Understanding vocational students' motivation for dietary and physical activity behaviours

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Abstract

Background: Unhealthy eating behaviours and low levels of physical activity are a major problem in adolescents and young adults in vocational education. In order to develop effective intervention programmes, more research is needed to understand how different types of motivation contribute to health behaviours. In the present study the Self-Determination Theory (SDT) is used as a framework to examine how motivation contributes to dietary and physical activity behaviours in Vocational Education & Training (VET) students.

Methods: This cross-sectional study included 809 students (mean age 17.8 ± 1.9 years) attending VET in the Netherlands. The Treatment Self-Regulation Questionnaire (TSRQ) for diet and physical activity, the Short QUestionnaire to ASsess Health- enhancing physical activity (SQUASH) and the Dutch Public Health Monitor questionnaire were used to asses type of motivation, physical activity and dietary behaviour. Linear multilevel regression analyses were used to investigate the association between type of motivation and dietary and physical activity behaviours.

Results: Amotivation was negatively associated with breakfast frequency and was positively associated with diet soda consumption and the number of unhealthy products consumed per week. A positive association was found between autonomous motivation and water intake, breakfast frequency, fruit intake and moderate-to-vigorous physical activity. Autonomous motivation was negatively associated with the consumption of unhealthy products. Controlled motivation was not associated with physical activity or dietary behaviours.

Conclusion: Type of motivation according to SDT seems to partly explain dietary and physical activity behaviours in VET students. Autonomous motivation in particular was shown to be associated with healthy behaviours and could therefore be a valuable intervention target.

Introduction

Unhealthy dietary behaviours and a decline in physical activity level are a major problem in adolescents and young adults (1). These unhealthy behaviours may lead to a higher risk of non-communicable diseases later in their lives (2–5). The prevalence of these unhealthy behaviours is not evenly distributed across young people (6,7). Students attending vocational education have less favourable health practices than students attending higher secondary schools (8). In the Netherlands, many vocational students are overweight, show more sedentary behaviour than recommended, do not engage in enough physical activity and most of them do not meet the guidelines for fruit and vegetable consumption (9–11).

Most vocational students are in their late adolescence, with ages ranging from 16 to 24 years old. Late adolescence is characterized by many cognitive changes, amongst which are changes in motivational processes (12–14). Late adolescence is a period of transition from adolescence to adulthood in which young people establish independence and adopt lasting health behaviour patterns. On the other hand, it is also seen as a period in which individuals are at high-risk to develop obesity, as well as unhealthy diet

and physical activity practices (15). It is therefore highly relevant to promote healthy dietary and physical activity behaviours among adolescents and young adults, especially those belonging to a vulnerable population group.

In order to develop effective intervention programmes for vocational students, more research is needed to identify factors that predict the engagement in health behaviours among this population. A wide range of theoretical explanations provide a basis for understanding the determinants of behaviour and behaviour change (16). Several studies have reported that successful behaviour change maintenance may depend on motives, self-regulation, resources, habits, and environmental and social influences and point out that motivation is a critical factor in supporting healthy dietary and physical activity behaviours (17–20). As a general theory of motivation, the Self-Determination Theory (SDT) is being applied to study motivation in numerous health care and health promotion contexts (21,22). SDT distinguishes different types of motivation on a continuum in terms of the degree to which the motivation is (non)self-determined from: amotivation, to controlled motivation, to autonomous motivation (23). *Amotivation* is a type of motivation in which an individual does not have any intention to perform a certain behaviour. *Autonomous motivation* describes a self-determined type of motivation. In this type of motivation, behaviour is performed for the individual's own sake and the goal is self-satisfaction. The motivation type between amotivation and autonomous motivation is *controlled motivation*, where the motivation to act is driven by external factors and thus is less self-determined than autonomous motivation. Driving factors can for example include social influences, like friends and family or teachers (23).

Previous studies on type of motivation and health behaviour among adults show that high autonomous motivation is a predictor for long-term weight control, exercise adherence and smoking cessation (24–26). In early and mid-adolescence, high autonomous motivation is known to be related to increased fruit and vegetable intake (27). Furthermore, in Finnish vocational students aged 17-19, a higher level of autonomous motivation was related to increased physical activity (28). In middle-school students aged 12 years and in children and adolescents aged up to 18 years old, similar results have been found (29–31). Controlled motivation on the other hand shows a weak negative association with physical activity (30). Moreover, individuals who report amotivation to live healthy, have poor uptake and adherence to healthy behaviour. They do not see any reason to change their behaviour and thus are not likely to implement any changes at all (32). Studies among young adults show that although they recognize the future health benefits of adopting healthier lifestyle behaviours. They are however not always motivated to engage in these behaviours, due to poor planning, lack of accountability and overall sense of apathy to engage with healthier lifestyle behaviours (33,34). However, amotivation only has a weak negative association with some health behaviours, like physical well-being and physical activity (30,31). The evidence above shows that types of motivation influence the health behaviour of both adults and adolescents. However, most research on adolescents is focussed on either early and mid-adolescents or young adults. There is little research on the SDT motivation to make healthy choices of late-adolescents, and of vocational students in particular.

In summary, because type of motivation has shown to have an important influence on the engagement in health behaviours, more extensive research is needed into the motivation of vocational students to live healthy. The information can be used to develop interventions by targeting the motivation types of vocational students more specifically. The purpose of this study is to examine the association between type of motivation and dietary and physical activity behaviours among adolescents and young adults in vocational education.

Methods

Design

In this cross-sectional study, data was collected as part of a health promoting intervention, aimed at improving physical activity and dietary behaviours among VET students, from November 2017 until January 2018.

Study population

The study population consisted of a convenience sample of 809 vocational students studying at three school locations for VET in an urban area of the Netherlands. Participants attended seven different types of VET education. Vocational schools were contacted by the researchers. Schools then suggested first and second year classes, based on their availability. Recruitment of the students took place during class, as researchers went to the selected classrooms. All students in the classes could participate in the study on a voluntary basis and received an information letter beforehand.

Measurements

Participants filled in an electronic consent form and completed an in-class digital questionnaire. The questions were tailored to the target group, to ensure clarity. This study is not within the scope of the Dutch Medical Research Involving Human Subjects Act and was therefore exempted from review by the Medical Ethics Committee Southwest Holland (35).

SDT motivation types

For both diet and physical activity motivation, the Treatment Self-Regulation Questionnaire (TSRQ) was used to determine the participants' self-determination to either eat healthy or to exercise regularly. In total the TSRQ consists of 15 statements: six statements on autonomous motivation, six on controlled motivation and three on amotivation (36,37). A five-point rating scale was used. For example, the autonomous statement 'I would eat healthier because I feel responsible for my health' could be scored from one (not applicable at all) to five (very applicable). The points scored on the autonomous motivation statements were averaged, forming the mean autonomy score. The same was done for controlled and amotivation statements, revealing the mean controlled and amotivation score, respectively. Both TSRQs for diet and exercise were translated from English to Dutch by the researchers.

Dietary behaviour

For questions on fruit, breakfast, sweet and savoury snacks, water, energy drink and soda consumption the dietary questions of the Dutch Public Health Monitor were used. The monitor is conducted every four years by Dutch Municipal Health Services (38). One example question was 'On how many days a week do you consume fruit?'. Eight answer options were given, from never to seven days a week. After this, the question 'How much fruit do you generally eat on those days?' followed. Answer options included 0.5, 1, 1.5, 2, 2.5 and 3 or more pieces per day. For analysis the amount of days that fruit was consumed was multiplied with the number of pieces a day. This was then divided by seven to obtain the average number of pieces of fruit per day. A similar calculation was carried out for the other dietary behaviours, taking into account the frequency of the behaviour and the amount of products consumed.

Physical activity

Physical activity was assessed using the Short QUestionnaire to ASsess Health- enhancing physical activity (SQUASH), which measures the average physical activity level per week in light, moderate and vigorous intensity exercise. It has proven to be fairly reliable and valid (39). It was however necessary to adapt the wording of some questions for the participants. Physical activity during work was for example changed to physical activity during a side job.

Covariates

Covariates that were measured using the questionnaire included gender, age, weight class, level of VET education and type of VET education. Previous research has suggested gender, age and weight class are of influence in diet and physical activity behaviour (40–42). Because education level in general is associated with a healthier lifestyle (43), it was decided to correct for level of VET education as well. Gender was determined as male or female. The birth year of participants was asked to determine their age. Participants were divided into the weight classes underweight, overweight and normal weight, based on their self-reported body height and weight. This was done by calculating the Body Mass Index (BMI) and using the IOTF cut-off points to determine their weight class (44). VET education has four different levels, level one being the lowest and four the highest, these were combined into three groups; VET level 1 & 2, level 3 and level 4. Participants followed seven different types of VET education. VET school location was not included as a covariate to avoid multicollinearity in the data matrix. The reason for this was that all types of VET education were offered at one specific location. The Pearson's r value showed a strong correlation of 0.72 between location and type of VET education (45).

Statistical analysis

All data was analysed using SPSS 25 (46). Baseline frequencies, ranges and medians were calculated. Outliers and missings in the data were explored and, if needed, removed from analyses. The dietary behaviours were further investigated by comparing the variables with the dietary guidelines of the

Netherlands Nutrition Centre (47). PA behaviours were compared with the PA guidelines of the Health Council of the Netherlands (48).

The data had a multilevel structure; individuals (level 1) were nested within seven VET education types (level 2). Therefore, linear multilevel regression analyses were performed to investigate the associations between type of motivation and physical activity and dietary choices. Because of the nested structure of the data, the seven VET education types were set as the random effect in the model. In fixed effects, the model was adjusted for gender, age, weight class and level of VET education. On top of these confounders, the motivation scores were included as fixed outcome measures. The dietary and physical activity behaviour variables were added as the dependent variable. To investigate the associations between motivation types and the dietary and physical activity variables, the calculated regression coefficients and 95% confidence intervals (CI) were used. An alpha of 0.05 was used to test statistical significance. The Intraclass Correlation Coefficient (ICC) was calculated to determine how much of the overall variation in the dependent variable was explained by clustering at the level of type of VET education.

Results

The study population characteristics can be found in table 1. The mean age of the study population was 17.8 (±1.9) years old. Most of the sample had a normal weight (75%) and was female (62%). Type of VET education varied, but a large part of the sample followed VET training for Lifestyle & Sports (31%). All levels of VET education were represented, but the majority of participants (66%) attended level 4 VET education.

Table 1. Study population characteristics

Characteristic	N=809
Age (years)	
Minimum	16
Maximum	33
Mean (SD)	17.8 (1.9)
Body Mass Index (kg/m^2)	
Mean (SD)	22.3 (3.5)
Underweight (%)	7
Normal (%)	75
Overweight (%)	15
Obese (%)	3
Gender	
Male (%)	38
Female (%)	62
Type of VET education	
Economics & Law(%)	20
IT (%)	3
Lifestyle & Sports (%)	31
Social Work (%)	8
Grooming (%)	20
Health Care (%)	7
Fashion (%)	11
Level of education	
Level 1&2 (%)	11
Level 3 (%)	23
Level 4 (%)	66

In table 2 descriptive statistics for dietary and physical activity behaviours can be found. The mean water consumption was 1086 mL/day. For fruit, the mean consumption was 0.9 pieces a day and for diet soda the mean consumption was 133 mL/day. Mean breakfast frequency was 4.7 days per week. The mean number of unhealthy week choices (the sum of sugar-sweetened beverages and snacks) was high in the

population, with 24 portions per week. The number of minutes of moderate-to-vigorous physical activity (MVPA) varied greatly among the population. The mean time for weekly MVPA was 935 minutes, 161 minutes for vigorous PA and 774 minutes for moderate PA. The percentage of participants meeting the guidelines for physical activity and dietary behaviours is also displayed. Almost all participants met the guideline for diet soda, but only twelve percent met the guideline for fruit consumption. In addition, only a limited percentage of participants met the guideline for a maximum of three unhealthy week choices. Overall, 49% met the guideline for MVPA. However a classification by age group shows that 20% of participants younger than 18 years met the recommended level of MVPA (at least 60 minutes MVPA per day) while 79% of participants aged 18 years and over met the adult MVPA guideline of at least 150 minutes MVPA per week.

Table 2. Dietary and physical activity behaviours of the study population (N=809)

Behaviours	Mean (SD)	Median (IQR)	% meeting guideline[1]
Water consumption (mL/day)	1086 (671)	1000 (536-1500)	35
Fruit consumption (pieces/day)	0.9 (2.6)	0.7 (0.3-1.3)	12
Diet soda consumption (mL/day)	133 (294)	0 (0-107)	98
Consumption of unhealthy choices (portions/week)	24 (21)	18 (8-33)	8
Breakfast consumption (days/week)	4.7 (2.6)	6.0 (3.0-7.0)	48
Moderate PA (minutes/week) [2]	774 (646)	690 (270-1080)	NA
Vigorous PA (minutes/week) [2]	161 (305)	0 (0-270)	NA
MVPA (minutes/week) [2]	935 (708)	840 (420-1260)	49

1. *The guidelines of the Netherlands Nutrition Centre were used for dietary behaviours: water intake 1,5L/day, fruit 2 pieces/day, diet soda a max of 4 units of 330mL/day, unhealthy week choices 3 portions/week, breakfast 7 times per week and the guidelines of the Health Council of the Netherlands for PA behaviours: 150 MVPA min/week for adults and MVPA 60 minutes/day for youth younger than 18.*
2. *For PA behaviours, 2 participants were excluded from analysis due to unrealistically high minutes of PA per week.*

The median motivation scores are highest for autonomous motivation for both diet and physical activity (table 3), followed by controlled motivation and lastly amotivation. Controlled motivation shows higher values for physical activity than it does for diet. Apart from this, scores are similar for diet and physical activity.

Table 3. Motivation scores of the study population (N=809)

Type of motivation	Mean (SD)	Median (IQR)
Autonomous motivation diet	3.7 (0.8)	3.7 (3.2-4.2)
Controlled motivation diet	2.4 (0.7)	2.4 (2.8-3.8)
Amotivation diet	2.2 (0.7)	2.2 (1.7-2.7)
Autonomous motivation PA	3.7 (0.8)	3.7 (3.2-4.2)
Controlled motivation PA	2.5 (0.8)	2.5 (2.0-3.0)
Amotivation PA	2.0 (0.7)	2.0 (1.3-2.7)

Table 4 and 5 show the associations of autonomous motivation, controlled motivation and amotivation with physical activity and dietary behaviours, as determined by multilevel linear regression analysis. For dietary behaviour (table 4), autonomous motivation showed an association with all dietary variables, except for diet soda. A negative association between autonomous motivation and amount of unhealthy week choices can be seen, meaning that with every increase of 1 in autonomous motivation score, 3.9 less unhealthy week choices are consumed. Autonomous motivation showed a positive association with the amount of fruit and water intake per day and the number of days that breakfast was consumed. For water for example, this means that with each increase of 1 in autonomous motivation score, 164 mL more water is consumed per day. Controlled motivation showed no significant associations with any of the dietary variables. For amotivation a negative association was found with the amount of days that breakfast was consumed, while positive associations were found with the portions of unhealthy week choices that were consumed per week and with diet soda consumption.

Table 4. Multilevel linear regression analysis of the associations between types of motivation and dietary choices (N=809)

Model Term	Unadj. coefficient	Unadj. sig.	Unadj. 95% CI	Adj. coefficient[1]	Adj. sig.[1]	Adj. 95% CI[1]
Unhealthy week choices (portions/week)						
Autonomous motivation score diet	-3.8*	0.001	-6.1 - -1.5	-3.9*	0.001	-6.1 - -1.6
Controlled motivation score diet	-1.8	0.114	-4.1 - 0.4	-1.6	0.171	-3.8 - 0.7
Amotivation score diet	5.7*	0.000	3.6 - 7.9	4.5*	0.000	2.3 - 6.7
ICC level 2 (type of VET education)	0.022			0.038		
Diet soda (mL/day)						
Autonomous motivation score diet	14	0.402	-19 - -48	13	0.431	-20 - 47
Controlled motivation score diet	15	0.372	-18 - 48	15	0.359	-18 - 48
Amotivation score diet	40*	0.013	8.6 - 72	33*	0.048	0.3 - 65
ICC level 2 (type of VET education)	0.026			0.022		
Fruit (pieces/day)						
Autonomous motivation score diet	0.2*	0.000	0.1 - 0.3	0.2*	0.000	0.1 - 0.3
Controlled motivation score diet	0.0	0.764	-0.1 - 0.1	0.0	0.757	-0.1 - 0.1
Amotivation score diet	0.0	0.497	-0.1 - 0.1	0.0	0.739	-0.1 - 0.1
ICC level 2 (type of VET	0.021			0.022		

education)						
Breakfast (times/week)						
Autonomous motivation score diet	0.5*	0.001	0.2 - 0.8	0.5*	0.001	0.2 - 0.8
Controlled motivation score diet	-0.1	0.364	-0.4 - 0.2	-0.1	0.533	-0.4 - 0.2
Amotivation score diet	-0.3*	0.019	-0.6 - -0.1	-0.3*	0.021	-0.6 - -0.1
ICC level 2 (type of VET education)	0.082			0.071		
Water intake (mL/day)						
Autonomous motivation score diet	158*	0.000	84 - 232	164*	0.000	90 - 237
Controlled motivation score diet	55	0.143	-19 - 129	46	0.221	-28 - 120
Amotivation score diet	-72*	0.046	-142 - -1.2	-66	0.072	-138 - 5.9
ICC level 2 (type of VET education)	<0.001			0.001		

1. Values were adjusted for the following confounders: gender (male/female), age, weight status (underweight, normal weight, overweight, obese) and level of VET education (level 1&2, 3 and 4). * significant value $\alpha < 0.05$

For physical activity behaviour (table 5), autonomous motivation was only positively associated with the number of minutes per week MVPA. No other significant associations with motivation were found.

Table 5. Multilevel linear regression analysis of the associations between type of motivation and physical activity (N=807*)

Model Term	Unadj. coefficient	Unadj. sig.	Unadj. 95% CI	Adj. Coefficient[1]	Adj. sig.[1]	Adj. 95% CI[1]
Moderate PA (min/week)						
Autonomous motivation score PA	49	0.147	-17 - 115	56	0.098	-10 - 122
Controlled motivation score PA	-19	0.609	-91 -53	-23	0.531	-95 - 49
Amotivation score PA	-25	0.490	-95 - 45	-29	0.428	-99 - 42
ICC level 2 (type of VET education)	0.007			0.007		
Vigorous PA (min/week)						
Autonomous motivation score PA	20	0.168	-8.4 - 48	19	0.193	-9.4 - 47
Controlled motivation score PA	21	0.190	-10 - 51	22	0.160	-8.7 - 52
Amotivation score PA	-12	0.417	-42 - 18	-19	0.222	-49 - 11
ICC level 2 (type of VET education)	0.135			0.095		
MVPA (min/week)						
Autonomous motivation score PA	69**	0.059	-2.6 - 140	74**	0.043	2.4 - 146
Controlled motivation score PA	8.0	0.842	-70 - 86	6.4	0.873	-72 - 84
Amotivation score PA	-40	0.301	-116 - 36	-51	0.188	-128 - 25
ICC level 2 (type of VET education)	0.027			0.014		

* *2 participants were excluded from analysis due to unrealistically high minutes of PA per week.* ** significant value *α < 0.05.Values were adjusted for the following confounders: gender (m/f), age, weight class (under-, over- and normal weight) and level of VET education (level 1&2, 3 and 4).*

Discussion

The aim of this study was to investigate the association between type of SDT motivation and diet and physical activity behaviours. Motivation partly explained the dietary and physical activity behaviour of vocational students. First, amotivation was associated with consuming more unhealthy products per week and consuming breakfast less often. This type of motivation is thus associated with unhealthy dietary behaviour. Second, high autonomous motivation scores showed a significant correlation with consuming less unhealthy products per week and consuming more water, breakfast and fruit and conducting more MVPA. Autonomous motivation thus seems to explain most of the healthy dietary and physical activity behaviour of vocational students. Third, controlled motivation did not show an association with any of the variables. It thus does not seem to explain the variation in diet and physical activity behaviour of vocational students. For moderate and vigorous physical activity separately, no motivation type seems to be of influence, since no type of motivation showed a significant association. Autonomous motivation is however significantly associated with MVPA, probably due to its large correlation with vigorous physical activity. For diet soda, no significant associations were found either. The most likely explanation for this is that it was not consumed enough in this target group to find any effect.

The average overall motivation scores show that autonomous motivation scored high for both diet and physical activity behaviour, while amotivation scored relatively low. This is interesting, because the vocational students generally did not make very healthy choices, as most dietary and PA guidelines were not met except for the MVPA guidelines in students 18 years and older. Socially desirable answers might have had an influence in this. They could have caused an overestimation of the autonomous motivation scores and an underestimation of the amotivation scores.

The type of VET education did not explain a large part of the variance of the variables. It was expected that type of education was an important factor of clustering in the data, because social norm is very important for emerging adults (33). However, the ICC for water consumption is smaller than 0.001. The other ICCs for dietary behaviour are larger and show that 2.1% to 8.2% of the variance in dietary variables was related to the type of VET education that participants followed. For PA, the ICCs explain 0.7 to 9.5% of the variation. The low intra-class correlation could be due to the fact that the group level variable that was used to adjust for clustering of the data might have been too large or too heterogeneous. Social norms may have more influence in smaller or homogeneous groups, like class level instead of type of VET education.

The associations found in this study are consistent with previous research in other age groups and educational levels. Amotivation shows a negative association with some of the dietary behaviours of vocational students. A possible explanation for this negative association is the indifferent attitude that

vocational students have towards making healthy lifestyle choices. Giles and Brennan (33) found that British late adolescents (aged 18-25) are not willing to put much effort into adopting a healthy lifestyle and thus have a rather indifferent attitude to it. This seems to be the same in Dutch vocational students. If this indifferent attitude leads to amotivation, it could explain its negative effect on dietary behaviour. Amotivation however also showed a significant positive effect on consumption of diet soda. A possible explanation for this is the fact that students show no awareness of calorie content in beverages. It was found that the most important factors for choosing beverages for college students (mean age 19y) were taste and price(49). Health thus might not be an important factor for vocational students when consuming diet soda. Autonomous motivation is described as the type of motivation that facilitates persistence and sustainability of behaviour due to its high levels of autonomy, while controlled motivation does not lead to sustainable behaviour(23,50,51). This explains why autonomous motivation is important in healthy diet and physical activity behaviour in vocational students. Results of other studies follow the same pattern; in early and mid-adolescents, autonomous motivation was found to be associated with increased fruit intake and increased physical activity (27–30) and in vocational students autonomous motivation was found to be associated with MVPA (28). Controlled motivation apparently is not enough to maintain the healthy lifestyle behaviours investigated in this study. It often does not lead to sustainable behaviour, because controlled motivation is characterized by lower levels of autonomy compared to autonomous motivation. This can lead to a relapse to old behaviour, as the external factor that drove the motivation is likely to be removed at some point (52).

Limitations, strengths and recommendations

The first limitation of this study is the use of self-administered questionnaires. This may have caused recall bias. In case of diet and physical activity questions, participants tend to be too positive about their habits (53). In this study, recall bias could thus have led to an overestimation of the diet and physical activity behaviour of the study population. Additionally, the SQUASH questionnaire is known to overestimate the physical activity that participants conduct, which could have caused an overestimation of the physical activity of vocational students (54). The exact effect that these possible overestimations might have had on the found associations cannot be inferred. Second, the cross-sectional nature of this study is a limitation, as type of motivation and behaviour were measured at the same time, their interrelationship does not necessarily reflect a causal association.

Finally, the study population consisted of vocational students from three VET school locations in the urban region of the Netherlands. This makes the results not automatically applicable for VET education in general. Female students were overrepresented in the sample. This may have caused an overestimation of the diet and physical activity behaviour of the study population, because being female is related to having healthier lifestyle habits (40). Furthermore, the sample included a large number of Lifestyle & Sports students. This type of VET education attracts many students that are interested in sports and lifestyle. Therefore, this could have caused an overestimation of the diet and physical activity behaviour of the study population, especially in the amount of physical activity that vocational students engage in. The effects that the above-mentioned factors had on the associations cannot be inferred. The

external validity of this study could thus be improved by obtaining a more representative sample of vocational students.

Despite the above-mentioned limitations, this study is one of the first study to our knowledge that reports associations between type of SDT motivation and dietary and physical activity behaviour of vocational students. Therefore, it provides new and much needed insights in their motivation and health behaviour. Moreover, the large sample size of the study increased its reliability. Furthermore, the use of multilevel analyses strengthened the conclusions of the study, because variability due to clustering of the data was accounted for.

For future research, we recommend diving deeper into the topic of SDT and self-directed health behaviours among vocational students. More insight is needed into the three basic psychological needs, autonomy, competence and relatedness and their relationship with autonomous and amotivation, in order to develop health promoting interventions for this group. In addition to diet and physical activity behaviour, more variables can be investigated to get a more complete picture of the determinants of vocational students' health behaviour.

Implications

The results of this study show a strong association of autonomous motivation with dietary behaviour and MVPA in vocational students. Raising the mean autonomous score for diet with one point could lead to 10-20% increases in the mean scores for healthy dietary choices and a 15% decrease in the mean number of unhealthy week choices. For MVPA, an increase of 74 minutes a week can be accomplished by increasing autonomous motivation with one point. The associations found implicate that autonomous motivation is a reasonable target in the development of health promoting interventions.

A review by Ng et al. (21) showed that enhancing autonomous motivation led to beneficial health outcomes. Furthermore, satisfying basic psychological needs was found to be important. To enhance autonomous motivation, autonomy-supportive interventions must focus on four SDT components. First, they must increase the sense of competence of participants. Second, these feelings of competence must be coupled with feelings of autonomy. Third, interventions must make sure to give participants a sense of security or relatedness. Lastly, extrinsic rewards must be avoided, as they stimulate controlled motivation instead of autonomous motivation (52). One possible intervention to enhance autonomous motivation is motivational interviewing, as this is a method to adhere to behaviour change with many parallels with the mentioned SDT concepts (55). In adolescents, motivational interviewing was found to be effective in promoting several healthy behaviours (56). In addition, the peer relations have a positive effect on autonomous motivation. Gairns et al. (57) found that high school students showed stronger autonomous motivation for physical education class, when they felt a positive relatedness with their fellow classmates. Both motivational interviewing and enhancing positive peer relations could thus be effective in enhancing autonomous motivation among vocational students.

Conclusions

This present study aimed to investigate to what extent each type of SDT motivation for healthy eating and physical activity explains the dietary and physical activity behaviour of vocational students. It contributes to the small body of literature that exists on the health behaviour of vocational students and is one of the first to our studies to investigate the association of health behaviours and SDT motivation in vocational students. In general, diet and PA behaviours of vocational students are poor. On the one hand, autonomous motivation is associated with their healthy diet and PA behaviours. On the other hand, amotivation shows associations with unhealthy dietary behaviours of vocational students. Controlled motivation does not show any associations with their diet and physical activity behaviour. Because of its positive association with healthy diet and physical activity behaviour, autonomous motivation seems to be a valuable target for new, autonomy-supportive interventions to improve the healthy lifestyle of vocational students.

Declarations

Ethics approval and consent to participate

This study is not within the scope of the Dutch Medical Research Involving Human Subjects Act and was therefore exempted from review by the Medical Ethics Committee Southwest Holland (reference number 17-088). All participants provided informed electronic consent prior to providing data.

Consent for publication

Not applicable.

Availability of data and materials

The datasets analysed for the present study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Contributions

AK performed the statistical analysis, contributed to the interpretation of data and drafted the manuscript. GCK coordinated data collection, and contributed to the statistical analysis, interpretation of the data and writing the manuscript. SIV supervised the project and contributed to the interpretation of the data and critically reviewed the manuscript for important intellectual content. All authors read and revised the manuscript critically and approved the final manuscript. AK conducted this project as part of a research internship for the master Health Sciences.

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References

1. McVeigh JA, Winkler EAH, Howie EK, Tremblay MS, Smith A, Abbott RA, et al. Objectively measured patterns of sedentary time and physical activity in young adults of the Raine study cohort. Int J Behav Nutr Phys Act. 2016;13(1):41.
2. Bellou V, Belbasis L, Tzoulaki I, Evangelou E. Risk factors for type 2 diabetes mellitus: An exposure-wide umbrella review of meta-analyses. PLoS One. 2018 Mar 20;13(3):e0194127–e0194127.
3. Aune D, Giovannucci E, Boffetta P, Fadnes LT, Keum N, Norat T, et al. Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality-a systematic review and dose-response meta-analysis of prospective studies. Int J Epidemiol. 2017 Jun 1;46(3):1029–56.
4. Wahid A, Manek N, Nichols M, Kelly P, Foster C, Webster P, et al. Quantifying the Association Between Physical Activity and Cardiovascular Disease and Diabetes: A Systematic Review and Meta-Analysis. J Am Heart Assoc. 2016 Sep 14;5(9):e002495.
5. Lee I-M, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet. 2012 Jul 21;380(9838):219–29.
6. Piirtola M, Kaprio J, Kujala UM, Heikkilä K, Koskenvuo M, Svedberg P, et al. Association between education and future leisure-time physical inactivity: a study of Finnish twins over a 35-year follow-up. BMC Public Health. 2016 Aug 4;16:720.
7. Shrewsbury VA, Foley BC, Flood VM, Bonnefin A, Hardy LL, Venchiarutti RL, et al. School-Level Socioeconomic Status Influences Adolescents' Health-Related Lifestyle Behaviors and Intentions. J Sch Health. 2018 Aug 1;88(8):583–9.
8. Dirven H-J, Mooren F van der. Drinken, roken, bewegen en overgewicht en de onderwijsloopbaan [Internet]. The Hague; 2012. Available from: https://www.cbs.nl/nl-nl/achtergrond/2012/20/drinken-roken-bewegen-en-overgewicht-en-de-onderwijsloopbaan
9. Bernaards CM, Van Buuren S. Rapportage veranderingen in het beweeggedrag van mbo studenten. Leiden: TNO; 2012.

10. Rijpstra A, Bernaards C. De leefstijl van MBO studenten in Nederland 2009/2010. Leiden: TNO; 2011.
11. Bonevski B, Guillaumier A, Paul C, Walsh R. The vocational education setting for health promotion: a survey of students' health risk behaviours and preferences for help. Heal Promot J Aust. 2013 Dec;24(3):185–91.
12. van Duijvenvoorde ACK, Peters S, Braams BR, Crone EA. What motivates adolescents? Neural responses to rewards and their influence on adolescents' risk taking, learning, and cognitive control. Neurosci Biobehav Rev. 2016 Nov;70:135–47.
13. Reyna VF, Farley F. Risk and Rationality in Adolescent Decision Making. Psychol Sci Public Interes. 2006 Sep 23;7(1):1–44.
14. Steinberg L. Cognitive and affective development in adolescence. Trends Cogn Sci. 2005 Feb;9(2):69–74.
15. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging Adulthood and College-aged Youth: An Overlooked Age for Weight-related Behavior Change. Obesity. 2008 Oct 1;16(10):2205–11.
16. Conner M, Norman P. Predicting and changing health behaviour: a social cognition approach. In: Conner M, Norman P, editors. Predicting and changing health behaviour Research an Practice with Social Cognition Models. 3th ed. Maidenhead: McGraw-Hill Education; 2015. p. 1–29.
17. Teixeira PJ, Carraça E V, Markland D, Silva MN, Ryan RM. Exercise, physical activity, and self-determination theory: A systematic review. Int J Behav Nutr Phys Act. 2012 Jun 22;9(1):78.
18. Teixeira PJ, Patrick H, Mata J. Why we eat what we eat: the role of autonomous motivation in eating behaviour regulation. Nutr Bull. 2011 Mar 1;36(1):102–7.
19. Kwasnicka D, Dombrowski SU, White M, Sniehotta F. Theoretical explanations for maintenance of behaviour change: a systematic review of behaviour theories. Health Psychol Rev. 2016 Jul 2;10(3):277–96.
20. Cortis C, Puggina A, Pesce C, Aleksovska K, Buck C, Burns C, et al. Psychological determinants of physical activity across the life course: A "DEterminants of DIet and Physical ACtivity" (DEDIPAC) umbrella systematic literature review. PLoS One. 2017;12(8):e0182709.
21. Ng JYY, Ntoumanis N, Thøgersen-Ntoumani C, Deci EL, Ryan RM, Duda JL, et al. Self-Determination Theory Applied to Health Contexts. Perspect Psychol Sci. 2012 Jul 29;7(4):325–40.
22. Ryan RM, Patrick H, Deci EL, Williams GC. Facilitating health behaviour change and its maintenance: Interventions based on self-determination theory. Eur Heal Psychol. 2008;10(1):2–5.
23. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. Am Psychol. 2000;55(1):68–78.
24. Teixeira PJ, Carraça E V, Marques MM, Rutter H, Oppert J-M, De Bourdeaudhuij I, et al. Successful behavior change in obesity interventions in adults: a systematic review of self-regulation mediators. BMC Med. 2015 Dec;13(1):84.
25. Teixeira PJ, Carraça E V, Markland D, Silva MN, Ryan RM. Exercise, physical activity, and self-determination theory: A systematic review. Int J Behav Nutr Phys Act. 2012 Jun;9(1):78.

26. Curry SJ, Grothaus L, McBride C. Reasons for quitting: intrinsic and extrinsic motivation for smoking cessation in a population-based sample of smokers. Addict Behav. 1997;22(6):727–39.
27. Dwyer LA, Bolger N, Laurenceau J-P, Patrick H, Oh AY, Nebeling LC, et al. Autonomous Motivation and Fruit/Vegetable Intake in Parent–Adolescent Dyads. Am J Prev Med. 2017 Jun;52(6):863–71.
28. Nurmi J, Hagger MS, Haukkala A, Araújo-Soares V, Hankonen N. Relations Between Autonomous Motivation and Leisure-Time Physical Activity Participation: The Mediating Role of Self-Regulation Techniques. J Sport Exerc Psychol. 2016 Apr;38(2):128–37.
29. Dishman RK, Mciver KL, Dowda M, Saunders RP, Pate RR. Motivation and Behavioral Regulation of Physical Activity in Middle School Students. Med Sci Sport Exerc. 2015 Sep;47(9):1913–21.
30. B. Owen K, Smith J, Lubans DR, Ng JYY, Lonsdale C. Self-determined motivation and physical activity in children and adolescents: A systematic review and meta-analysis. Prev Med (Baltim). 2014;67:270–9.
31. Ha AS, Ng JYY. Autonomous Motivation Predicts 7-Day Physical Activity in Hong Kong Students. Appl Psychol Heal Well-Being. 2015;7(2):214–29.
32. Thøgersen-Ntoumani C, Ntoumanis N. The role of self-determined motivation in the understanding of exercise-related behaviours, cognitions and physical self-evaluations. J Sports Sci. 2006 Apr;24(4):393–404.
33. Giles EL, Brennan M. Changing the lifestyles of young adults. J Soc Mark. 2015 Jul;5(3):206–25.
34. Strong KA, Parks SL, Anderson E, Winett R, Davy BM. Weight gain prevention: identifying theory-based targets for health behavior change in young adults. J Am Diet Assoc. 2008;108(10):1708–15.
35. wetten.nl - Regeling - Wet medisch-wetenschappelijk onderzoek met mensen - BWBR0009408 [Internet]. [cited 2019 May 20]. Available from: https://wetten.overheid.nl/BWBR0009408/2019-04-02
36. Levesque CS, Williams GC, Elliot D, Pickering MA, Bodenhamer B, Finley PJ. Validating the theoretical structure of the Treatment Self-Regulation Questionnaire (TSRQ) across three different health behaviors. Health Educ Res. 2006 Oct;22(5):691–702.
37. Ryan RM, Connell JP, Avery R, Grolnick W, Lynch J, Frederick C, et al. Perceived Locus of Causality and Internalization: Examining Reasons for Acting in Two Domains. 1989.
38. De Gezondheidsmonitors | Gezondheidsmonitor [Internet]. [cited 2019 Feb 12]. Available from: https://www.monitorgezondheid.nl/
39. Wendel-Vos GCW, Schuit AJ, Saris WHM, Kromhout D. Reproducibility and relative validity of the short questionnaire to assess health-enhancing physical activity. J Clin Epidemiol. 2003 Dec;56(12):1163–9.
40. von Bothmer MIK, Fridlund B. Gender differences in health habits and in motivation for a healthy lifestyle among Swedish university students. Nurs Heal Sci. 2005;7(2):107–18.
41. Mozaffarian D, Hao T, Rimm EB, Willett WC, Hu FB. Changes in Diet and Lifestyle and Long-Term Weight Gain in Women and Men. N Engl J Med. 2011 Jun;364(25):2392–404.

42. Hjartåker A, Lund E. Relationship between dietary habits, age, lifestyle, and socio-economic status among adult Norwegian women. The Norwegian Women and Cancer Study. Eur J Clin Nutr. 1998 Aug;52(8):565–72.
43. Qi V, Phillips SP, Hopman WM. Determinants of a healthy lifestyle and use of preventive screening in Canada. BMC Public Health. 2006 Dec;6(1):275.
44. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ. 2000 May 6 [cited 2019 Sep 29];320(7244):1240–1240.
45. Benesty J, Chen J, Huang Y, Cohen I. Pearson Correlation Coefficient. In: Noise Reduction in Speech Processing. Springer, Berlin, Heidelberg; 2009. p. 1–4.
46. IBM Statistical Package for Social Sciences [Internet]. [cited 2019 May 20]. Available from: https://www.ibm.com/nl-nl/analytics/spss-statistics-software
47. The Netherlands Nutrition Centre | Voedingscentrum [Internet]. Available from: https://www.voedingscentrum.nl/nl/service/english.aspx
48. Health Council of the Netherlands. Physical activity guidelines 2017. The Hague; 2017.
49. Block JP, Gillman MW, Linakis SK, Goldman RE. “If It Tastes Good, I’m Drinking It”: Qualitative Study of Beverage Consumption Among College Students. J Adolesc Heal. 2013 Jun;52(6):702–6.
50. Deci EL, Ryan RM. The “What” and “Why” of Goal Pursuits: Human Needs and the Self-Determination of Behavior. 2000.
51. Patrick H, Williams GC. Self-determination theory: its application to health behavior and complementarity with motivational interviewing. Int J Behav Nutr Phys Act. 2012 Mar;9(1):18.
52. Conner M, Norman P. Predicting and Changing Health Behaviour: Future Directions. In: Predicting Health Behaviour. Berkshire: Open University Press; 2005. p. 336–8.
53. Paeratakul S, Popkin B, Kohlmeier L, Hertz-Picciotto I, Guo X, Edwards L. Measurement error in dietary data: Implications for the epidemiologic study of the diet–disease relationship. Eur J Clin Nutr. 1998 Oct;52(10):722–7.
54. Nicolaou M, Gademan MGJ, Snijder MB, Engelbert RHH, Dijkshoorn H, Terwee CB, et al. Validation of the SQUASH Physical Activity Questionnaire in a Multi-Ethnic Population: The HELIUS Study. PLoS One. 2016;11(8):e0161066.
55. Markland D, Ryan RM, Tobin V, Rollnick S. Motivational Interviewing and Self Determination Theory. J Soc Clin Psychol. 2005;24(6):811–31.
56. Cushing CC, Jensen CD, Miller MB, Leffingwell TR. Meta-analysis of motivational interviewing for adolescent health behavior: Efficacy beyond substance use. J Consult Clin Psychol. 2014 Dec;82(6):1212–8.
57. Gairns F, Whipp PR, Jackson B. Relational perceptions in high school physical education: teacher- and peer-related predictors of female students’ motivation, behavioral engagement, and social anxiety. Front Psychol. 2015;6:850.