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# Relationships between food insecurity, physical activity, detachment from studies, and students' well-being: A prospective study

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**Objective:** Research on students' well-being has shown that studies may have an impact on well-being. However, this relationship is complex and involves many other parameters (e.g., food security and physical activity). Therefore, the objective of the present study was to investigate the relationships between food insecurity (FI), physical activity (PA), and detachment from studies on the one hand, and student well-being, on the other.

**Method:** A total of 4410 students (mean age = 21.55, 65.192% female) answered an online survey measuring FI, PA, detachment from studies, anxiety, burnout, depression, and satisfaction with life.

**Results:** A structural equation model ( $\chi^2 [18] = 585.739$ , RMSEA = 0.095, 90% CI [0.089; 0.102], comparative fit index [CFI] = 0.92, NNFI = 0.921) indicated that FI negatively predicted, and that detachment from studies and PA positively predicted, the latent variable of well-being.

**Discussion:** The results of the present study highlight that students' well-being is partly determined by FI, detachment from studies, and PA. Therefore, this study highlights the importance of looking at both the diets of students, as well as the activities and experiences they have outside their studies to gain a better understanding of the factors influencing student well-being and the action leverages to promote it.

## KEYWORDS

anxiety, burnout, depression, satisfaction with life, university

## 1 | INTRODUCTION

A recent study among French university students conducted by the Student Life Observatory<sup>1</sup> showed that 37% of students reported signs of psychological distress.

Furthermore, 21.3% of French university students present with signs of depression, anxiety, and stress.<sup>2</sup> These mental health disorders could affect all aspects of a student's life, including cognitive function, psychosocial adjustment, motivation, and especially academic performance.<sup>3,4</sup>

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Research on university student well-being has shown that studying may have an impact on well-being. For example, some specific academic stressors such as workload or role ambiguity were found to be negatively correlated with well-being indicators.<sup>5</sup> Beyond stressors specifically related to studies, other factors can predict student well-being. Among these, food insecurity (FI) appears to be central and has been a subject of increasing interest among government agencies and researchers over the last few years. According to the general inspection of social affairs,<sup>6</sup> almost 20% of the university students in France lived under the poverty line. One consequence of this insecurity is that it directly affects university students' diet. Indeed, a large body of research documents that one of the primary causes of FI is low income.<sup>7</sup> Poverty is closely related to FI.<sup>8</sup> Thus, university students financially independent from their parents,<sup>9,10</sup> carrying debts—mainly to pay tuition fees<sup>10</sup>—or with a family history of financial struggles,<sup>11</sup> are more likely to be food insecure. Moreover, the negative relationships between FI and physical and mental health are well known,<sup>12</sup> and students are not spared.<sup>13</sup> Therefore, it seems relevant to consider FI as a potential predictor of university student well-being.

In addition to FI, many environmental and behavioral factors can influence the well-being of university students.<sup>14,15</sup> Some extracurricular elements may have protective effects on well-being. For example, participation in regular physical activity (PA), as well as being able to recover from studies by taking breaks or taking psychological distance from them, appears to have a significant protective effect.<sup>16–18</sup> These extracurricular behaviors partially buffer the negative effects of stressors on well-being. Thus, the objective of the present study was to examine the relationships between FI and well-being among university students, and to examine the potential protective effect of PA and detachment from studies on the well-being of university students.

## 1.1 | Well-being among students

Even if well-being is a public health concern, there is no clear consensus in the literature on this concept.<sup>19</sup> According to Keyes,<sup>20,21</sup> mental health is a complete state that consists of two dimensions, including a continuum of mental illness and a continuum of well-being.<sup>22</sup> Life satisfaction is one of the most widely used indicators of well-being.<sup>23,24</sup> It refers to a judgmental process in which individuals assess the quality of their lives based on their own unique set of criteria.<sup>25</sup> At the same time, anxiety and depression are the most common indicators of ill-being, specifically among students.<sup>26–28</sup> Anxiety is a negative emotional state that is accompanied by nervousness,

worry, and apprehension, along with high body activation.<sup>29</sup> This is a common experience for humans and can be a functional state. However, when anxiety becomes excessive, it can be classified as an anxiety disorder.<sup>30</sup> Anxiety disorders take many forms, such as phobias, panic disorders, and obsessive–compulsive disorders. Depression is also a common mental disorder characterized by sadness, loss of interest or pleasure, feelings of guilt, or low self-worth, disturbed sleep or appetite, feelings of fatigue, and poor concentration.<sup>31</sup> In France, one in five people has or will suffer from depression in their lifetime,<sup>32</sup> and among university students, the prevalence of depression has been estimated at 16.4%.<sup>33</sup>

Beyond the effects on the general well-being of students, some studies suggest that context-specific indicators are also examined, namely study-related well-being indicators. Burnout was used as a negative indicator of work-related well-being, and Shirom<sup>34</sup> (p. 245) defined it as “an affective reaction to ongoing stress whose core content is the gradual depletion over time of individuals' intrinsic energy resources, including, as the major types of energy resource depletion, emotional exhaustion, physical fatigue, and cognitive weariness”. Several studies have hypothesized that school burnout is a major problem among students and requires examination in studies of these populations.<sup>35–37</sup> Studies have indicated that one in five students (17.9%) experienced burnout in relation to their studies.<sup>37</sup> In France, the highest prevalence of burnout was found among medical students (19.0%) and law students (18.9%), whereas the lowest prevalence was found among sports science students (10.2%) at the university.<sup>38</sup> These observations underscore the relevance of considering this indicator to measure the negative aspects of study-related well-being.

To inform on the potential determinants of student well-being, the biopsychosocial model<sup>39,40</sup> seems particularly interesting. This model posits that health and well-being are determined by complex interactions among biological, psychological, and social factors. PA, diet, and psychological functioning are all important components of this model and can significantly influence well-being. Indeed, regular PA has been associated with improved quality of life and well-being<sup>41</sup>. Furthermore, a healthy diet, rich in fruits, vegetables, whole grains, lean proteins, and healthy fats, has also been shown to have positive effects on well-being<sup>42</sup>. Finally, individual psychological functioning, including emotional regulation and stress management, can also play a crucial role in promoting well-being<sup>43</sup>. Therefore, the biopsychosocial model thus provides a comprehensive framework to understand the complex relationships among PA, diet (i.e., related to FI), and psychological functioning (i.e., in particular detachment from studies), and their combined influence on overall student well-being.

## 1.2 | The role of fi and pa on well-being

FI is a complex, multifaceted, and comprehensive concept that has evolved over time.<sup>44</sup> The Food and Agriculture Organization of the United Nations provides the most complete definition of FI,<sup>44</sup> where FI is defined as a situation in which people lack secure access to enough safe and nutritious food for normal growth and development and an active and healthy life. This may be due to the unavailability of food, insufficient purchasing power, inappropriate distribution, or inadequate use of food at the household level. The “intensity” of FI refers to its severity and could be divided into three levels: (a) food secure/light FI, (b) moderate FI, and (c) severe FI. In the United States, the prevalence of FI is estimated at 35% among college students.<sup>45</sup>

One of the main consequences of FI among students is its adverse effects on their well-being. Indeed, while there is no consensus around a single definition of well-being, there is agreement that well-being is dependent on positive social relationships, self-perceived mental and physical health, and the availability and access to basic resources, such as food.<sup>46</sup> Some studies have shown that students with high levels of FI had lower levels of well-being.<sup>47–50</sup> For example, food-insecure students have higher odds of depression and anxiety.<sup>47</sup> In two studies conducted in the United States, more than half of food-insecure students reported feeling overwhelmed, exhausted, lonely, and/or sad, and stress levels were significantly greater in those students who experienced FI.<sup>48,49</sup> FI can also have long-term effects on well-being. Young adults with a history of FI had higher average levels of depressive symptoms, stress, and disordered eating scores than individuals with no history of FI.<sup>51</sup> Of the studies that examined the relationships between FI and student general health, some also examined student levels of PA levels.<sup>52,53</sup> In particular, one study found that FI was related to less PA, which in turn was related to poorer health.<sup>47,52</sup> Beyond the aspects related to global health, it has been shown that PA can also impact students' well-being.<sup>14,15,54–57</sup> Previous studies including university students indicated that PA was negatively related to anxiety and depression<sup>14</sup> and positively related to life satisfaction, happiness, and affects.<sup>15</sup>

## 1.3 | The role of detachment from studies during leisure time on student well-being

Beyond a dose–response effect between PA and well-being, some studies have focused on the experiences lived during the practice of PA, suggesting that the practice of PA was not only the condition for its effectiveness, and that

the experiences lived could maximize its effect on well-being.<sup>58–60</sup> Thus, some studies have also found that the process of recovery, aiming to restore personal resources depleted by the demands that individuals face in different domains, is a predictor of well-being.<sup>61–63</sup> Recovery is described as the result of replenishing psychological and physical resources that have been depleted by facing demands.<sup>64</sup> de Jonge et al.<sup>63</sup> focused on the recovery mechanism of detachment from work, which has been widely studied and is often identified as the most effective recovery mechanism.<sup>65</sup> Detachment from work or studies is a subjective experience that corresponds to the fact that one is no longer thinking about work or studies, leaving it aside during free time. The literature provides increasing evidence regarding the benefits of detachment from work. For instance, in the work context, employees who detach from work during leisure time report lower levels of burnout,<sup>16</sup> depression,<sup>17</sup> and higher life satisfaction.<sup>18,66</sup> Therefore, it is possible that detachment from studies can have a significant influence on study-related well-being. Indeed, detachment was hypothesized to be a particularly interesting experience for students at the university, and it was positively related to the need for recovery, engagement, and study satisfaction, which are indicators of well-being.<sup>5,67</sup>

## 1.4 | Additive relationships of FI, PA, and detachment from studies with student well-being

To our knowledge, no previous study has jointly examined the additive relationships of these three variables with student well-being. However, considering the relationships of these three variables with well-being together could reduce the risk of finding under- or overestimated effects, as some studies have found some links between these variables.<sup>65,68</sup> Investigating the additive relationships of these three variables with student well-being allowed, for example, the relationship of PA with well-being to be determined while controlling for the relationships of FI and detachment from studies with well-being. Since these three variables appear to have a unique influence on student well-being, it is relevant to examine whether they also have the same influence when studied together through a single model.

## 1.5 | Objectives and hypotheses

Taking into account the elements presented above, the objective of the present study was to investigate the relationships between FI, PA, and detachment from studies, on the one hand, and the well-being university students,

on the other. In view of the theoretical elements and the results of existing studies, we can assume that FI is negatively and that PA and detachment from studies are positively related with university student well-being.

## 2 | METHODS

### 2.1 | Participants and procedure

Participants were recruited from the authors' university. To be included, participants had to be part of a postgraduate course in this university and speak French. First, an email presenting the study was sent to the students' mailing list by the administrative service of the Student Life Branch (i.e., “*service de la vie étudiante*”) in the beginning of February 2021. This mailing list is intended for the 59 000 students of the university. To enhance the visibility of this email and capture the attention of the participants, this email was sent a second time, and the heads of the training departments of each university were invited to relay this email. The email contained a description of the study: the main purpose, what is expected of participants, information about participation (e.g., voluntary participation, confidentiality of the study), and contact information of the researchers if students had questions about the study. The online questionnaire was open for 1 month from the time the first email was sent. Informed consent was obtained from all individual participants included in the study at the beginning of the online questionnaire. The present research followed the ethical principles of American Psychological Association (APA) (Ethics Committee of the American Psychological Association, 1996). Institutional approval was obtained from the data protection delegate of the first author's university prior to conducting the global research project.

### 2.2 | Measures

The online survey was conducted in two parts. The first part asked for demographic information and FI measures, while the second part assessed school burnout, life satisfaction, depression, anxiety, PA, and detachment from studies during leisure. For all measures, students were asked to indicate what they have experienced since the beginning of the academic year (September).

#### 2.2.1 | Food insecurity

FI was assessed using a French adaptation of the Food Insecurity Experience Scale (Food Insecurity Experience

Scale | Voices of the Hungry | Food and Agriculture Organization of the United Nations) composed of eight items. The instruction was adapted from the original version. In the present study, participants were asked to refer to the beginning of the academic year when they responded to the scale. Items were assessed from the lower level of severity (e.g., “... you were worried you would not have enough food to eat because of a lack of money or other resources”) to the higher (e.g., “... you went without eating for a whole day because of a lack of money or other resources”). The sum of the items (i.e., Yes = 1 and No = 0) defined the level of severity. According to the Food and Agriculture Organization of the United Nations, it is not a question of disruption, but rather a continuum from a security level to a severe insecurity one. However, on this continuum, the Food and Agriculture Organization of the United Nations proposes two thresholds to categorize the respondents into different levels. The first threshold is fixed at the fourth item (i.e., eating less than normally). When responding “Yes” to this item, the participants were in the *moderate food insecurity* zone. The second threshold corresponds to the last item (i.e., spending an entire day without eating) and places respondents on the *severe food insecurity* level.<sup>69</sup>

#### 2.2.2 | Burnout

Burnout was measured using the French version of the Shirom–Melamed Burnout Measure.<sup>70</sup> This scale is composed of 14 items, including five for cognitive weariness (e.g., “I feel I'm not focused on my thinking”), six items for physical fatigue (e.g., “I feel tired”), and three items for emotional exhaustion (e.g., “I feel I am not capable of investing emotionally with my classmates”). The stem asks participants to indicate how often they experienced the different affects described in the questionnaire since the beginning of the academic year, using a 7-point Likert scale ranging from (1) “Never or almost never” to (7) “Always or almost always”. The stem was adapted to online courses because of the COVID-19 lockdown context. Items addressing “colleagues” in the original version were adapted to address “classmates”. A score was calculated for each of the three dimensions and the general score for burnout was calculated by averaging all the items. Confirmatory factor analysis (CFA) was performed to examine the factorial structure of the scale, and revealed an acceptable model fit:  $\chi^2(62) = 2272.82$ , comparative fit index (CFI) = 0.93, TLI = 0.92, RMSEA = 0.094 [0.91; 0.98], SRMR = 0.05 (for details see the R script in the online supplementary material). The Cronbach coefficient to assess the internal consistency was acceptable for all the



subscales ( $0.82 > \alpha > 0.90$ ), and for the general construct of burnout ( $\alpha = 0.91$ ).

### 2.2.3 | Satisfaction with life

Life satisfaction (SWL) was measured using the French adaptation of the Satisfaction with Life Scale.<sup>71</sup> The five items were answered using a 7-point Likert scale ranging from (1) “strongly disagree” to (7) “strongly agree”. A sample item of the scale is, “I am satisfied with my life.” The average of all scores was calculated and compared with the average of the interpretation scale. The Cronbach coefficient to assess the internal consistency was acceptable for this scale ( $\alpha = 0.84$ ).

### 2.2.4 | Anxiety and depression

Anxiety and depression were evaluated using the French version of the Hospital Anxiety and Depression Scale.<sup>72</sup> The 14 items included seven items on depression and seven items on anxiety. Participants responded on a 0-to-3-point scale with different answer possibilities for each item. The time frame was modified from “the last week” to “since the beginning of the academic year in September”. Depression was measured through items such as “I still enjoy the things I used to enjoy” with answer possibilities such as (0) “Definitely as much”, (1) “Not quite so much”, (2) “Only a little”, and (3) “Hardly at all”. A sample item for anxiety is “Worrying thoughts go through my mind”. The answers to this item were (3) “A great deal of time”, (2) “A lot of the time”, (1) “From time to time, but not too often”, and (0) “Only occasionally”. The first item of the depression subscale (i.e., “I still enjoy the things I used to enjoy”) was removed according to CFA and reliability analyses. Thus, a CFA was performed to examine the factorial structure of the scale and revealed an acceptable model fit:  $\chi^2(64) = 1128.43$ , CFI = 0.93, TLI = 0.91, RMSEA = 0.064 [0.61; 0.68], SRMR = 0.048 (for details see the R script in the online supplementary material). The Cronbach coefficient to assess the internal consistency was acceptable for anxiety ( $\alpha = 0.79$ ), and for depression ( $\alpha = 0.70$ ) after removing the first item of the scale.

### 2.2.5 | Self-reported PA

PA levels were measured using the Saltin Grimby Physical Activity Level Scale (SGPALS<sup>73</sup>). The instruction has been slightly modified regarding the timeframe to embrace the entire academic year: “In general, since the start of the academic year (September), how would you define your

PA “profile” (choose one of the four options)? If an activity varies greatly from week to week, try to estimate an average”. Four options were provided. Participants could choose a profile between (1) “Sedentary”, (2) “Light PA”, (3) “Moderate PA”, and (4) “Regular hard physical training for competitive sports”. Previous investigations have shown that this instrument successfully discriminates sedentary and active individuals.<sup>73–76</sup>

### 2.2.6 | Detachment from studies during leisure time

Detachment from studies during leisure time was assessed by using the DISC-R questionnaire.<sup>63</sup> The French version of this questionnaire was obtained after a back-translation process, and the items were slightly adapted to the student population. The timeframe was adapted to fit the survey. The 12 items included four for physical detachment (e.g., “I got a break from the physical demands of my studies”), four for mental detachment (e.g., “I mentally distanced myself from my studies”), and four items for emotional detachment (e.g., “I put all emotions from studies aside”). Participants’ detachment from studies was assessed using a 7-point Likert-type scale ranging from (1) “strongly disagree” to (7) “strongly agree”. CFA was performed to examine the factorial structure of the scale and revealed a poor model fit:  $\chi^2(51) = 3200.68$ , CFI = 0.86, TLI = 0.82, RMSEA = 0.127 [0.123; 0.130] (for details, see the R script in the online supplementary material). The Cronbach’s coefficient assessing internal consistency was acceptable for all subscales ( $\alpha = 0.84$ ), except for physical detachment ( $\alpha = 0.59$ ). We retained the three lowest items of physical detachment because none of them would have substantially increased the alpha coefficient if it were deleted and because their factor loadings of the observed indicators on the factor were acceptable (i.e.,  $> 0.40$ ;<sup>77</sup>). In addition, as we will use the general score of detachment, and not the score of each subscale separately, we computed Cronbach’s coefficient to assess the internal consistency for the whole scale. The latter was considered good ( $\alpha = 0.89$ ).

## 2.3 | Statistical analysis

First, data cleaning was performed to identify duplicates and skewed responses. Second, the structure of the questionnaires and the reliability of the subdimensions were verified using confirmatory factor analyses and the calculation of the Cronbach’s alpha.

The hypotheses were tested using structural equation modeling (SEM) with the Lavaan package version 0.6-3

TABLE 1 Descriptive statistics and correlations.

	M	SD	Observed range	1	2	3	4	5	6	7
1. Gender	1.334	0.472	—	—	—	—	—	—	—	—
2. Food insecurity	0.723	1.066	1–2	0.007	—	—	—	—	—	—
3. PA	2.024	0.922	1–4	0.107***	–0.119***	—	—	—	—	—
4. Detachment from studies	2.653	0.730	1–5	0.189***	–0.092***	0.181***	—	—	—	—
5. Anxiety	9.708	4.286	0–21	–0.225***	0.240***	–0.111***	–0.407***	—	—	—
6. Depression	7.366	3.290	0–21	–0.057***	0.269***	–0.237***	–0.343***	0.512***	—	—
7. Burnout	4.218	1.108	1–7	–0.058***	0.249***	–0.247***	–0.311***	0.589***	0.602***	—
8. SWL	4.409	1.268	1–7	–0.059***	–0.379***	0.197***	0.221***	–0.402***	–0.514***	–0.473***

Note: Correlations are in a between-person level ( $n = 4012$ ).

Abbreviations: M, mean; PA, physical activity; SD, standard deviation; SWL, satisfaction with life.

\*\*\* $p < 0.001$ .

in R (<https://www.R-project.org/>). Considering the correlations between burnout, anxiety, depression, and life satisfaction ( $0.311 < |r| < 0.602$ ; see the correlation matrix in Table 1), we created a latent variable representing students' well-being with mean scores for burnout, satisfaction with life, anxiety and depression as observed variables. Using a two-step method, CFA was used to assess the measurement model, followed by an assessment of the hypothesized model. This approach first establishes the fit of the measurement model by examining the relationship between the observed variables (e.g., satisfaction with life, depression, anxiety, and burnout). Second, we tested the fit of the structural model (i.e., the presumed relationships between the independent variables and the latent well-being variable). The fit of the models was evaluated by examining the comparative fit index (CFI), the Normed-Fit Index (NFI), and the root-mean-square error of approximation (RMSEA). A satisfactory model fit was indicated by a CFI and NFI over 0.90 and an RMSEA below 0.05.<sup>78</sup> We tested an SEM model in which FI, PA, and detachment from studies were presumed to predict well-being, in which we added sex (women were coded 0), age, financial status, amount of money allocated monthly to food supplies, and the university domain studied as control variables for well-being. Insignificant paths were removed from the final model and the most parsimonious model is presented.

### 3 | RESULTS

#### 3.1 | Descriptive results

Of the 59000 students of the university, 4410 participants responded to the online survey (which represents a response rate of 7.5%). Then, 33 answers were removed because of duplicates, and four answers were removed because the participants indicated that they did not respond seriously to the questionnaire. After cleaning the data and removing incomplete answers, the final data set comprised 4012 full answers. Participants from approximately 40 education departments answered the survey, providing a varied sample. The mean age was 21.55 (SD = 4.05). Of the total sample, 65.19% were female and 19.93% had jobs. The average budget to live per month was €616.29 (SD = 507.85) and the average budget dedicated to food was €142.41 (SD = 134.02). The majority lived in a location (32.02%), familial house (28.25%), or colocation (21.05%).

On average, 75% of students experience moderate to high levels of burnout (i.e., the highest two-thirds of the scale), 41% of students experience a definite symptomatology of anxiety (i.e., the highest third of the scale), and 25% are classified as suspected symptomatology (i.e.,

the second-highest third of the scale). The percentage of depression is 17% for definite symptomatology (i.e., the highest third of the scale), and 26% for suspected symptomatology (i.e., the highest third of the scale). Additionally, 62% of students report a very low to an average level of satisfaction with life. Finally, 29% of the participants experience light FI, 12% experience moderate FI, and 2% experienced severe FI.

### 3.2 | Structural equation modeling results

First, the analysis confirmed the relevance of the measured model that contains the latent variable. According to the modification indices, covariances between satisfaction with life and anxiety, satisfaction with life and depression, burnout and anxiety, and burnout and depression were added to improve the model fits.<sup>79</sup> We then tested the structural model by adding all the independent variables, as presented in Figure 1. The model fit indices were acceptable ( $\chi^2 [18] = 585.739$ , RMSEA = 0.095, 90% CI [0.089; 0.102], CFI = 0.92, NNFI = 0.921).

The results indicate that satisfaction with life ( $\lambda = 0.67$ ,  $p < 0.001$ ), burnout ( $\lambda = -0.69$ ,  $p < 0.001$ ), anxiety ( $\lambda = -0.73$ ,  $p < 0.001$ ), and depression ( $\lambda = -0.71$ ,  $p < 0.001$ ) significantly contributed to defining the latent well-being variable. These results also show that FI was significantly and negatively linked to the latent variable of well-being ( $\gamma = -0.36$ ,  $p < 0.001$ ). Detachment from studies was significantly and positively linked to the latent variable of well-being ( $\gamma = 0.39$ ,  $p < 0.001$ ). PA was linked to the latent variable of well-being significantly and positively ( $\gamma = 0.14$ ,  $p < 0.001$ ). Gender was also significantly and positively linked to the latent variable, but less than previous variables ( $\gamma = 0.08$ ,  $p < 0.001$ ), meaning that boys report slightly higher well-being than girls. The percentage of the explained variance of the latent variable of

well-being is  $R^2 = 0.375$ , which means that the four independent variables explain almost 38% of the variance in well-being.

## 4 | DISCUSSION

Research on university student well-being has shown that academics can have an impact on well-being.<sup>5</sup> Beyond stressors specifically related to studies, other factors could be linked to student well-being. Among these, FI, PA, and detachment from studies during leisure time seem to be central and have been the subject of increasing interest among government agencies and researchers over the last few years. The objective of the present study was to investigate relationships between FI, PA, detachment from studies on the one hand, and well-being, on the other.

### 4.1 | Food insecurity and student well-being

The results have highlighted that FI was negatively related to the latent well-being variable represented by life satisfaction, burnout, anxiety, and depression. These results confirmed our hypotheses. Therefore, we can argue that FI has a significantly negative association with well-being. These results are in line with those of previous studies.<sup>47-49</sup> Indeed, previous studies have found that students who were categorized as food insecure had a higher risk of depression than food-secure students,<sup>47</sup> that food-insecure students had poorer health and more difficulty concentrating on their studies,<sup>48</sup> and that FI was linked to poorer mental health.<sup>49</sup> Although this field of research is quite recent, our results, together with those of the other past studies, suggest the importance of considering perceived FI in the future when examining university student well-being.

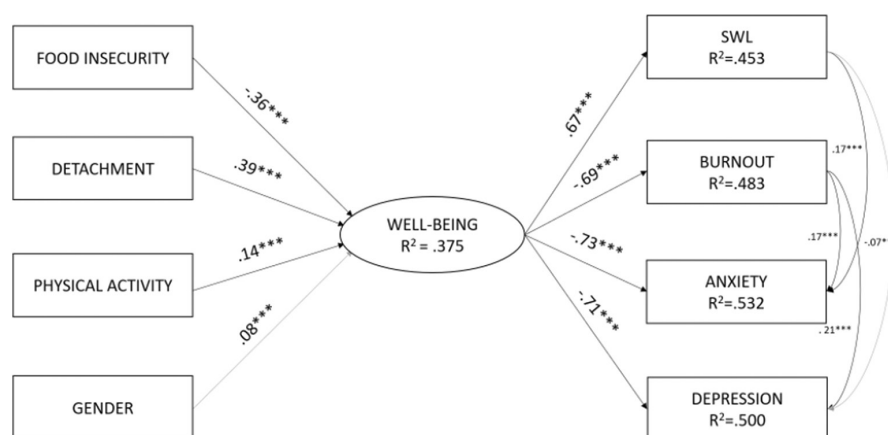


FIGURE 1 Structural equation modeling of student well-being model. \*\*\* $p < 0.001$ . Variances and covariances were not displayed to improve readability.



## 4.2 | PA and student well-being

Previous work of Zhang et al. identified that PA was positively linked to life satisfaction, happiness, positive affect, and negatively linked to affect in a student population.<sup>15</sup> Additionally, PA was negatively related to anxiety and depression.<sup>14</sup> Our results were in line with these conclusions and confirmed that PA was positively linked to the latent variable of well-being composed of depression, anxiety, life satisfaction, and burnout. These results confirm our hypotheses and are linked to past studies concerning the relationships between FI and university student well-being.

## 4.3 | Detachment from studies and student well-being

Our results also confirmed the positive effect of detachment from studies on well-being, supporting our hypotheses regarding life satisfaction, anxiety, depression, and burnout. These results are in line with previous results from occupational health psychology and among university students. Indeed, research has highlighted that employees who detach from work during leisure time report lower levels of burnout,<sup>16</sup> depression (Muhamad Nasharuddin et al., 2020), and higher life satisfaction.<sup>18,66</sup> Moreover, studies among university students confirm that detachment was negatively linked to need for recovery, and positively linked to engagement and satisfaction with studies.<sup>5,67</sup> These results highlight that it is relevant to consider detachment from studies when examining students' well-being.

## 4.4 | Additive relationships of FI, PA, and detachment from studies with student well-being

In addition to the above results, it is important to note that in this study, we examined the additive relationships of FI, PA, and detachment from studies in the same model. This allowed us to discuss the effect of FI, PA, or detachment from studies on student well-being, controlling for the relationships of other independent variables (e.g., PA and detachment from studies). Thus, the risk of a Type 1 error is reduced compared to performing the three models with only one independent variable to explain student well-being. The results of the present study highlight that the student level of well-being is in part determined by FI, detachment from studies, PA, and, to a lesser extent, gender. This finding is consistent with the theoretical choices of this study. However, these five variables explained 35% of

the variance in the latent well-being variable. This means that part of the variance in the present concept of student well-being is still not explained.

## 4.5 | Strength, limitations, and perspectives

One of the greatest strengths of this study is that it examined the additive influence of three variables (i.e., FI, PA, and detachment from studies) that are known to affect student well-being but have always been studied separately. Thus, it allows us to know the influence of each variable more precisely and, therefore, to propose more precise directions for future research and practical implications. Furthermore, the number of university students who participated in this study (i.e., more than 4000) as well as the variety of their characteristics (e.g., girls/boys, fields of study) is also a strength of this study, which allows for a greater generalization of the results.

Despite the precautions taken during the design and execution of this study, several limitations were identified. First, it would have been interesting to measure demands and resources in the online survey. However, this study is part of a larger project (i.e., Student Food, Nutrition, and Health Project, “*Projet Étudiant Alimentation NUTrition et Santé*”) that includes other substudies and laboratories. Therefore, the online survey was a common base for all members of the project and it was not possible to add a large number of variables to preserve the students and not exhaust them when answering the online questionnaire.<sup>80</sup> Second, the cross-sectional nature of this study does not allow for the examination of changes over time and reciprocal influences between the different variables. It would then be interesting to conduct a longitudinal follow-up on FI, PA, detachment from studies, and well-being among students.

In this study, we focused on PA to explain well-being; however, other activities—named “resource-providing activities”—had a positive effect on the level of well-being.<sup>65</sup> Creative, expressive, social, and low-effort activities are part of it. Future research could explore the effects of these activities on student well-being. In the same vein, detachment from studies is not the only psychological experience that positively affects well-being. Sonnentag et al.<sup>65</sup> grouped these experiences under the name “recovery experiences”. To date, research that has tested the effects of recovery experiences in students has found an effect of detachment from work.<sup>5</sup> Therefore, we selected this recovery experience. However, Ragsdale et al. also showed significant effects of relaxation and control experiences. Future studies should also examine these different recovery experiences to determine whether they have a significant effect on students' well-being.<sup>5</sup>

## AUTHOR CONTRIBUTIONS

*Conceptualization:* Karine Couturier, Clément Ginoux, and Sandrine Isoard-Gauthier. *Methodology:* Karine Couturier, Clément Ginoux, and Sandrine Isoard-Gauthier. *Formal analysis and investigation:* Clément Ginoux, Romain Petit and Dulce Dias. *Writing—original draft preparation:* Sandrine Isoard-Gauthier. *Writing—review and editing:* Karine Couturier, Clément Ginoux, Romain Petit, Philippe Sarrazin, Viviane Clavier, and Dulce Dias. *Funding acquisition:* Viviane Clavier, Karine Couturier, and Sandrine Isoard-Gauthier. *Supervision:* Sandrine Isoard-Gauthier.

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## CONFLICT OF INTEREST STATEMENT

Sandrine Isoard-Gauthier, Clément Ginoux, Romain Petit, Dulce Dias, Viviane Clavier, Philippe Sarrazin, and Karine Couturier declare that they have no competing interests.

## DATA AVAILABILITY STATEMENT

Supplemental files, data, experimental materials, and code of statistics analyses have been made publicly available at the Open Science Framework (OSF) and can be accessed at [https://osf.io/sgm57/?view\\_only=4c6ac09c88aa473a91b7b498741d3a09](https://osf.io/sgm57/?view_only=4c6ac09c88aa473a91b7b498741d3a09).

## CONSENT TO PARTICIPATE

Informed consent was obtained from all individual participants included in the study.

## CONSENT FOR PUBLICATION

Consent for publication was obtained from all individual participants included in the study.

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