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Analysis of the Effect of Life Disorders on Taste Perception

Fransiskus Harf Poluan[1], Lina Marlina[1,2]

[1]Department of Ear Nose and Throat, Faculty of Medicine, Universitas Kristen Indonesia, Jakarta, Indonesia
[2]General Hospital Universitas Kristen Indonesia, Jakarta, Indonesia

Corresponding Author: Fransiskus Harf Poluan

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ABSTRACT

Smell disorders mostly damage the olfactory membrane of the sense of smell. This can reduce the ability to detect smells, reduce the ability to taste, or food, and even lose appetite. This research aimed to find real evidence of the influence of olfactory disturbances on taste perception carried out on the FK UKI Students' class of 2012. This research used an experimental design; data was taken in July 2015, and 32 students were used as research subjects. The research examined participants' taste perceptions through an intervention by covering the patient's nose as a symbol of olfactory disturbance and without covering the participant's nose as a control. The data will be processed using the SPSS version 16 program and then analyzed using the t-test or independent samples T-test. The results showed that 38.7% of women and 37.5% of men had correct taste perception in the presence of olfactory disturbances. In comparison, 68.7% of women and 60% of men had proper taste perception without olfactory disturbances.

Keywords: Smell physiology, Taste Physiology, Smell Disorders

INTRODUCTION

Most people with smell and taste disorders have problems with smell, not taste. The olfactory system plays an important role in assessing the taste of food, such as chocolate, coffee, strawberries, apples and others. Food mediates our olfactory sensation, where the aroma or odor resulting from the activity of chewing food will be released, stick to the nasal mucosa, dissolve, and will be detected by the olfactory receptors located in the superior nasal concha. Meanwhile, the taste buds which act as taste receptors are mainly located on the surface of the tongue, palate area and pharynx. This receptor only mediates the sensations of sweet, sour, bitter, salty and umami (savory).

Apart from the above, the function of the taste system also plays a role as: (1) triggering the reflex of the digestive system to secrete saliva, stomach acid and pancreatic juice; (2) gives a feeling of pleasure and fullness when we eat. Meanwhile, the function of smell is; (1) allows us to identify and differentiate a food and its qualities; (2) affects appetite; (3) detect gas leaks or other toxic compounds. If there is interference with the olfactory system, some of the functions above will not work properly [1,2]

According to the National Institute on Deafness and other Communication disorders (NIDCD), more than 200,000 sufferers in the USA experience smell disorders. The most common etiologies of permanent smell disorders according to the National Health and Nutrition Examination Survey (NHANES) are upper respiratory tract infections (ARI), head injury and chronic rhinosinusitis. Apart from that, it is also caused by degenerative diseases such as Alzheimer's, Parkinson's, and others. In Indonesia in 2001 around 1.3% of total annual visits were caused by chronic

rhinosinusitis. In the 2003-2007 period at 3 teaching hospitals in Jakarta, it was reported that 41.5% were caused by rhinosinusitis. About 53% are caused by inflammation of the nose or paranasal sinuses, 19% are caused by respiratory dysfunction, 11% are caused by bacterial or viral infections. Toxic compounds can stimulate olfactory disorders, where compounds such as acrylite, metacrylite, and cadmium can directly damage olfactory receptors and indirectly cause inflammation in the upper respiratory tract which in turn will cause damage to the receptors as well [3,4]

Research Problem

1. How do smell disorders affect taste perception?
2. How is gender related to taste perception?
3. How do various test materials affect taste perception?

Hypothesis

The presence of olfactory disturbances reduces taste perception.

Writing purpose

1. General Purpose:
   To determine the effect of olfactory disturbances on taste perception.
2. Specific Purpose:

To determine the relationship between olfactory disturbances and taste perception of various test materials.

Benefits of research

Theoretical Benefits

It is hoped that the information obtained from this research will be useful in the future for the development of science and can be used as comparison material for further research.

Practical Benefits

It is hoped that the results of the research will be useful as knowledge about various symptoms of olfactory disorders and their influence on taste perception.

Author Benefits

a. Increasing researchers' knowledge about physiology, especially about the senses of smell and taste.
b. As one of the requirements for obtaining a medical degree.

MATERIALS & METHODS

Research design

This research is classified as an interventional research type, often also called an experimental study. An experiment is a study in which the researcher manipulates and controls the independent variables and makes observations of the dependent variables to find variations that appear along with the manipulation of the independent variables[21] Experimental studies are a form of research that is used to look for cause-effect relationships. effect-relationship) of smell disorders will affect taste perception.

Place and time of research

This research was conducted in July 2015, at the Indonesian Christian University, Faculty of Medicine, Cawang.

Population and Sample

Population

Population is a large number of subjects who have certain characteristics, as well as the entire object to be studied. In this study, the population was 32 students from FK UKI class of 2012.

Sample

How to Selection of Samples

The sample is a subset (part) of the population studied.[22] In this research, the sample selection method uses probability sampling, a type of simple random sampling. The principle of probability sampling is that each subject in the (reachable) population has the same opportunity to be selected or not selected as a research sample.

Sample Size Estimation

Determining the sample size in this study was by using the formula according to Federer:

(t-1) (r-1) ≥ 15

So, the number of samples taken in this research:

(t-1) (r-1) ≥ 15

(2-1) (r-1) ≥ 15

1 (r-1) ≥ 15

r ≥ 16

Adverb:

t = number of treatment groups

r = number of replications

Inclusion and exclusion criteria

Inclusion criteria are general requirements that must be met by research subjects in order to be included in the research. Exclusion criteria, also called rejection criteria or also referred to as conditions that cause research subjects who meet the inclusion criteria, cannot be included in the research.[23] After being given an explanation of the aims and objectives of the research, we get:

Inclusion criteria:

1. 2012 FK UKI students are very aware that they are taking part in experiments related to smell and taste
2. 2012 FK UKI students are not sick or have flu
3. 2012 FK UKI students as participants have no history of allergies to certain foods

Exclusion criteria:

1. Students who were also unable to take part in this experiment at that time
2. Students who are not willing to undergo this experiment

Research variable

Independent variable: Smell Disorders

Dependent variable: Taste Perception

Research Instrument

The instruments used in this research are:

1. The table contains a list of test materials and a column for filling in the results of participant answers
2. Test ingredients, such as strawberries, tomatoes, pears, onions, cucumbers
3. Computer and SPSS program

In this research, the sampling technique was carried out using a simple random sampling type probability sampling technique. Sampling was based on inclusion and exclusion criteria.

After explaining the aims and objectives of the research, the researcher asked the participants' willingness to take part in this experiment. After that, participants try several test materials that have been provided, then the results of the questions and answers according to the list of test materials are continued.

Implementation of Data Collection

Subject Identification

On the first day, researchers carried out a simple random sampling type probability sampling technique to obtain the required number of samples, as well as samples that were suitable for participation in the experiment based on inclusion and exclusion criteria.

Informed Consent

On the second day, the researcher explained the aims and objectives of the research, after which the researcher immediately asked the participants' willingness to take part in this experiment.

Taste perception data

This data was obtained on the second day based on measuring taste perception using a table containing a list of test ingredients made by the researcher himself. Then the results are recorded in the table and then processed.

Data processing

After the data is collected, data processing is carried out using the following steps:

1. Editing
   Researchers carry out corrections (re-checking) to ensure completeness, suitability, clarity and consistency of the answers that have been filled in.

2. Coding
   Researchers carry out coding or coding the data, to make data entry and analysis easier.
3. Entry
   Researchers enter data from the results obtained into a computer using a data processing program.
4. Cleaning
   Researchers carry out Cleaning (data cleaning process) by re-checking the data that has been entered. Checking is done to see if there is missing data by making a list, checking again whether the data that has been entered is correct or wrong by looking at variations in the data or codes used, as well as the consistency of the data by comparing two tables.

STATISTICAL ANALYSIS

Data analysis

Data analysis is the process of systematically searching and compiling data obtained from interviews, field notes and documentation, as well as making conclusions so that they are easily understood by oneself and others.

Data analysis will be carried out through statistical tests on the SPSS 16 computer program facility. In this research the statistical technique used is the independent samples T test technique, a technique used to determine the comparison or difference between two data distributions.

This is used to determine the difference between students whose noses are covered as a symbol of olfactory disturbances and those whose noses are opened as normal ones, regarding their taste perception. So this statistical technique will test the significance of the differences between the two data distributions.

The basis for decision making is based on comparing the significance value with the limit of 0.05:

• If the Sig value is > 0.05, then there is no significant relationship between the two data distributions.

• If the Sig value is <0.05, then there is a significant relationship between the two data distributions.

Data Presentation

Data that has been processed and analyzed will be presented in the form of distribution tables and bar charts accompanied by explanations.

The results of research on participant characteristics, smell disorders and taste perception are presented in the form of tables and bar charts and the explanation is as follows:

Participant Characteristics by Gender

The subjects in this research were FK UKI students and Students class of 2012. In Table 1 you can see that the sample size was 32 participants. Meanwhile, Table 2 shows that there were 16 male participants or 50% of the total subjects, 16 female subjects or 50% of the total subjects.

Table 1. Distribution of the number of participants

Statistics		
Gender		
N	Valid	32
	Missing	0

Table 2. Distribution of participants according to gender

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Man	16	50.0	50.0	50.0
	Woman	16	50.0	50.0	100.0
	Total	32	100.0	100.0	

Taste Perception based on Test Materials

In Figure 1, it can be seen that the test ingredient most frequently detected by all participants was onions, with the intervention being closed, namely around 59.4% and opened, namely around 90.6%. This is because onions have a sulfur atomic structure and this will come out when the

onion's cell structure is destroyed when chewed. [24] Materials that contain a sulfur atomic structure have the lowest olfactory threshold compared to other materials, which means that the human sense of smell is still able to detect it even in small amounts.[25]

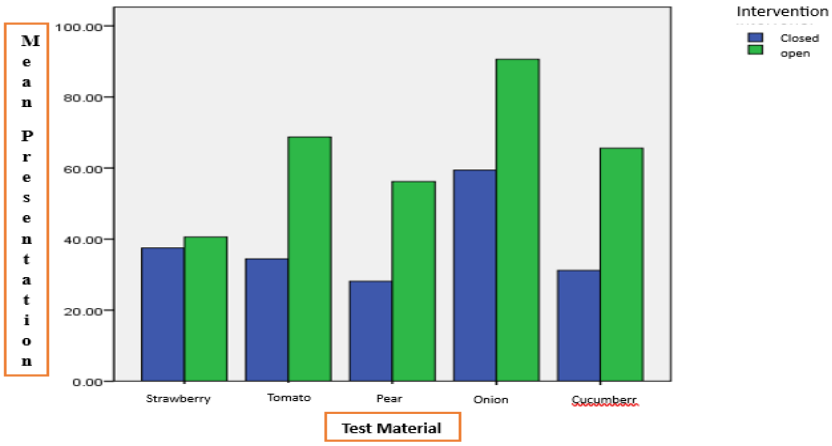

Figure 1. Distribution of Participants based on Test Materials

Table 3 shows that the strawberry test material when closed was around 37.5% and opened around 40.6%. This test material is the lowest when viewed as a whole in Figure 2 and when statistical tests were carried out this test material did not show significant results.

Table 3. Distribution of Participants based on Test Materials

Intervention	Strawberry		Tomato		Pear		Onion		Cucumber	
	Number	Persentage (%)	Number	Persentage (%)	Number	Persentage (%)	Number	Persentage (%)	Number	Persentage (%)
Closed	12	37,5%	11	34,4%	9	28,12%	19	59,4%	10	31,25%
Open	13	40,6%	22	68,7%	18	56,25%	29	90,6%	21	65,6%
TOTAL	32									

Taste Perception by Gender

In Figure 2, it can be seen that based on gender, women are the ones who can most often detect the test material, if only the participants' perceptions or correct answers are added up.

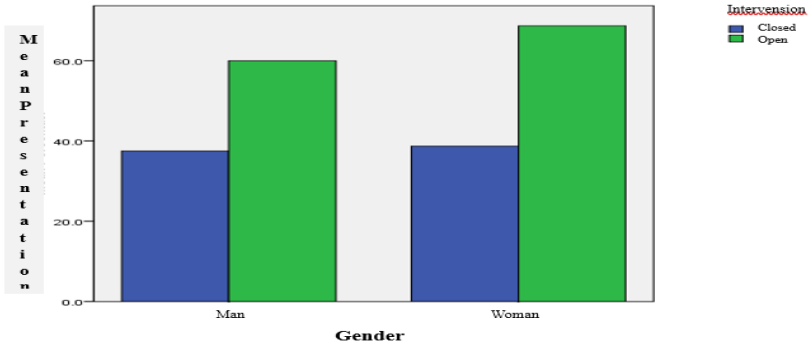

Figure 2. Distribution of Taste Perceptions by Gender

In Table 4, if you add up the female participants answered 31 times correctly when closed and 55 times correctly when opened. The percentage results in Table 4 can be interpreted in the form of a bar chart seen in Figure 3.

Table 4. Distribution of Women on Test Materials

WOMAN										
Intervention	Strawberry		Tomato		Pear		Onion		Cucumber	
	Number	Persentage (%)	Number	Persentage (%)	Number	Persentage (%)	Number	Persentage (%)	Number	Persentage (%)
Closed	9	56,2%	4	25%	4	25%	9	56,2%	5	31,2%
Open	8	50%	11	68,7%	11	68,7%	14	87,5%	11	68,7%
TOTAL	16									

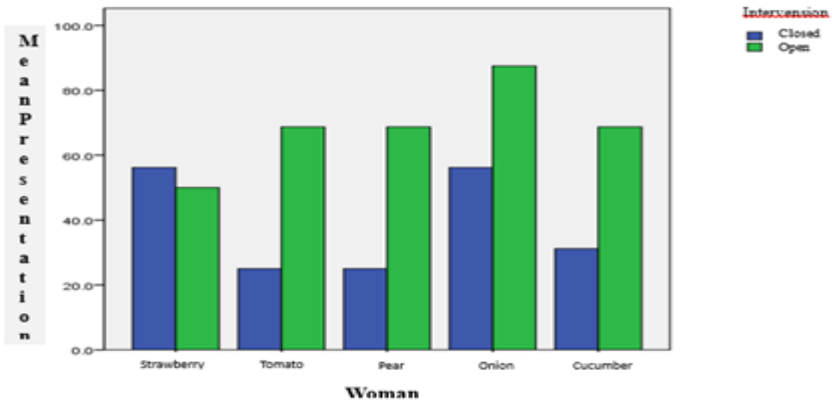

Figure 3. Women's Distribution of Test Materials

In Table 5, if you add up the male participants answered 30 times correctly when closed and 48 times correctly when opened. The percentage results in Table 5 can be interpreted in the form of a bar chart seen in Figure 4

Table 4. Distribution of Man on Test Materials

MAN										
Intervention	Strawberry		Tomato		Pear		Onion		Cucumber	
	Number	Persentage (%)	Number	Persentage (%)	Number	Persentage (%)	Number	Persentage (%)	Number	Persentage (%)
Closed	3	18,7%	7	43,7%	5	31,2%	10	62,5%	5	31,2%
Open	5	31,2%	11	68,7%	7	43,7%	15	93,7%	10	62,5%
TOTAL	16									

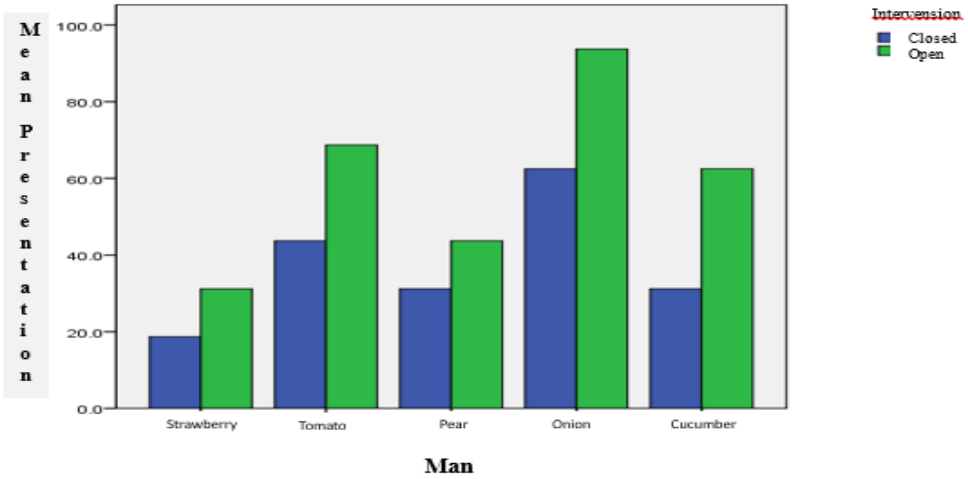

Figure 2. Male Distribution of Test Materials

DISCUSSION

Table 3 shows that the strawberry test material when closed was around 37.5% and opened around 40.6%. This test material is the lowest when viewed as a whole in Figure 2 and when statistical tests were carried out this test material did not show significant results. Of the more than one hundred chemicals contained in strawberries, only a small part contributes to the aroma, namely from the ester and terpene compounds they contain. 26 These two chemicals greatly contribute to the aroma, but in identifying strawberries we have to look at the texture. fruit, the acidity of the fruit and the sweet taste it gives off. This is very difficult to distinguish from the texture of other foods which are similar to the texture of strawberries so it is difficult to identify when the nose is closed, plus only 2 chemicals contribute to the aroma. The sweetness and acidity of strawberries depend on the environment in which they grow, because an unsuitable environment can reduce the sucrose which provides a sweet taste and reduce the amount of aromatic material contained in strawberries [27].

The percentage of tomato test material in Table 3 when closed was 34.4% and when opened it was 68.7%. The taste of the tomato test material is built from sugar (glucose and fructose), acids (citric, malic and glutamate), and several aromatic elements from tomatoes. There are more than 400 odorants that can be detected from tomatoes, but only 16 odorants are predicted to contribute to establishing the taste of tomatoes and their olfactory threshold. The sweet taste produced by fructose is important in building the aroma of tomatoes, and some of the strong aromas produced by tomatoes come from β-damascenone and phenylacetaldehyde which play an important role in the content of tomatoes because they have a very low olfactory threshold[28].

Table 3 shows that when the pear test material was closed it was around 28.12% and when it was opened it was around 56.2%. Even though the percentage results for this test material are quite high, when statistical tests were carried out, the pear test material did not show significant results either. Pears have a taste that depends on the composition of sugar, acid and aromatic elements of the pear. There are more than 300 aromatic elements in pears, among which those that contribute are esters, alcohols, hydrocarbons, aldehydes and ketones[29]. But these compounds are only in small concentrations (per million, per billion, per trillion) in pears depending of the total weight of the fruit. Ester compounds are aromatics that are typical of pears, in fact many ester compounds are synthesized in the skin of the fruit rather than in the flesh of the fruit. Even when the fruit flesh is crushed using a blender without including the fruit skin, the presence of ester compounds cannot be detected. The skin of the fruit also contains a lot of fatty acids which are the aromatic precursors of pears. 30 When conducting the experiment, the author used the flesh of the fruit as a test material and did not include the skin of the fruit, this is why this test material was difficult to identify and ultimately did not show significant results.

The percentage of cucumber test material in Table 3 when closed was 31.2% and when opened was 65.6%. Cucumbers have 78 aromatic elements that have been identified, including aldehydes, alcohols, esters and ketones as important elements in determining the taste of cucumbers[31]. Aldehydes are the main aromatics in cucumbers, and determine the level of maturity of the cucumber. Cucumbers also have a low olfactory threshold for human smell, this determines the aromatic effect of cucumbers on the sense of smell which is still able to detect it even in small amounts[32].

Before carrying out the experiment, several questions must be asked to participants regarding the test material that will be given later, such as "have you previously smelled an odor similar to this test material?", "have you previously tasted this test material?",

"have you previously been used to it?" familiar with this test material?" This will also affect the participants' taste perception because those who have never tasted or are not familiar with this test ingredient will find it difficult to identify the ingredient [33] Various studies show that women have a better sense of smell than men. This is caused by ovarian hormones, namely estrogen and progesterone, which women have, making women more sensitive in identifying smells[34]. This will increase when women are in their menstrual cycle and during pregnancy. Hormones from the ovaries lower the olfactory threshold and improve olfactory memory in identifying aromas [35].

CONCLUSION

Based on the results of research conducted by the author at the Indonesian Christian University, Faculty of Medicine on 6-8 July 2015, it can be concluded as follows:

1. Taste perception can be influenced by gender and the test material used. Women were able to identify the test material around 68.7% of the time when it was opened and 38.7% of the time when it was closed compared to men. Meanwhile, in the test material, onions could be identified around 90.6% when opened and 59.4% when closed compared to other test materials.
2. There is a significant relationship between smell disorders and taste perception.

Suggestion

1. For Institutions
   The research results show that there is a significant relationship between smell disorders and taste perception. Therefore, it is hoped that education can be provided to FK UKI students, RSU UKI patients and residents around the FK UKI campus.
2. For Students
   It is hoped that this research will become an additional reference in further research efforts and increase insight into the impacts and symptoms of olfactory disorders that affect the human sense of taste.
3. For Researchers
   Apart from being able to provide additional insight for researchers, researchers are also expected to be able to conduct further research related to the system of smell, taste and its disorders.

Declaration by Authors

Ethical Approval: Approved

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