high α . A rough indication of the internal consistency of a unidimensional instrument is that the average inter-item correlation must be considerably higher than 0.20, and Cronbach's α must be at least 0.75⁽³⁹⁾. The average inter-item correlation of the FSE instrument was 0.46 and of the VSE instrument 0.50.

Temporal stability

Because the conditions in which the students completed the instruments for the second time varied, subgroups

Table 4 Test-retest reliability of the FSE and VSE instruments (completed in the classroom; ICC)

	In the classroom/ started with the FSE and VSE instruments† (n 11)	In the classroom/ended with the FSE and VSE instruments‡ (n 47)
FSE	0.84**	0.35**
VSE	0.70**	0.33*

FSE, fruit self-efficacy instrument; VSE, vegetable self-efficacy instrument; ICC, intra-class correlation coefficient.

* $P < 0.05$; ** $P < 0.01$.

†Questionnaire started with the FSE and VSE instruments and ended with the 'alcohol self-efficacy' instrument.

‡Questionnaire started with the 'alcohol self-efficacy' instrument and ended with the FSE and VSE instruments.

Table 5 Test-retest reliability of the FSE and VSE instruments (completed at the students' own initiative; ICC)

	Own initiative/started with the FSE and VSE instruments† (n 20)	Own initiative/ended with the FSE and VSE instruments‡ (n 28)
FSE	0.70**	0.41*
VSE	0.57**	0.47**

FSE, fruit self-efficacy instrument; VSE, vegetable self-efficacy instrument; ICC, intra-class correlation coefficient.

* $P < 0.05$; ** $P < 0.01$.

†Questionnaire started with the FSE and VSE instruments and ended with the 'alcohol self-efficacy' instrument.

‡Questionnaire started with the 'alcohol self-efficacy' instrument and ended with the FSE and VSE instruments.

Table 6 Predictive validity of the FSE and VSE instruments (Spearman's rank correlation)

	FSE (n 462)	VSE (n 460)
Fruit consumption	0.41**†	0.26**‡
Vegetable consumption	0.27**‡	0.32**†

FSE, fruit self-efficacy instrument; VSE, vegetable self-efficacy instrument. ** $P < 0.01$.

†Refers to the level in which self-efficacy is positively correlated within the fruit behavioural domain or the vegetable behavioural domain ('generality').

‡Refers to the level in which self-efficacy is positively correlated between the fruit behavioural domain and the vegetable behavioural domain ('generality').

were formed for calculating the ICC. Students completed the instruments the second time in the classroom (Table 4) or at their own initiative (Table 5). A distinction was also made in the order in which the self-efficacy instruments were completed. As with the first test, students started either with the FSE and VSE instruments or with the 'alcohol self-efficacy' instrument. The ICC of the two self-efficacy instruments varied between 0.33 and 0.84 ($P < 0.05$) in the subgroups.

Predictive validity

Spearman's rank correlations between FSE and consumption and between VSE and consumption varied between 0.26 and 0.41 ($P < 0.01$; Table 6).

Discussion

The purpose of the present research was to test the reliability and validity of the developed FSE and VSE instruments for secondary-school students.

Reliability

Reliability is determined by calculating internal consistency and temporal stability. Both the FSE and VSE instruments display good internal consistency. The fact that the Cronbach's α of both instruments is very high (>0.90) could indicate that a number of items pose the same question in a slightly different way⁽⁴⁰⁾. Therefore, a reduction in the number of items is worth the benefit of lowering respondent burden. For example, the content of items 3, 7 and 14 of the FSE instrument (Table 2) seems to overlap with that of item 6, and the content of items 5, 9 and 11 with that of item 1. If these six items are removed, α is 0.90. The content of items 3 and 17 of the VSE instrument (Table 3) seems to overlap with that of item 14, and that of items 7, 9 and 10 with item 1. If these five items are removed, α is 0.93. The final decision regarding the definite deletion of items of both instruments should be taken by the expert panel.

This is the first time that the stability of an FSE or VSE instrument is being studied for secondary-school students or for young people in this age group. The order in which the self-efficacy instruments were completed seems to

have had a larger influence on stability than the method used to gather the data (Tables 4 and 5). The students who completed the 'alcohol self-efficacy' instrument first scored lower for the stability of the FSE and VSE instruments than the students who started with the FSE instrument. A possible explanation is that the students started to tire of the questionnaires, and were unable to concentrate properly on the last instruments⁽²⁶⁾. However, it is important to mention here that there were not many students in the subgroups, and thus conclusions must not be drawn too hastily.

On the basis of the guidelines of Cichetti⁽³⁷⁾, the ICC of the self-efficacy instruments used in the present research are fair to excellent for students who started by completing the FSE (0.70 and 0.84) and VSE instruments (0.57 and 0.70). The ICC is poor to fair for students who completed the FSE (0.35 and 0.41) and VSE instruments (0.33 and 0.47) last.

Validity

Content validity, construct validity and predictive validity were all calculated. The content validity of both instruments was thoroughly examined by experts with knowledge of the concept of self-efficacy and fruit and vegetable consumption among young people. The content validity of the research would thus appear to be sufficiently safeguarded.

Research on the factors used in an FSE or VSE instrument among secondary-school students or young people in this age group has not been described previously in the literature. In previous research of 10–11-year-old primary-school students⁽⁴¹⁾ and adults^(42,43), the FSE and VSE instruments were characterised as unidimensional, just as in the present research.

The predictive validity of both instruments is moderate. In comparison with the research by Neumark-Sztainer *et al.*⁽²¹⁾ – the only study of secondary-school students that describes the correlation coefficient – the correlations in the present research are higher. In the research by Neumark-Sztainer *et al.*⁽²¹⁾, a correlation of 0.18 was found between the 'self-efficacy for making healthy dietary choices' and fruit and vegetable consumption.

It is striking that the present research is the first on secondary-school students in which self-efficacy is measured specifically for vegetables, and only the second in which it is measured specifically for fruit. Other studies measured such phenomena as 'self-efficacy for making healthy dietary choices'. It is possible that a relationship with fruit and vegetable consumption was not always found in earlier research among secondary-school students because of this.

The correlations in the present research are comparable with research on 10–12-year-old primary-school students^(41,44–46). The correlation between FSE and fruit consumption was 0.41 in the present research, whereas among primary-school students it varied between 0.19

and 0.42. The correlation between VSE and vegetable consumption was 0.32 in the present research, whereas among primary-school students it varied between no correlation in one study and 0.33. These results suggest that the self-efficacy of secondary-school students does not have, or hardly has, more influence on fruit and vegetable consumption than the self-efficacy of primary-school students. These results also lead one to surmise that self-efficacy has an influence on fruit and vegetable consumption at an earlier stage than at secondary-school level. Another salient finding is that the relationship between FSE and fruit consumption is stronger than that between VSE and vegetable consumption. The explanation for this may be that young people have more influence on what they consume between meals, such as fruit, than on what they consume at main meal times, such as vegetables⁽⁴⁴⁾.

On the basis of the poor correlation found between self-efficacy and fruit and vegetable consumption in the present research, it is debatable whether there is any value in designing interventions for increasing FSE and VSE. Self-efficacy increasing interventions may well have only a slight effect on fruit and vegetable consumption.

Limitations

Because the instruments were completed in the classroom, it is conceivable that the students influenced each other's choices. The students were spaced apart to prevent this as much as possible. During the completion of the instruments a second time, this 'separation' was not possible for seventeen classes. The students were allowed to decide for themselves where and when they would complete the instruments digitally. This has also influenced the number of responses negatively.

Furthermore, alongside the FSE and VSE instruments, the students also had to complete an 'alcohol self-efficacy' instrument. Because some students may have become demotivated after completing one or two instruments, this may have influenced the results.

Another limitation is that many ethnic minorities widely represented in the Netherlands were strongly under-represented.

Practical implications

Both instruments can be used for researching self-efficacy as a determinant of fruit and vegetable consumption, and for evaluating the effects of nutrition education programmes on secondary-school students. The two instruments can be used independently or in combination. It is important not to offer too many instruments to the students at the same time, as this could influence the reliability of the results.

Conclusion and recommendations

The FSE and VSE instruments are sufficiently reliable and valid. The instruments can be used to measure FSE and VSE

among Dutch secondary-school students. Further research, in which the predominant ethnic minorities in the Netherlands are sufficiently represented, is required to confirm this conclusion.

Despite the fact that increasing FSE and VSE can have a small effect on fruit and vegetable consumption, more research on the effect of self-efficacy increasing interventions is required to understand this better. Such experimental research can provide more evidence of a causal relationship than can cross-sectional research.

Furthermore, following research should preferably measure fruit and vegetable consumption by means of observation or '24 h recall' questionnaires⁽⁷⁾. This would allow more accurate measurement of consumption, and the relationship between consumption and self-efficacy could be more precisely studied.

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