

An Analysis of Critical Thinking Skills and Nutrition and Health Literacy of Students

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Abstract. This study used a cross sectional design, which focused on the relationship between critical thinking skills and nutrition and health literacy. The research subjects were 102, first year (37 students) and second year (65 students) Culinary Education students. Critical thinking skills level was obtained by providing multiple choice tests, with score grade of 1-4. Nutrition and health literacy level was obtained by providing questionnaires from Nlit and The Newest Vital Sign. The relationship degree was analyzed by using Pearson correlation. Meanwhile, the difference in year of admission and gender were tested using independent sample t-test. The results showed that there was a correlation of $r = 0.304$ with $p = 0.002$ for the critical thinking skills and nutrition and health literacy. The critical thinking skills of first year students (65.7 ± 4.5 , very high) was not significantly different ($p = 0.735$) with second year students (66.0 ± 4.1 , very high). Nutrition literacy and health of first year students (45.9 ± 9.8 , high) were significantly different ($p = 0.045$) with second year students (49.2 ± 6.5 , high). The critical thinking skills of male students was higher (68.5 ± 3.4 , very high) and not significantly different from that of female students (65.5 ± 4.3 , very high). The nutrition and health literacy of male students (68.5 ± 3.4 , very high) was higher and significantly different than female students (65.5 ± 4.3 , very high).

Key words: critical thinking skills; nutrition and health literacy; students.

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INTRODUCTION

Young adulthood which is around 18 to 26 years (including college students) is a critical period in life, which bridges adolescence and independent adulthood. Adolescents and young adults (10–30 years) are positive and active agents of change, by 2030 (WHO, 2018). Young adulthood is a critical period to protect health. Habits that are common include no-breakfast, no-exercise, and no-having regular physical and dental checkups, but more inclined to eastern fast food, contracting sexually transmitted diseases, smoking, consuming marijuana and drugs, as well as alcohol. The health profiles of that group include hypertension (25%), prehypertension (69%), diabetes (7%), and prediabetes (27%). One-fifth of young adults had suffered from mental illness in the past year, even 4% of them were in a serious condition (WHO, 2020).

On the other hand, the current challenges are about living in a more global and networked world, rapid technological change, and economic challenges. These conditions affect the increase of challenges in the world of work. A study result showed that the desired and very important skills of college graduates for employers include verbal communication (95 %), collaboration and work

ethic (94 %), and critical thinking and problem solving skills (92%), skills related to English (88%), mathematics (66%), science (33%) (Kyllonen, 2012). To match the demands of the world of work, universities need to prepare graduates who have these competencies. The 21st century has proclaimed that the must-have skills of students in the "Four Cs" are critical thinking, communication, collaboration, and creativity (National Education Association, 2019).

Critical thinking is a convergent thinking pattern, where there is a process of processing information from various points of view to produce a decision (Sani, *et al.*, 2019). A research result related to critical thinking skills showed that peer groups who work together (collaborating) in solving problems have higher critical thinking skills (Mahalingam, *et al.*, 2017), and it increased after an 8-week program (Lee, *et al.*, 2020). A research of group (pretest to posttest) or between groups (simulation versus written case study) found that there was no difference in critical thinking (Blakeslee, 2020). There is no significant difference between students who have low and high critical thinking in explicit textual reading. However, when reading implied texts and item-based scripts, the

two groups differ significantly (Heidari, 2020). The development of critical thinking skills is done by explicitly integrating them into courses (Caceres, *et al.*, 2020). In this study, the research was conducted on students of the Culinary Education Program who received several courses (MK) related to nutrition, which are Nutrition Science (semester 1), Applied Nutrition (semester 2), and Special Physiological Food (semester 4).

The three subjects above focus about the concept of nutrition, nutritional components related to health, nutritional needs and nutritional adequacy and their application to regulating food patterns for both healthy people and people with illness. Nutrition and health literacy measurements were carried out to determine the success and its application process in daily life. Nutrition literacy is the skills to distinguish between evidence-based and accurate nutrition knowledge or information from non-factual knowledge or information (for example, the skills to read labels and read recipes, seek reliable information and food literacy (Thomas, *et al.*, 2019) and the needs to make appropriate nutritional decisions (Gibbs, *et al.*, 2018). Health literacy is the extent to which an individual has the skills to obtain, process, and understand basic health information and services needed to make a proper health decision (Carbone, *et al.*, 2012), in health care, disease prevention and health promotion (Okan, *et al.*, 2018, Denuwara, *et al.*, 2017).

The nutrition literacy assessment result of students of Faculty of Health Sciences of the Istanbul Aydin University, Turkey, showed that the score obtained by female students (69.72 ± 8.59) was significantly ($P < 0.001$) higher than that of male students (64.98 ± 10.15) (Kalkan, 2019). The results of health literacy research in Germany showed that people at the age of 15-29 years have limited health literacy which is 47.3% (Berens, *et al.*, 2016). Youngsters at the age of 12-15 years in China have a low level of health literacy, which is 25.5 % (Ran, *et al.*, 2018). Nutrition is always related to health. A more comprehensive and sensitive research combines nutrition literacy and health literacy to become nutrition and health literacy.

In nutrition and health literacy, it is necessary to understand, analyze and make the right nutrition and health decisions. This requires critical thinking skills which include analyzing arguments, claims or evidence, making inferences using inductive and deductive reasoning, judging or evaluating, and making

decisions or solving problems (Sani, 2019). This study aims to analyze the critical thinking skills and nutrition and health literacy of the students of the Culinary Education, Faculty of Engineering, UNNES

METHOD

Research Goal

The purposes of this study are 1) to analyze the relationship between critical thinking skills and nutrition literacy and health of students at the Culinary Education, Faculty of Engineering, UNNES, 2) to differentiate the level of critical thinking skills based on the year of study and gender, and 3) to differentiate the level of nutrition and health literacy based on the year of study and gender.

Sample and Data Collection

The study was conducted in a cross sectional manner which was taken in the same period of time (Jacobs, *et al.*, 2012). The research sample was the students of the Culinary Education Program of UNNES. There were 102 students consisting of 37 first year students and 65 second year students.

Critical thinking skills was measured using a multiple choice test instrument on the concept of balanced nutrition with a scoring guide (scale 1 - 4), according to the stages of the thinking process to solve problems correctly. The critical thinking components studied include the skills to argue, to make inferences (deductive and inductive thinking), and to evaluate, as well as to make the best solution (Sani, 2019). Nutrition and health literacy was measured by the combination of NLit (Gibbs, *et al.*, 2018) and The Newest Vital Sign (NVS) used by Cha, *et al.* (2014). The components of nutrition and health literacy include: 1) nutrition and health, 2) sources of energy in food, 3) food labels and numeration, 4) household food measurement, 5) food groups, 6) consumer skills, 7) nutrition labels. The scoring is based on the reference guidelines above, which are true 1 and false 0. The Indonesian translation and the content completeness of the questionnaires (international standard) on the level of nutrition and health literacy modified, especially for types of food, was validated.

Analyzing of Data

The data was analyzed by using a person correlation (r) technique to determine the relationship between variables using. The differences in the years of study was determined

using the t-test independent sample and the gender was determined using SPSS 25 software (Bonamente, 2017).

RESULTS AND DISCUSSION

The skills to think critically is deemed as one of the 21st century skill possessed by the students of the Culinary Education Program that belongs to “very high” category. This shows that students have been able to process the information received (balanced nutrition) from various sources correctly to then apply it in everyday life. The three components of critical thinking skills are the skills to argue, inference, and make decisions which included in “very high” category, except for the evaluation component which is in “high” category (Table 1). The inference skills obtained the highest score (18.0), indicating that the students' skills to express ideas was in accordance with the information obtained. The skills to evaluate still needs to be improved. It is the skills to assess the strength of information based on arguments that support the conclusions or how strong the evidence are provided for claims.

Tabel 1. The Description of the Critical Thinking Skills Components of Culinary Education Students

Component	Minimum	Maximum	Mean	Deviation Std.	Category
Argumentation skills	10	20	16.6	2.4	Very High
Inference skills	11	20	18.0	1.9	Very High
Evaluation skills	11	19	15.4	2.1	High
Decision making skills	10	20	15.8	2.3	Very High
Critical Thinking Skills	57	75	65.9	4.2	Very High

Nutrition and Health literacy of Culinary Education students is in “high” category with a mean score of 48.0 ± 8.0 (Table 2). Very high literacy is found in the food group component, which is about choosing the type of food based on the source of nutrients. The lowest literacy is found in food labels and numeration, which is about reading and calculating nutritional value information written on food packaging and the relationship between portions and nutritional value.

Tabel 2. The Description of the Nutrition and Health Literacy Components of Culinary Education Students

Component	Minimum	Maximum	Mean	Deviation Std.	Category
Nutrition and health	3	10	7.9	1.9	High
Source of energy in food	5	10	7.8	1.1	High
Food Labels and Numerations	0	7	2.7	1.7	Medium
Household food measurement	1	10	7.1	2.2	High
Food group	7	16	13.3	2.2	Very High
Consumer skills	2	9	5.4	1.4	High
Health nutrition label	0	6	3.8	1.4	High
Nutrition and Health Literacy	27	61	48.0	8.0	High

If the data in Table 1 and Table 2 were analyzed for the relationship using *person correlation*, the r value was 0.304 with $p = 0.002$. This figure shows a significant correlation between critical thinking skills with health literacy, with a low correlation.

Based on the student's year of admission - the first year and the second year - it is known that there is no difference in critical thinking skills. They have almost the same average score. The difference in nutritional and health literacy scores is around 3.3 (Table 3), which shows a significant difference in nutritional and health literacy levels between students' year of admission.

Tabel 3. The Differences in Critical Thinking Skills and Nutrition and Health Literacy According to the Year of Admission of Culinary Education Students

Year of Admission	Critical Thinking Skills	Nutrition and Health Literacy
First year	66.0 ± 4.1^a (very high)	49.2 ± 6.5^a (high)
Second year	65.7 ± 4.5^a (very high)	45.9 ± 9.8^b (high)

Based on the year of admission, the very high category of critical thinking skills in the second year students (90, 8%) was more than the first year students (83,8%) (Figure 1). For nutrition and health literacy, the number of second year students with very high category of nutrition and health literacy is less than the first year students. On the other hand, the number of second year students who have high category of nutrition and health literacy is more than the first year students. Overall, students who have very high and high category of nutrition and health literacy are 36.3% and 53.9%, respectively (Figure 2).

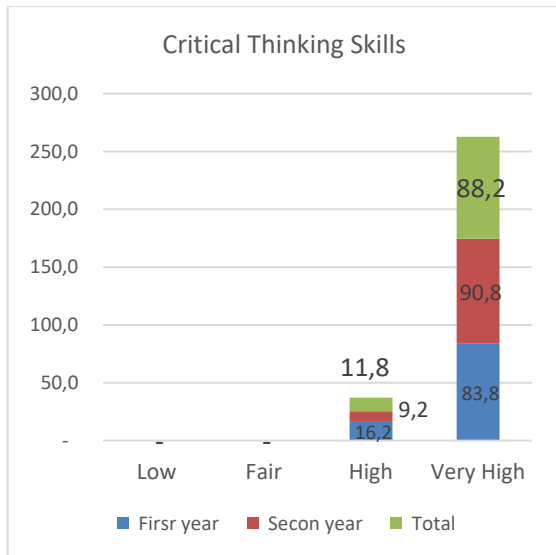


Figure 1. Critical Thinking Skills based on

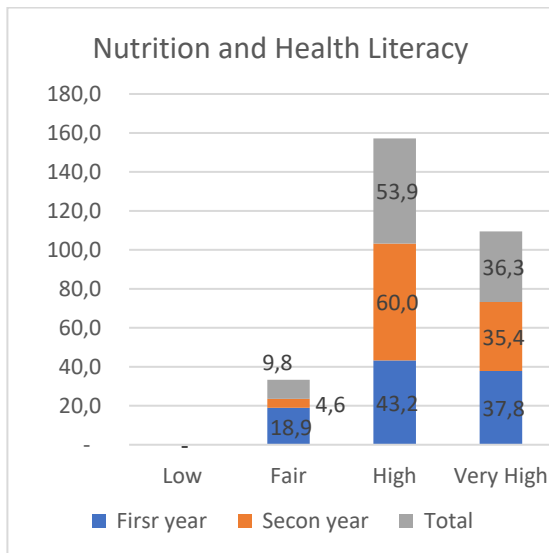


Figure 2. Nutrition and Health Literacy based on Students' year of admission Students' year of admission

The results were the same for the test of differences based on gender. The critical thinking skills of male students is not different from that of female students, which was "very high" category. However, the level of nutritional and health literacy of men is higher than that of female students with a significant difference (Table 4). The score is higher for male students, both in critical thinking skills as well as nutritional and health literacy.

Table 4. The Differences in Critical Thinking Skills and Nutrition and Health Literacy According to Gender of Culinary Education Students

Gender	Critical thinking skills	Nutrition and health literacy
Male	68.5 ± 3.4 ^a (very high)	53.7 ± 4.0 ^a (very high)
Female	65.5 ± 4.3 ^a (very high)	47.2 ± 8.1 ^b (high)

All male students' critical thinking skills is in "very high" category, while 13.5% of women are in "high" category. Likewise, the category of nutrition and health literacy of 53.8% of men and 33.7% of women is "very high". Meanwhile, 11.2% and 55.1% of female students are in the "high" and "medium" category of nutrition and health literacy, respectively. Overall, there are three categories of students' nutrition and health literacy, 9.8% of them is medium, 53.9% of them is high and 36.3% of them is very high.

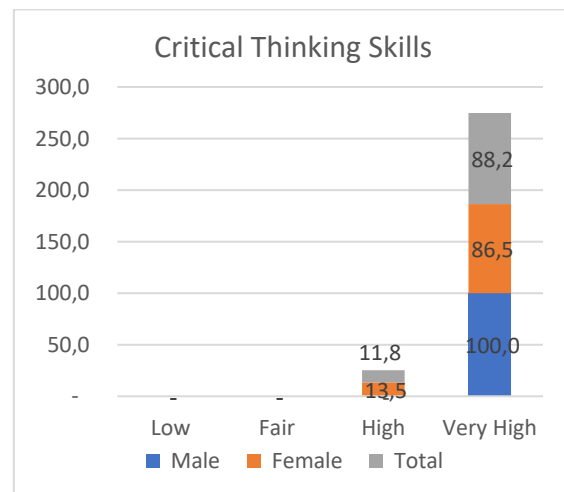


Figure 3. Criticak thinking skills based on

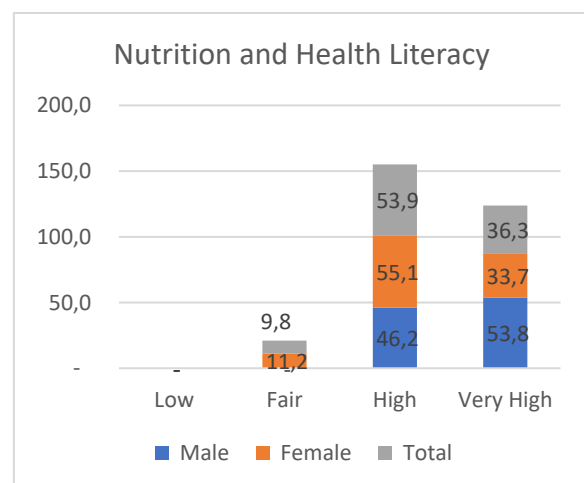


Figure 4. Nutrition and health literacy based on The gender of students The gender of students

Discussion

The critical thinking skills of the Culinary Education students related to balanced nutrition is very high. This shows that the students have the skills to argue, inference, evaluate, and make the best solution. The skills to evaluate still needs improvement, which is in the “high” category. Students made efforts by looking for new evidences and accurate information as much as possible, conducting wider exploration, and making interpretations of phenomena from various points of view (Sani, *et.al.*, 2019). Very high critical thinking skills will support students to determine what they believe and do correctly (Facione, 2011). Learning to think critically leads students to develop other skills, such as higher levels of concentration, deeper analytical abilities, and better thinking process. In their daily work, employees must use critical thinking to better serve customers, develop better products, and continuously improve themselves in a changing global economy (National Education Association, 2019). The skills to think critically is an important skill for future success and for driving innovation (de la Sienna, 2020). Researches related to critical thinking skills in students show almost the same results. A research on 2000 undergraduate students in six Malaysian State Universities showed that they had high critical thinking skills (Rodzalan, *et.al.*, 2015).

Students have a very high literacy in the food group component. This shows that students have the skills to determine the type of food based on the source of nutrients. For example, chicken and beef as the source of protein. On the other hand, the nutrition label and numeration literacy is still poor. To understand food labels (nutritional information labels), knowledge is needed. Some researches stated about how knowledge is an important predictor of understanding nutritional information (Miller, *et al.*, 2010), and how to understand food labels (Thomas, *et.al.*, 2019). The nutritional information label written on food packaging aims to provide correct and clear information about each packaged food product before a consumer buys and/or consume it (Fathonah, et al., 2020), and to know the food-choice behavior. (Cuskelly, *et al.*, 2012; Rhea, *et al.*, 2020). Therefore, nutritional information labels need to be comprehensible, understandable, interpretive, and can be used as nutrition promotion strategies (Pettigrew, *et al.*, 2016).

Nutrition and health literacy of 36.3% of Culinary Education students is in the “very high”

category. This shows that students' competence in understanding, analyzing and making decisions related to nutrition and health is correct. However, there are still 9.8% and 53.9% of students who are in the medium and high category respectively. The result of this study is not much different from other studies. In Iran, it was found that almost 14% of students had low nutritional literacy scores (Khorramrouz, *et.al.*, 2020). Eighty percent of staff received a level 3 score on the NLit, which indicates the possibility of good nutrition literacy (Allison, *et al.*, 2019). A total of 29.3% of Indian students have a high level of health literacy, where 33.1% of them have medium level and 37.6% of them are in the low level (Sandhu, *et al.*, 2017).

The result showed that there was a low but significant relationship between critical thinking skills and nutrition and health literacy. This shows that students needs to think critically to choose and use nutritional information label information and make the right decisions about nutrition and health. Students who have the skills to think critically can make decisions based on careful consideration (Sani, *et al.*, 2019).

Critical thinking skills does not differ according to the year of admission and gender of students. However, nutrition and health literacy differs significantly by the year of admission and gender of students. The results of the study are varied. The critical thinking skills of older students is higher in the scope of understanding and working independently, while the younger students have higher development of cognitive and social skills. (Caceres, *et.al.*, 2020). Men are considered to have critical thinking (Rodzalan, *et.al.*, 2015). The nutrition literacy of male students is significantly lower than that of females which is influenced by food consumption patterns (Kalkan, 2019). Men are considered to have critical thinking (Rodzalan, *et.al.*, 2015). An inline research stated that men have slightly higher learning achievement abilities than women, while women have higher interest and motivation in learning science (Cairns, *et al.*, 2020). There is no difference in nutrition literacy scores based on education or years of SNAP-Ed experience (Allison, *et al.*, 2019). A recent research on brain development by gender shows diverse results. The brain is constantly changing, showing different directions for different brains, depending on toys, clothes, books, parents, family, teachers, schools, universities, employers, social and cultural norms (Rippon, 2019). Gender is a very imprecise indicator of what kind of brain

a person will own. No individual brain area for male and female which varies more than about 1% (Eliot, 2021).

Nutrition and Health Education needs to consider that men has a linear pattern of thinking performance, while women tend to have a quadratic pattern (Chiu, 2020). This means that men have more rational (logical) thinking, and women usually think in a more non-rational and irregular/varied pattern. Students' critical thinking skills, including cognitive skill (Kyllonen, 2012), as well as nutritional and health literacy, have not yet reached the maximum level. This condition still needs improvement in various ways. Various studies have shown positive results, including a contextual-inquiry approach based on information technology on the topic of how food additive can improve students' critical thinking skills (Mahmudatusaadah, 2011). Another research is about how the Discovery Learning learning model affects the students' critical thinking skills (Nurrohmi, *et al.*, 2017). The development of android-based Sports Psychology textbooks can improve critical thinking skills and learning motivation of the students at the Budi Utomo Teacher Training Institute Malang (Lufthansa, *et al.*, 2020). Playful Design Jams (PDJ) enhance critical thinking and creativity, (Tang, *et al.*, 2020). The Wiki research project on functional foods for health in the form of courses with experimental and cross-disciplinary topics can improve critical thinking skills, communication, and information literacy (Crist, *et al.*, 2017). Health education through active learning is effective in improving comprehensive health literacy, memory, verbal fluency, physical activity, and dietary variation (Uemura, *et al.*, 2018). Fifteen (15) out of twenty-two (22) health literacy intervention studies produced improvements in the aspect of health literacy (Walters, *et al.*, 2020). An educational program with three educational sessions delivered by trained local nurses among indigenous peoples using tablet applications, pill cards and booklets is very effective in increasing medical knowledge and health literacy practices (Smylie, *et al.*, 2018). Animated videos have a great potential to improve diabetes health literacy among Latinos with limited health literacy (Calderon, *et al.*, 2019).

CONCLUSION

The conclusions in this study for the students of the Culinary Education program are 1) The critical thinking skills owned is very high, as a

21st century skill; 2) Nutrition and health literacy is in the "high" criteria; 3) There is a significant but low relationship between critical thinking skills and nutrition and health literacy; 4) Based on the year of admission and gender, there is no difference in critical thinking skills. However, there are differences in the nutrition literacy and student health.

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