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Comparison between Threshold of Bitterness Perception and Blood Pressure for Resident Health Examination in Yakumo Town

By Naomi Katayama, Akemi Ito, Mayumi Hirabayashi, Shoko Kondo, Yui Nakayama, Takafumi Nakada, Seiya Goto, Satofumi Sugimoto, Tadao Yoshida, Masaaki Teranisi, Michihiko Sone, Yasushi Fujimoto€, Hironao Otake, Hirokazu Suzuki, Naoki, Saji, Seiichi Nakata, Tsutomu Nakashima, Kenji Kondo & Takaki Miwa

Nagoya Women's University

Abstract- Japan is a super-aged society. Malnutrition, sarcopenia, and flail in the elderly are problems. It has also reported that abnormal olfaction and taste (function decline) occur as an early symptom of Alzheimer's dementia. Taste and smell have a close relationship with appetite. It is need to study the provision of meals that enhance and the combination of foods from the middle age to the elderly. Because Alzheimer's dementia gradually progresses from the middle-ages, and symptoms spear after becoming an older adult. For 16 years, we have conducted research on taste and olfaction in Yakumo town in Hokkaido, Japan, Where the population does not move much. In this report, we report on the results of the taste test using TASTDISC (Bitterness) in 2019 at Yakumo Town Resident Examination, which has been ongoing since 2007.

Keywords: *bitterness; taste; gender; healthy older adult; yakumo study.*

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Comparison between Threshold of Bitterness Perception and Blood Pressure for Resident Health Examination in Yakumo Town

Naomi Katayama [α], Akemi Ito [σ], Mayumi Hirabayashi [ρ], Shoko Kondo [ω], Yui Nakayama [¥], Takafumi Nakada [§], Seiya Goto [χ], Satofumi Sugimoto [ν], Tadao Yoshida [Θ], Masaaki Teranisi [ζ], Michihiko Sone [£], Yasushi Fujimoto [€], Hironao Otake [₣], Hirokazu Suzuki [₴], Naoki, Saji [₵], Seiichi Nakata [₳], Tsutomu Nakashima [₫], Kenji Kondo [₥] & Takaki Miwa [₲]

Abstract- Japan is a super-aged society. Malnutrition, sarcopenia, and flail in the elderly are problems. It has also reported that abnormal olfaction and taste (function decline) occur as an early symptom of Alzheimer's dementia. Taste and smell have a close relationship with appetite. It is need to study the provision of meals that enhance and the combination of foods from the middle age to the elderly. Because Alzheimer's dementia gradually progresses from the middle-ages, and symptoms spear after becoming an older adult. For 16 years, we have conducted research on taste and olfaction in Yakumo town in Hokkaido, Japan, Where the population does not move much. In this report, we report on the results of the taste test using TASTDISC (Bitterness) in 2019at Yakumo Town Resident Examination, which has been ongoing since 2007.From the database, 298 participants (169 females and 129 males) were selected form data in August 2019. The bitterness test performed using the bitterness test paper with liquid TASTEDISC (Sanwa Chemical Laboratory Co., Ltd) which include five different densities of Quinine hydrochloride on a liquid with test paper namely:, 1(0.001%), 2(0.02%),3(0.1%), 4(0.5%), 5(4.0%). As a result, 12males out of 129 male participants (9.3%) and 9females of 169 female participants (5.3%) had abnormal values in bitter taste test (Taste disc) results. Feeling bitterness can also protect us from ingesting dangerous foods (various toxins). However, a low threshold of bitterness in important toenjoy the taste of spring vegetables as such as wild vegetables and the delicious beer taste. Bitterness studies are increasingly needed.

Keywords: bitterness; taste; gender; healthy older adult; yakumo study.

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I. Introduction

Japan is aging and has become a super-aged society as of 2020. The Japanese government is working with prefectures to take measures to extend healthy life expectancy, aiming for healthy longevity. We are recruiting participants for various events, such as cooking classes for preventing under nutrition of the elderly, exercise for preventing dementia, and cooking classes. Taste mainly studied for saltiness and sweetness. This is because the salty taste is closely related to cardiovascular areas such as blood pressure, and the government calls for salt reduction from the perspective of preventing hypertension. Also, the sweetness is related to blood sugar level, HbA1c, etc. It is involved in obesity, diabetes, and even Alzheimer's dementia and a great deal of research has reported to improve lifestyle-related diseases. However, the taste has sourness, bitterness, and umami. Therefore, this study tries to understand what is the threshold value of the bitter taste that determines the taste of beer from the middle ages to the elderly. The bitterness is food is known as a poison such as an alkaloid mainly contained in vegetables. A small amount of bitter taste, like spices, can change the taste of a meal and help to create a variety of tastes. The best example is "the hops" which are indispensable for making beer. At first, even if there is resistance to bitterness, it is that we will want to repeat or eat it. We get used to it. A low threshold of bitterness to quickly detect dangerous tastes and avoid poisonous foods and drinks. From the above, it is also necessary to study the threshold of bitterness that decline with age. This time, we will report the results of a bitterness threshold test conducted at the time of resident screening in Yakumo Town in Hokkaido, Japan, where the population does not move much.

II. Materials and Methods

a) Participants

Yakumo is located in the south of Hokkaido, the northern island of Japan. Townspeople make a living mainly in agriculture and fisheries. The study in Yakumo

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is a prospective cohort study. This research has been ongoing since 1981. The reason is that Yakumo Town has the least migration of population in Japan. The participants had managed their everyday life themselves. And the Nagoya University Graduate School of Medicine, professionals in the fields of epidemiology, internal medicine, orthopedics, neuropsychology, ophthalmology, otolaryngology, and urology joined the Yakumo Study. The participants had been engaged in a variety of jobs. Therefore, this town can be regarded as representative of today's Japanese society. From the database, 298participants (169 females and 129 males) were selected form data in August 2019 (Table 1).

Table 1: Age composition of participants in Yakumo inhabitants examination (n=298)

Participants	40's	50's	60's	70's	80's
Male (129)	10	24	49	40	6
Female (169)	23	40	66	37	3
Total (298)	33	64	115	77	9

b) Assessment of bitter taste identification

The gustatory test was performed using test paper with liquid TASTEDISC (Sanwa Chemical Laboratory Co., Ltd) which include five different densities of Quinine hydrochloride on a liquid with test paper namely:, 1(0.001%), 2(0.02%),3(0.1%), 4(0.5%), 5(4.0%).The inspection method is as follows. 1) Show participants the taste choice paper: Sweet, Salty, Sour, Bitter. Taste something but I don't know, No taste. 2) Hold the filter paper disc with tweezers. The bitterening solution is dropped on it and moistened. 3) The moistened disc is gently placed on the canaliculus chordae tympani innervation area of the participant's tongue. The canaliculus chordaetympani innervation area is located 2 cm left and right from the tip of it. 4) Instruct the user to answer one of the taste choice paper in 2~3 seconds with the mouth open. 5) The examiner then removes the disc from the participant's tongue with tweezers. 6) If a correct answer is not obtained to the participants, the test is continuing to use a solution having a higher concentration in order. 7) After gargling with water to prevent residual teste, perform the next taste test at intervals of 1 minute or more. This method was in accordance with the test method of the teste test kit (TASTEDISC: Sanwa Chemical Laboratory Co., Ltd).

c) Ethical review board

This study is conducted with the approval of the Ethical Review Board (Nagoya women's university Ethics Committee: 'hito wo mochiita kennkyuu ni kansuru iinnkai'). The approval number is 30-14.

d) Statistical processing

The test results were confirmed to be normal distribution by F-test. Data that werethe tolerance range (in this study, it called the normal range) distributed were compared with Student-t without correlation of parametric test. The data that is not normally distributed was compared without correlated Mann-Whitney one of the non-parametric test.

III. Results

a) Participant's body composition and blood pressure

Data on body composition and blood pressure of participants show by age. The males showed in Table 2. And the females showed in Table 3. All data showed as averages by age. For both males and females, the mean values of blood pressure for each generation were in the normal range. Body fat percentage was higher in females than in males, and BMI and body fat were almost the tolerance range (in this study, it called the normal range) for both males and females.

Table 2: Bitterness test (Tastedisc) results and blood pressure and body composition results (Average for Males in their 40's to 80's)

	Number	Age	Height	Weight	Waist	BMI	Body fat rate	Systolic blood pressure	Dyastolic blood pressure
			cm	g	cm	kg/m/m	%	mmHg	mmHg
Average of 40's Male	10	45.5	170.1	74.2	84.8	25.7	23.7	136.8	80.9
Average of 50's Male	24	54.8	168.0	71.3	86.7	25.4	24.4	131.0	81.3
Average of 60's Male	49	64.8	167.3	68.9	86.5	24.6	24.7	138.3	83.1
Average of 70's Male	40	73.0	164.7	66.2	84.6	24.4	23.7	145.5	79.7
Average of 80's Male	6	84.8	159.1	63.5	87.4	25.1	24.3	134.7	66.2
Total average of Male	129	64.9	166.4	68.7	85.8	24.8	24.2	138.9	80.8

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Table 3: Bitterness test (Tastedisc) results and blood pressure and body composition results (Average for Females in their 40's to 80's)

	Number	Age	Height cm	Weight g	Waist cm	BMI kg/m/m	Body fat rate %	Systolic blood pressure mmHg	Dyastolic blood pressure mmHg
Average of 40's Female	**23**	**45.2**	**158.0**	**57.2**	**76.7**	**22.8**	**33.2**	**122.3**	**70.1**
Average of 50's Female	**40**	**54.3**	**155.5**	**56.4**	**76.8**	**23.3**	**33.4**	**131.6**	**77.4**
Average of 60's Female	**66**	**64.5**	**153.8**	**55.7**	**77.7**	**23.5**	**33.9**	**137.1**	**77.0**
Average of 70's Female	**37**	**72.8**	**150.6**	**52.8**	**76.2**	**23.3**	**33.1**	**140.1**	**74.7**
Average of 80's Female	**3**	**82.0**	**147.4**	**49.6**	**78.1**	**22.9**	**31.1**	**149.0**	**77.0**
Total average of Female	**169**	**61.6**	**154.0**	**55.3**	**77.0**	**23.3**	**33.4**	**134.7**	**75.7**

b) Assessment of bitter taste identification

Bitter taste identification performed by using test paper TASTDESC (Sanwa Chemical Laboratory Co., Ltd).Table 4 shows the bitterness measurement results for male and female by age. The bitterness results using TASTDISC can teste for sensitivity to Quinine hydrochloride concentrations. As a result, 12 males of 129 male participants (9.3%) and nine females of 169 female participants (5.3%) had abnormal values in the result of bitterness test. Males almost twice as many as females required consultation.

Table 4: Bitterness test (Tastedisc) results (Number of Males in their 40's to 80's)

	Tastedisc		
(n=298)	**Normal 0.001%, 0.02%**	**Observation 0.1%, 0.5%**	**Consultation 4.0% ormore**
Male 40's (n=10)	**4**	**4**	**2**
Male 50's (n=24)	**11**	**11**	**2**
Male 60's (n=49)	**27**	**17**	**5**
Male 70's (n=40)	**23**	**15**	**2**
Male 80's (n=6)	**2**	**3**	**1**
Male total (n=129)	**67**	**50**	**12**
Female 40's (n=23)	**16**	**7**	**0**
Female 50's (n=40)	**32**	**8**	**0**
Female 60's (n=66)	**45**	**16**	**5**
Female 70's (n=37)	**23**	**10**	**4**
Female 80's (n=3)	**3**	**0**	**0**
Female total(n=169)	**119**	**41**	**9**

c) Statistical processing results

The bitter test result was statistically processed. Table 5 and Table 6 show the results of comparison of the bitterness test results using TASTDISC with the tolerance range (in this study, it called the normal range) systolic and diastolic blood pressure values and others. The results did not show a statistically significant difference in either case.

Table 5: Results of statistical comparison of Bitterness test results between fasting systolic blood pressure level less than 120 (Normal value) and 120 or more

	Systolic biood pressure (mmHg)		Tastedisc test result (Normal=1, Ovservation = 2, Consultation =3)	
	Less than 120	**120 or more**	**Systolic blood pressure e Less than 120**	**Systolic blood pressure 120 or more**
Average±Standard deviaton	**108.934±19.003**	**144.616±16.889**	**1.459±0.601**	**1.435±0.625**
F test	**P=0.0001****		**P=0.326**	
Unpaired student − t test			**P=0.768**	
Mann-Whaitny test	**P=0.0001****			

*** P<0.05, ** P<0.01**

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Table 6: Results of statistical comparison of Bitterness test results between fasting systolic blood pressure level less than 90 (Normal value) and 90 or more

	Diastolic blood pressure (mmHg)		Tastedisc test result (Normal=1, Ovservation = 2, Consultation =3)	
	Less than 90	90 or more	Diastolic blood pressure Less than 90	Diastolic blood pressure 90 or more
Average±Standard deviaton	73.984±8.903	97.180±8.329	1.417±0.605	1.549±0.673
F test	P=0.291		P=0.183	
Unpaired student − t test	P=0.0001**		P=0.615	
Mann-Whaitny test				

Table 7 shows the results of the comparison of the bitterness test results using TASTDISC with the tolerance range (in this study, it called the normal range) BMI and others. The results did not show a statistically significant difference in either case.

Table 7: Results of statistical comparison of Bitterness test results between fasting BMI level less than 25.0 (Normal value) and 25.0 or more

	BMI (kg/m/m)		Saltness test result (Normal=1, Ovservation = 2, Consultation =3)	
	Less than 25.0	2.50 or more	BMI Less than 25.0	BMI 2.50 or more
Average±Standard deviaton	27.548±2.143	32.993±2.439	1.578±0.665	1.439±0.624
F test	P=0.0001**		P=0.246	
Unpaired student − t test			P=0.110	
Mann-Whaitny test	P=0.0001**			

*** P<0.05, ** P<0.01**

Table 8 shows the results of the comparison of the bitterness test results using TASTDISC with the tolerance range (in this study, it called the normal range) Body fat and others. The results showed that there was a statistically significant difference between the tolerance range (in this study, it called the normal range) Body fat range and the others. Participants with a high body fat percentage were able to feel bitterness at thin concentrations than those with a low body fat percentage.

Table 8: Results of statistical comparison of Bitterness test results between fasting Body fat level less than 25.0 (Normal value) and 25.0 or more

	Body fat (%)		Saltness test result (Normal=1, Ovservation = 2, Consultation =3)	
	Less than 25.0	2.50 or more	Body fat % Less than 25.0	Body fatt % 2.50 or more
Average±Standard deviaton	27.548±2.143	32.993±2.439	1.578±0.665	1.388±0.593
F test	P=0.0001**		P=0.097	
Unpaired student − t test			P=017*	
Mann-Whaitny test	P=0.0001**			

*** P<0.05, ** P<0.01**

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Table 9 and Table 10 shows the results of the comparison of the bitterness test results using TASTDISC with the tolerance range (in this study, it called the normal range) Waist circumference range and In Japan, the tolerance range (in this study, it called the normal range) waist circumference of the male is less than 85 cm (Table 9), and female is less than 90 Cm (Table10). The results did not show a statistically significant difference in either case.

Table 9: Results of statistical comparison of Bitterness test results between waist circumference level less than 85.0 (Normal value) and 85.0 or more for Male

	Waist circumference(cm)		Saltness test result (Normal=1, Ovservation = 2, Consultation =3)	
	Less than 85.0	85.0 or more	Waist Less than 85.0	Waist 85.0 or more
Average±Standard deviaton	78.327±4.478	91.603±4.721	1.5741±0.659	1.534±0.647
F test	P=0.334		P=0.440	
Unpaired student − t test	P=0.0001**		P=0.647	
Mann-Whaitny test				

* P<0.05, ** P<0.01

Table 10: Results of statistical comparison of Bitterness test results between waist level less than 90.0 (Normal value) and 85.0 or more for Female

	Waist (cm)		Salttness test result (Normal=1, Ovservation = 2, Consultation =3)	
	Less than 90.0	90.0 or more	Waist Less than 90.0	Waist 90.0 or more
Average±Standard deviaton	75.729±7.477	93.733±4.338	1.346±0.575	1.250±0.452
F test	P=0.0019**		P=0.175	
Unpaired student − t test			P=0.452	
Mann-Whaitny test	P=0.0001**			

* P<0.05, ** P<0.01

(Table 10). The results did not show a statistically significant difference in either case.

IV. Discussion

The taste is mainly divided into 5 flavors, sweetness, saltiness, sourness, bitterness, and umami[1,2,3,4]. It has reported that the cognitive threshold of taste changes with temperature[5]. Of these five tastes, saltiness and bitterness are to be thin when the temperature is high when the temperature is low[6]. Many medicines have a bitter taste and may be difficult for children to take, especially[7]. Many researchers have reported the results of studies of coating the bitter drug with another taste[8]. However, bitterness is an ability necessary to identify dangerous things (poisonous substances, etc.)[9]. The problem is that with age, the taste may deteriorate, and we may not feel the taste[10]. Particularly today, it has begun to be reported that taste perception due to Alzheimer's dementia deteriorates[11,12,13]. Furthermore, it has reported that patients were suffering from coronavirus report sysgeusia[14, 15]. It can say that it is need to study taste. According to the results of our previous research on saltiness, there was no statistically significant difference in saltiness threshold results between all normal ranges, such as blood pressure, BMI, body fat percentage, waist circumference, and the other values[15]. However, this time, when comparing bitterness with the normal range of blood pressure, BMI, body fat percentage, waist circumference as in the case of salty taste, there was a statistically significant difference in body fat percentage. Participants with a low body fat percentage had a high threshold of bitterness, and participants with abundant body fat percentage had a high sensitivity of bitterness. Regarding this result, we need to further investigate. And the relationship between diet and other factors which we need to study in the future.

V. Conclusions

We obtained bitterness test results, TASTDISC, at the time of health check-up in Yakumo Town, Hokkaido, where population migration is low. From the database, 298 participants (169 females and 129 males) were selected form data in August 2019. The Bitterness test performed using test paper with liquid TASTEDISC

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(Sanwa Chemical Laboratory Co., Ltd) which include five different densities of Quinine hydrochloride on a liquid with test paper namely:, 1(0.001%), 2(0.02%), 3(-.1%), 4(0.5%), 5(4.0%). As a result, 12 males out of 129 male participants (9.3%) and nine females of 169 female participants (5.3%) had abnormal values in the bitterness taste test (TASTEDISC) results. The tolerance range (in this study, it called the normal range) of bitterness, blood pressure (systole, diastole), and body composition (BMI, body fat percentage, abdominal circumference) compared with other values. As a result, there was no statistically significant difference in the bitterness threshold between the normal range of blood pressure, BMI, and abdominal circumference and the others. However, there was a statistically significant difference in the threshold of bitterness between the normal range of body fat percentage and the other range. Bitterness thresholds were lower in participants with high body fat than in participants with low body fat. It is necessary to increase the number of participants and analyse it in the future.

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Socio-economic Vulnerabilities to COVID-19 in India: Swimming against the Tide

By S. K. Singh, Aditi & Sudipta Mondal

Abstract- COVID-19 poses an unforeseen challenge to the world. The virus is testing the capacity of public health systems globally and their ability to respond effectively. India is no exception. The country has already witnessed more than 35,000 confirmed positive cases by the end of April 2020, and the number is fast rising despite strict measures by the government. The virus has reached every state and union territory of the country. In the absence of a drug or a vaccine, the only measure available to fight this deadly novel pathogen is to adopt changes in behaviors and lifestyle – physical distancing, frequent hand washing, and proper respiratory etiquette. The government has imposed lockdown to maintain social distance since 24th March 2020, but it cannot continue for long due to the immense loss of economy and livelihood. The country needs to learn to co-exist with the virus and embrace the prescribed measure of physical distancing, and handwashing even after the government lifts the lockdown. The paper uses the data from the most recent Indian version of DHS, known as National Family Health Survey-4, to examine the feasibility of the adoption of these new norms and their impact on a densely populated country like India, where there are nearly half of the households (49%) with three or more people sleeping in a room, 35% going out to fetch water for daily usage, and 38% have no toilet facility within their household premises. The study uses multivariate analysis, Wagstaff's Concentration Index, and decomposition analysis to find out the extent of vulnerability across different socio-economic strata of the Indian population in adopting these safety measures to fend themselves from the corona infection.

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SOCIOECONOMICVULNERABILITIESTOCOVID19ININDIASWIMMINGAGAINSTTHETIDE

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Socio-economic Vulnerabilities to COVID-19 in India: Swimming against the Tide

S. K. Singh [α], Aditi [σ] & Sudipta Mondal [ρ]

Abstract- COVID-19 poses an unforeseen challenge to the world. The virus is testing the capacity of public health systems globally and their ability to respond effectively. India is no exception. The country has already witnessed more than 35,000 confirmed positive cases by the end of April 2020, and the number is fast rising despite strict measures by the government. The virus has reached every state and union territory of the country. In the absence of a drug or a vaccine, the only measure available to fight this deadly novel pathogen is to adopt changes in behaviors and lifestyle – physical distancing, frequent hand washing, and proper respiratory etiquette. The government has imposed lockdown to maintain social distance since 24th March 2020, but it cannot continue for long due to the immense loss of economy and livelihood. The country needs to learn to co-exist with the virus and embrace the prescribed measure of physical distancing, and handwashing even after the government lifts the lockdown. The paper uses the data from the most recent Indian version of DHS, known as National Family Health Survey-4, to examine the feasibility of the adoption of these new norms and their impact on a densely populated country like India, where there are nearly half of the households (49%) with three or more people sleeping in a room, 35% going out to fetch water for daily usage, and 38% have no toilet facility within their household premises. The study uses multivariate analysis, Wagstaff's Concentration Index, and decomposition analysis to find out the extent of vulnerability across different socio-economic strata of the Indian population in adopting these safety measures to fend themselves from the corona infection. The paper acknowledges that widespread inequalities in protective behaviour from COVID -19 and the invisible virus will coexist till the development of a vaccine. The study, in its closing, recommends adopting focussed interventions with the most vulnerable groups, not only for changing their behavior but also improving their access to essential services on a war footing with a particular focus at people from low-income communities, who are socially deprived, and economically marginalized and living in resource-poor settings in 53 million-plus urban agglomerations of India.

I. Background and Rationale

The rapidly spreading severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), which originated from Wuhan city in China, was declared as a pandemic by the World Health Organisation (WHO) in early March 2020. Initially, not much could be said about the virus except for the fact that it was highly infectious. The disease spread fast and engulfed about 185 countries in a short period, with nations reporting human-to-human transmission (Cohen and Kupferschmidt, 2020). The entire human population generally lacks immunity to SARS-CoV-2 and hence is susceptible to the novel virus. Even after months, there has been no substantial containment in geographical spread, mortality, and economic losses caused due to the pandemic. Worldwide, it has engulfed 3,269,667 people, and there have been 233,704 reported deaths as on 30th April 2020 (JHU CCSE, 2020). China is the epicenter of the pandemic and witnessed the havoc first with a massive number of patients and deaths, later the disease spread to the entire world encasing almost all the major countries of the world including US, Italy, Spain, Iran, UK France, India and many more (Khan & Fahad, 2020). Currently, the case-fatality ratio of the current pandemic in the world is 7.1 percent. The United States has the maximum number of confirmed cases and deceased people due to the virus (JHU CCSE, 2020). The Indian sub-continent is not aloof to the disease. In India, as of 30th April 2020, a total of 35,043 confirmed cases and 1,154 deaths had taken place with the current case-fatality ratio of 3.3 percent (JHU CCSE, 2020). The reproduction number defines the transmissibility of a virus, and represents the average number of new patients rising due to an infectious person in a naïve population. SARS-CoV-2 is much more contagious than any known virus that affects human race. On an average one infected person passes the disease to 3.2 people (Liu et al., 2020; Ryu et al., 2020). The older adults with comorbidities and pregnant women are more prone to acquiring SARS-CoV-2 (Yi et al., 2020).

The COVID-19 is contagious during the latency period and is highly transmissible in humans, especially in the elderly and people with underlying diseases. People who have a weak immune system and who are exposed to the virus directly or indirectly are more likely to catch the infection. The symptoms of the disease are similar to that of pneumonia, common flu such as fever, malaise, and cough (Guo et al., 2020; Singhal, 2020; Yi et al., 2020). Yet, it is a more severe illness with a substantial risk of death, particularly among the elderly and especially among those with other chronic underlying conditions (Zhou et al., 2020). The disease has an incubation period of 1-14 days, and the advanced stage of the disease has people exhibiting symptoms like acute respiratory distress syndrome,

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respiratory failure, multiple organ failure, and eventually death (Guo et al., 2020). However, not all the affected people show symptoms of the disease. There are asymptotic carriers who do not have any visible signs, but they are the possible carriers of the infection (Ryu et al., 2020). For this one way out is testing, but again, there are constraints such as; only limited availability of testing kits and other health resources. The overall case-fatality rate of 2019-nCoV, as estimated by international experts, ranges from 3 percent to 14 percent (Ryu et al., 2020). The case-fatality ratio is less than that seen in two recent epidemics i.e., SARS-CoV-1 and Middle East Respiratory Syndrome (MERS)-CoV. Still, it is more concerning because the observed characteristics of this virus are excessive transmissibility and rapidity of the spread (Chowell, 2015). There are various predictions made for the COVID-19, including by a leading Harvard epidemiologist Marc Lipsitch who warned that the coronavirus would infect up to 70 percent of humanity within a year (HTHC, 2020).

The vaccine remains the only solution to end the COVID-19 pandemic. Yet, until now, no vaccine is in sight; clinical trials are going on to develop a vaccine against the novel coronavirus. However, as put forward by the WHO and other experts, developing and approving the use of a vaccine is a lengthy process, and it may take at least 18 months before such a vaccine is available. Hence, to limit the spread of the disease, it is need of the hour to not only treat the infected persons but also to take immediate steps to isolate them from the general population through social distancing and other behavioral measures. The novel coronavirus is known for its high infectivity, once its spread continues, it can lead to stage 3 or 'the community transmission' of the disease, which will make it impossible to track and contain the source of the infection (Singh & Adhikari, 2020). No approved treatments are available at present, various non-pharmaceutical interventions (NPIs) are the only options to halt the exponential rise of the disease. The measures include maintaining social distance, washing hands repeatedly, observing safe respiratory etiquette, avoiding contact with those infected with COVID-19, refraining from non-essential use of public transport, working from home and avoiding gatherings, socializing, and visiting other places where infections can spread rapidly. Hand hygiene and respiratory etiquettes are individual behavior. Hence, the health officials and governments have widely propagated these manners (Bhatia, 2020). It is well established that if we implement these measures promptly and effectively during a pandemic, it can reduce disease transmission. In the absence of a cure or an established theraputic strategy, curtailing transmission through preventive measures is the only means available to stem the growth of the pandemic (Cascella et al, 2020).

It is important to flatten the exponential growth curve of the COVID-19 cases because if the outbreak becomes severe in a country like India, then it can prove to be devastating as it will be overwhelming for the health system to handle. It will lead to a huge shortage of health workers and essential supplies like Personal Protective Equipment (PPE), masks, oxygen ventilators, testing kits, among others. Considering India's population size and existing health facilities, the problem will compound even further. As per the National Health Profile-2019, 713,986 beds are available in the government hospitals in India, which amount to 0.55 beds per 1000 population and around 915 government allopathic doctors per 10,00,000 population. With 1.38 billion population, and with much less number of hospital beds and health care physicians, not overwhelming the hospitals is the first and the foremost crucial step that the country can take and gradually prepare for the emerging cases of the disease (Bedford et al., 2020; Singh at al., 2020). These differentials will be even more glaring in rural areas compared to urban areas. Keeping the directives of the WHO and the healthcare professionals in view, the Indian government imposed a complete lockdown from 24th March 2020 till 17th May 2020 (IANS, 2020). The government has completely shut its borders, put in place restrictions on inbound travel, suspended all visas except diplomatic ones, and quarantined the travelers who came to the country (Bajpai, 2020). Additionally, it has been actively trying to make people understand the importance of social distancing and self-quarantining for preventing the spread of the virus and has been creating isolation wards, arranging testing kits, identifying as well as providing fast-track provision of medical facilities to those who have symptoms. The government suspended all public transports, including rail, inter-state bus services, and metro services. The masses have been encouraged to maintain personal hygiene, frequent handwashing with soap and water, or using alcohol-based hand sanitizer, mandatory use of facemask in case one has any of the symptoms, covering the face with a handkerchief while sneezing and, most importantly, to follow social distancing (Prem et al., 2020).

The importance of social distancing as a tool to limit disease transmission is well recognized, but there are several difficulties associated with this measure in a country like India. There are challenges in ensuring social distancing, especially in densely populated urban slums in Indian cities where people helplessly occupy and live together in small overcrowded and poorly ventilated homes (Bhatia, 2020). Accessibility to clean water for maintaining proper hygiene, as well as usage of soap as recommended, is also an issue. Given the Indian scenario, it would be worth delving deeper into the feasibility of using such measures successfully in the country.

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II. Research Questions and Objectives

The COVID-19, which is not randomly distributed in the population but transmits through human contacts, can be contained by ensuring social distancing and hand hygiene practices, which are the two significant behavioral interventions in addition to the above-discussed structural and ecological interventions promoted by the Governments and hordes of civil society organizations. The lockdown of a country or some selected states/districts in a country can be treated simply as a pause to shift the severity of the problem by breaking the chain of transmission, but. Still, it may not be the permanent solution to ensure preventive practices including social distancing. Keeping this in view, the key research question to be addressed in this study is the extent of vulnerability for a substantial proportion of Indians. The socially deprived, economically marginalized, those who were not a part of inclusive development, in adopting the protective measures against COVID-19. The specific objectives of this paper are to analyze the barriers in ensuring the protective measures i.e., social distancing and hand-hygiene practices, and examine the socio-economic inequalities in adopting preventive practices for COVID-19 in India.

III. Data and Methods

The study utilized data from the fourth round of the Indian DHS, popularly known as the National Family Health Survey (NFHS), which is a cross-sectional survey conducted during 2015-2016. NFHS is conducted under the stewardship of the Ministry of Health and Family Welfare (MoHFW), Government of India. The survey provides information on demographic and health indicators at the national, regional, state, and district levels from a nationally representative sample. NFHS-4 (2015-16) collected information from a total of 601,509 households and 699,686 women aged between 15-49 years (IIPS and ICF, 2017). Different rounds of NFHS have been a key source of information on household assets, WASH, household environment, and other socio-economic and developmental indicators. It is put to use for evidence-based decision making in the country. Other relevant information regarding the study design and response rates in the NFHS-4 are there on the Demographic and Health Surveys website (IIPS and ICF, 2017).

Among the various analytical approaches used in this paper, the first one is descriptive statistics to analyze the variation in household crowding as an indicator of vulnerability to maintain social distance and availability of soap or detergent at the place designated for hand washing in a household as an indicator of hand hygiene by some selected background characteristics. To analyze the adjusted effects of various predictors on the response variables, we applied a multivariate logistic regression technique. The study further calculated the Wagstaff's Concentration Index and decomposition to investigate the inequalities in the prevalence of preventive practices for COVID-19 measured in terms of household crowding, water source outside household premises, and not having a toilet within the household as the barrier to maintain social distancing. Socio-economic inequalities in barriers and preventive practices for COVID-19 were quantified with the concentration index and subsequently decomposed into associated factors using Decomposition Analysis. A concentration index (CI) provides a measure of socioeconomic inequality in the variables under study. It ranges from -1 to +1: a value close to zero indicates near equality, a value near -1 shows a greater concentration of the study variable among the poor (pro-poor) while a value increasing to +1 indicates greater concentration amongst the wealthier groups (pro-rich). The CI is twice the area between the concentration curve and the line of perfect equality, or as twice the weighted covariance between the outcome variables and the fractional rank in the wealth distribution divided by the mean of study variable. The study used the concentration index to assess the vulnerability to infection from COVID-19 owing to prevailing socio-economic inequality measured in terms of household crowding and presence of soap or detergent for handwashing at the place designated for handwashing in a household. The concentration index can be defined merely as twice the covariance between the study variables, (y: let household crowding) of individual i and the ranking of the socioeconomic status, r, divided by the mean of the study variable (μ):

$$CI = \frac{2}{\mu} \operatorname{cov}(y_i, r_i)$$

CI is a widely used measure since it ranks the individuals across SES, sensitive to changes in population distribution across SES and they can assess relative and absolute socioeconomic inequality (Kakwani et al., 1997; Wagstaff et al., 1991).

Even though concentration indices are relevant to show the extent of socioeconomic-related inequalities in variables under study, but it cannot explain the factors that contribute to observed disparities. Therefore, the study used the regression-based-decomposition methodology to decompose the concentration index to explain the socio-economic inequality as vulnerability to protection from COVID-19. Since the regressed variable of the study is continuous; therefore, the study used a linear probability model to decompose the concentration index. Thus, the expression of the model is- -

$$y_i = \alpha + \sum_j \beta_j x_{ji} + u_i$$

Here j is the probability of protection from COVID-19, associated with j determinants. The Cly decomposition happens as follow-

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$$CI_y = \sum_j (^{\beta_j \overline{x}_j}/_{\mu_y}) CI_{xj} + \frac{CI_u}{\mu_y}$$

where the term on the right-hand side represents income-related socio-economic inequality in the regressed variable that is not explained by systematic variation in x's by income. However, we are interested in the term on the right-hand side of the equation, which represents the contribution of each of the determinants to the Concentration Index CI(y).

IV. Results and Discussion

It is needless to mention that maintaining social distancing, constant use of masks at public places, and hand hygiene are some of the important means to curtail the spread of COVID-19 and protect the general population. However, the most recent demographic and health data of the country paints a complex and discouraging picture to ensure these behavioral changes. It is evident from Table 1 that nearly half of the households in the country (49%) suffer from the problem of overcrowding with three or more people sleeping in a room. Proportions of such households were significantly higher in rural areas (51%), and in the socially deprived and economically marginalized communities (53%-56% scheduled caste/ scheduled tribe households; 55% Muslim households, and 62% poorest households). The other two indicators adversely affecting social distancing in these communities are the location of the source of drinking water outside the household/dwelling/yard (35%) and no toilet facility within the household premises (38%). Despite all the structural interventions, people will move out for using these two facilities and hence, would be more vulnerable to adhering to the protocols of social distancing as the means of protection from the COVID-19. The pattern in this vulnerability to protection through social distancing is not uniform across different Indian states (Fig.1). The proportion of households with household crowding was the highest in Uttar Pradesh (61%) followed by Maharashtra (58%), Bihar and Gujarat (56% each), Telangana (55%), Madhya Pradesh (54%), Andhra Pradesh (53%), Mizoram (51%), Delhi (48%), Odisha (47%) and Chhattisgarh (45%). Similarly, the proportion of households with the source of water located outside household/yard/plot was the maximum in Odisha (68%) followed by Chhattisgarh (65%) Jharkhand (64%), Madhya Pradesh and West Bengal (55% each) and Telangana (45%). Most of these states have a significant proportion of the tribal population living in remote rural areas, who are socially deprived, economically marginalized, have poor or no access to healthcare, and hence, may require special focus, particularly in the latter stages of community transmission of COVID-19 in India.

The second important means of protection from COVID-19 is the hand hygiene with well-stated guidelines about frequency and modalities to wash hands with soap or detergent and sanitize with alcohol-based hand sanitizers. The NFHS-4 (2015-16) data, however, portrays that despite over 96 percent of households having a designated place for handwashing, almost one-in-seven households did not have water available and over one-in-three households did not have soap or detergent at the place designated for handwashing. The proportion of such households was significantly higher in rural areas (18% and 49%), scheduled tribe households (30% and 58%), and those coming from the poorer households (20% and 53%) and poorest households (32% and 73%) respectively. Regional disparity in the proportion of households lagging in the basic facilities to ensure hand hygiene by its members demonstrates comparatively larger concentration of such households in the eastern part of the country (23% and 57%), comprising of Bihar, Chhattisgarh, Jharkhand, Odisha, and West Bengal (See Table 1). Fig. 2 presents the percent of households whose members are highly vulnerable to ensuring hand hygiene as a means of protection from COVID-19 in different States/UTs. It portrays that people in Odisha (43%), Jharkhand (41%), Chhattisgarh (29%), Tripura (25%) and West Bengal (22%) were highly vulnerable to hand hygiene due to non-availability of water in their houses. Further, a substantial proportion of households in Odisha (65%), Jharkhand (64%), Tripura (51%), West Bengal (50%), Tamil Nadu (48%) and Madhya Pradesh (40%) did not have soap or detergent at the place designated for hand wash in their houses. Therefore, members of these households may be highly vulnerable in adopting hand hygiene practices to protect themselves from COVID-19 in the third stage of transmission at the community level. Thus, all the agencies engaged in curtailing the chain of transmission and protecting people from COVID-19, especially in the third stage of transmission, should adopt suitable strategies to address the vulnerability of socially deprived and economically marginalized communities in protecting themselves. The aforementioned is possible by motivating them to adopt micro-level social distancing even within their households to the extent possible and developing a support system and creating an enabling environment to practice hand hygiene.

More refined effects of these predictors on the response variable, which are related to various guidelines to follow for containing the spread of COVID-19, can be obtained only after computing the adjusted effects of these predictors on response variables. Table 2 portrays the Logistic regression odds ratios for the adjusted effects of some selected socio-economic characteristics on the vulnerability to infection from COVID-19, India. As far as social distancing is concerned, people from the richest wealth quintile (OR=0.14; 95% CI= [1.14-1.15]) were much less likely to live in a crowded home compared to people from poorest wealth quintile. Compared to the urban area,

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rural people (OR=0.67; 95%CI= [0.67-0.69]) were less likely to live in a crowded home. People from non-SC/ST and OBC caste category (OR=0.65; 95%CI= [0.64-0.67]) and the other backward castes (OR=0.86; 95%CI= [0.85-0.88]) were 35 percent and 14 percent, less likely to live in crowded setup respectively as compared to those from Scheduled Caste. In comparison to the Hindu family, the Muslim family (OR=1.63; 95%CI= [1.61-1.67]) were more likely to live in a crowded setting. Also, people from other religions (OR=1.09; 95%CI= [1.07-1.12]) were 9 percent more likely to live in crowded spaces. The people from northern region (OR=1.67; 95%CI= [1.64-1.70]) were 67 percent more likely to live in a crowded setting as compared to people from the eastern region and those from the western region (OR=2.00; 95%CI= [1.96-2.04]) were twice more likely to live in a crowded setting as compared to eastern region people. These findings are consistent with the reported number of positive coronavirus cases in India, in the absence of population-based testing, which is disproportionately higher in million-plus cities in the country with a larger concentration in Mumbai, Delhi, Ahmedabad, Indore, Bhopal, Jaipur, Agra, Lucknow among others. The situation is further threatening with a larger number of COVID-19 hotspots centered on slum pockets in these million-plus cities.

The availability of water at the place of hand wash is an important predictor of protecting from the vulnerability to infection. The richer people (OR=7.77; 95% CI= [7.52-8.03]) had more water available at the place of hand wash in comparison to the poorest. The rural people had 18 percent less likelihood of water available to them at the place of hand wash. The people from other castes (OR=1.15; 95%CI= [1.11-1.17]) were more likely to face the problem of water unavailability at the place of hand wash in comparison to people from a scheduled caste. In comparison to the Hindus, Muslims (OR=1.24; 95% CI= [1.21-1.28]) were 1.2 times more likely to have water available at the place of hand wash and the people from other religion (OR=1.34; 95% CI= [1.30-1.39]) were 1.3 times more likely to have water available at the place of hand wash. The central region people (OR=1.33; 95% CI= [1.30-1.37]) were more likely to have water available at their place of hand wash as compared to people from the eastern region. Similar was the case for people from southern region (OR=1.31; 95%CI= [1.30-1.37]). The people from the northeast region (OR=2.06; 95%CI= [1.99-2.13]), too, had water available to them more in comparison to people from the eastern region.

The availability of soap or detergent at the place of hand wash as an indicator of hand hygiene portrays that the richer people were more likely to maintain hand hygiene (OR=10.64; 95% CI= [10.41-10.88]), as compared to the poorest. The rural people (OR=0.71; 95% CI= [0.70-0.73]) were 29 percent less likely to maintain hand hygiene as compared to urban people. In comparison to people from scheduled caste, people from other castes (OR=1.22; 95%CI= [1.19-1.25]) were more likely to maintain proper hand hygiene. In comparison to Hindus, Muslims (OR=1.13; 95% CI= [1.11-1.16]) were more likely to maintain hand hygiene. The northern region people (OR= 2.24; 95% CI= [2.19-2.29]) were more likely to maintain hand hygiene as compared to the eastern region people. The people from the southern region (OR=0.90; 95%CI= [0.89-1.93]) were 10 percent less likely to maintain hand hygiene as compared to people from the eastern region. Those from the north-eastern region (OR=2.24; 95%CI= [2.19-2.29]) were more likely to maintain hand hygiene as compared to people from the eastern region.

Further, it is evident from Figure-3 that household crowding was concentrated mostly among poor households [Concentration Index: - 0.14], whereas, hand wash with the use of soap or detergent was prominent among rich households [Concentration Index: 0.23]. Therefore, it is essential to decompose the contribution of different predictors in the overall value of CIs. Table 3 provides the results of decomposition analysis for the estimated contribution of selected background characteristics in the economic inequalities of household crowding, as a proxy of vulnerability to social distancing and availability of soap or detergent for hand-washing as a proxy of maintaining hand hygiene. The value of absolute contribution indicates the extent of inequality contributed by the explanatory variable. A negative value of the concentration index indicates a larger concentration of variable understudy in poorer households. In the case of household crowding, it is evident that crowding is more concentrated amongst the poor than in rich households. Urban as the place of residence explains about 35 percent of the gap of economic inequality in terms of household crowding, whereas belonging to Scheduled Caste/Scheduled Tribe explains about 28 percent of the gap pertained by economic inequality between rich and poor. Additionally, possession of the Below Poverty Line (BPL) card explains about 28 percent of inequality. The location of water sources outside the house/plot/yard explains about 17 percent of the gap for economic inequality for household crowding. The western region of India narrowed down the gap between rich and poor.

On the other hand, the availability of soap or detergent for handwashing, which is an essential component of maintaining hand hygiene was much more concentrated in richer households than among poorer households. Around 47 percent of inequality was explained by urban place of residence, whereas the Scheduled caste/Scheduled tribe explained 11 percent of the gap. About 11 percent of the gap in economic inequality for the availability of soap or detergent for handwashing was explained by the location of the water source which was outside the house. About 12 percent

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and 9 percent of inequality were explained by the southern and western region of India to explain the gap between rich and poor in terms of use of soap and detergent for handwashing. These findings indicate that all the efforts to curtail the COVID-19 transmission chain may not be effective once the period of lockdown is over, which we cannot extend for an indefinite period. However, these structural barriers will restrain people in following the stringent measures of social distancing, which is mandatory in the absence of any vaccination or other forms of proper treatment.

V. Conclusions and Recommendations

Today the world is growing through an unprecedented crisis. Many countries were taken unaware and have failed terribly in containing the spread of the COVID-19. Initially, these countries did not recognize the gravity of the situation but, within a few weeks, realized the unimaginable economic and human costs of the COVID-19 pandemic. India is a vast and diverse country both demographically and geographically, and hence, handling such a crisis is a huge challenge in itself. This deadly virus has no boundaries, and it transmits from one human to another and often silently since the infected persons with no visible symptom also transmit the virus to others. Hence, India should educate and make the masses aware of the preventive measures and ensure that each one should religiously follow those before it goes completely out of hand. This pandemic has been an eye-opener and has taught us many a lesson. An important one being that we should learn to coexist with nature and not exploit it to the extent that we have to pay a huge price which may be no less than our existence. Despite all the efforts to curtail the chain of transmission of COVID-19, a large section of the population especially in resource poor settings in urban areas will find it difficult to adopt the prescribed preventive measures. India is home to 53 million-plus urban agglomerations where a substantial proportion of the population lives in slums under deplorable living conditions and often face various forms of social exclusions. The large urban agglomerations need to have a micro-plan for each slum under its jurisdiction and actively work for reducing their socio-economic vulnerability that impede them from maintaining the preventive measures.

The need of the hour is to adopt suitable strategies to address the vulnerability of socially deprived and economically marginalized communities to protect themselves by motivating them to adopt micro-level social distancing even within their households to the extent possible, developing a support system and creating enabling environment to practice hand hygiene. Another strategy to curtail the chain of transmission may be decongesting urban slums in all the 53 million-plus urban agglomerations by arranging temporary shelter homes outside cities and developing adequate quarantine facilities. Further, increasing the use of technology to track the mobile population suffering from COVID-19, putting them in quarantine, and strengthening testing facilities following a community based randomized sampling design are perhaps some of the key strategies to minimize the vulnerability of Indian population to COVID-19. Finally, India needs to address the vulnerability of its socially deprived and economically marginalized community in large cities to have a successful COVID-19 containment strategy.

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Table 1: Percent of households (HHs) whose members are highly vulnerable to ensure social distance and hand hygiene as the means of protection from COVID-19 in India, NFHS-4

Background Characteristics	Vulnerability to maintain Social Distance			Vulnerability to maintain Hand Hygiene		
	% of HHs with three or more members per room used for sleeping	% of HHs having water source located outside HH/ dwelling plot	% of HHs having no toilet facility within HH	% of HHs not having any designated place for hand wash	% of HHs with non-availability of water at the place of hand wash	% of HHs not having soap or detergent at the place of hand wash
Place of Residence						
Urban	43.5	20.4	10.5	2.4	6.3	17.5
Rural	51.3	42.9	54.1	3.7	18.0	47.8
Caste/Tribe						
SC	55.7	41.9	50.5	3.8	17.8	44.9
ST	53.4	59.9	65.6	4.6	29.7	58.2
OBC	49.3	33.1	40.4	2.9	12.2	37.0
Others	41.2	24.6	19.8	2.6	8.0	23.3
Religion						
Hindu	48.3	37.0	42.5	3.2	14.7	38.5
Muslim	55.2	25.7	24.1	3.8	9.9	32.5
Others	39.0	27.8	20.9	2.4	11.2	27.5
Wealth Quintile						
Poorest	62.2	56.9	88.1	5.8	32.1	72.5
Poorer	56.8	47.4	62.7	4.0	19.6	53.3
Middle	52.6	37.7	35.4	2.9	11.9	36.2
Richer	44.6	23.7	7.8	2.1	5.4	19.5
Richest	27.1	9.7	0.4	1.4	1.3	5.9
Region						
North	52.7	25.8	37.8	2.0	8.9	24.0
Central	51.7	39.3	57.6	2.6	21.2	44.4
East	48.1	43.8	51.5	5.1	23.4	57.3
North East	27.5	21.0	8.7	6.5	13.8	42.2
West	55.9	22.4	33.1	2.4	10.1	25.4
South	41.3	38.0	31.3	3.1	10.6	37.5
India	**48.6**	**35.1**	**38.9**	**3.2**	**13.9**	**37.1**

Table 2: Logistic regression odds ratios for the adjusted effects of some selected socio-economic characteristics on the vulnerability to infection from COVID-19, India

Covariates	Household crowding as a barrier in ensuring social distancing			Availability of water at the place of hand wash			Likelihood of hand hygiene		
	OR	CI with 95%		OR	CI with 95%		OR	CI with 95%	
Wealth Index									
Poorest®									
Poorer	0.71*	0.70	0.73	1.82*	1.79	1.86	2.36*	2.32	2.41
Middle	0.52*	0.51	0.53	3.39*	3.32	3.48	4.98*	4.89	5.08
Richer	0.34*	0.34	0.35	7.77*	7.52	8.03	10.64*	10.41	10.88
Richest	0.14*	0.14	0.15	33.75*	31.66	35.9	28.50*	27.63	29.40
Place Of residence									
Urban®									
Rural	0.67*	0.67	0.69	0.82*	0.86	0.90	0.71*	0.70	0.73
Caste									
SC®									
ST	0.76*	0.75	0.78	0.72*	0.70	0.74	0.93*	0.91	0.95
OBC	0.86*	0.85	0.88	1.22*	1.19	1.24	1.12*	1.11	1.15
Others	0.65*	0.64	0.67	1.15*	1.11	1.17	1.22*	1.19	1.25
Religion									
Hindu®									
Muslim	1.63*	1.61	1.67	1.24*	1.21	1.28	1.13*	1.11	1.16
Others	1.09*	1.07	1.12	1.34*	1.30	1.39	1.61*	1.57	1.65
Region									
East®									
West	2.00*	1.96	2.04	1.60*	1.56	1.65	2.02*	1.98	2.07
North	1.67*	1.64	1.70	2.01*	1.97	2.07	2.80*	2.75	2.86
South	1.22*	1.19	1.25	1.31*	1.28	1.36	0.90*	0.89	0.93
North East	0.58*	0.57	0.60	2.06*	1.99	2.13	2.24*	2.19	2.29
Central	1.39*	1.37	1.43	1.33*	1.30	1.37	1.71*	1.67	1.75
Constant	2.00	1.96	2.05	1.47	1.42	1.52	0.26	0.25	0.27

*Note: Log likely- Social Distancing -366965.64; Availability of water at the place of hand wash -202114.78; Hand Hygiene -297336.45; *P<0.01*

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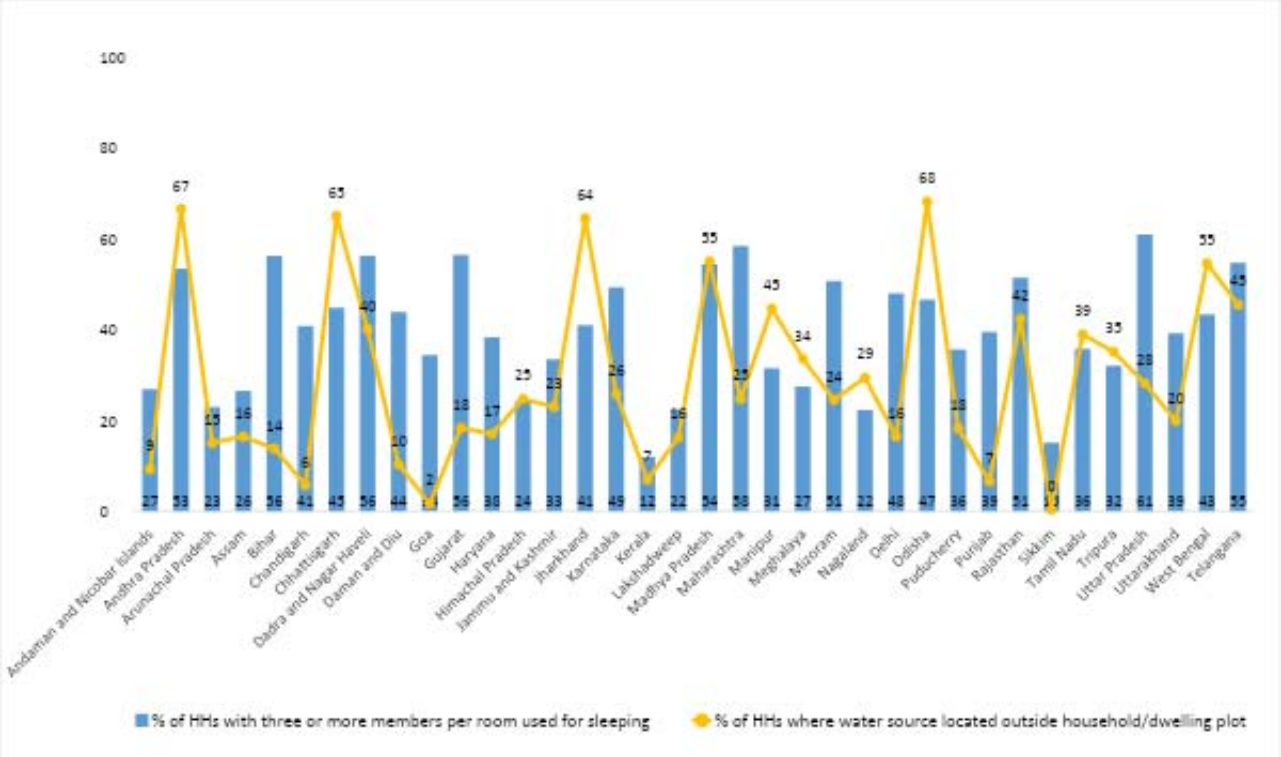


Figure 1: Percent of households whose members are highly vulnerable to ensure social distance as a means of protection from COVID-19 in different States/UTs of India, NFHS-4

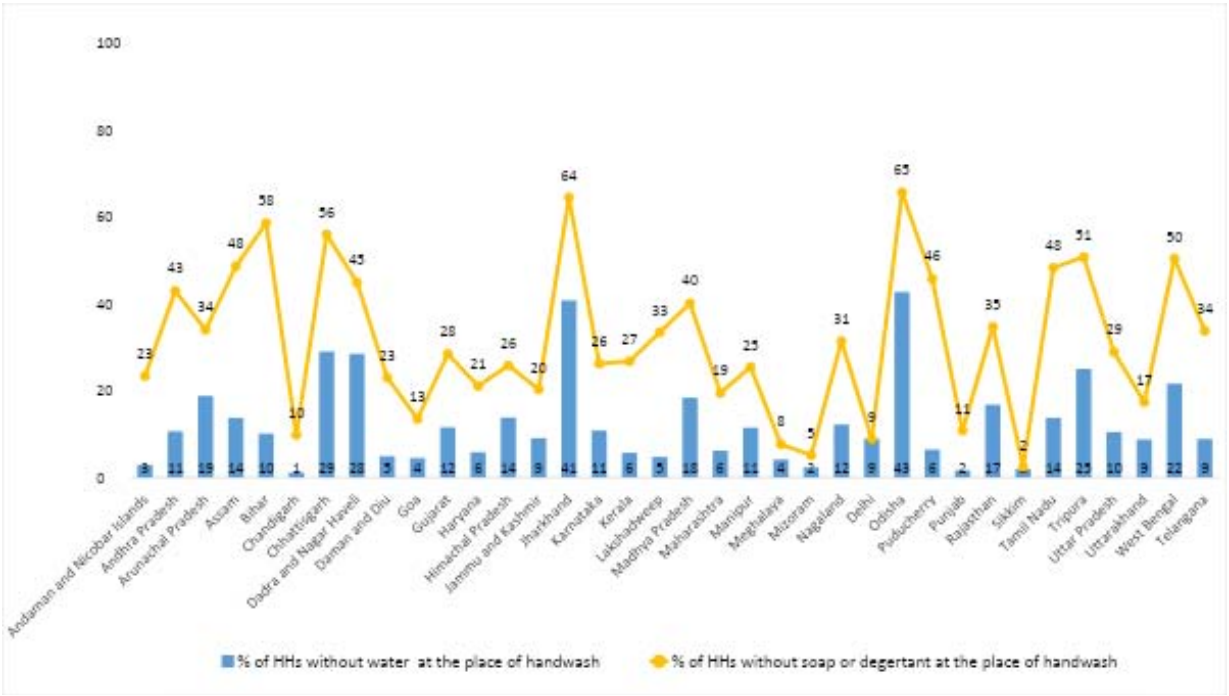


Figure 2: Percent of households whose members are highly vulnerable to ensure hand hygiene as a means of protection from COVID-19 in different States/UTs of India, NFHS-4

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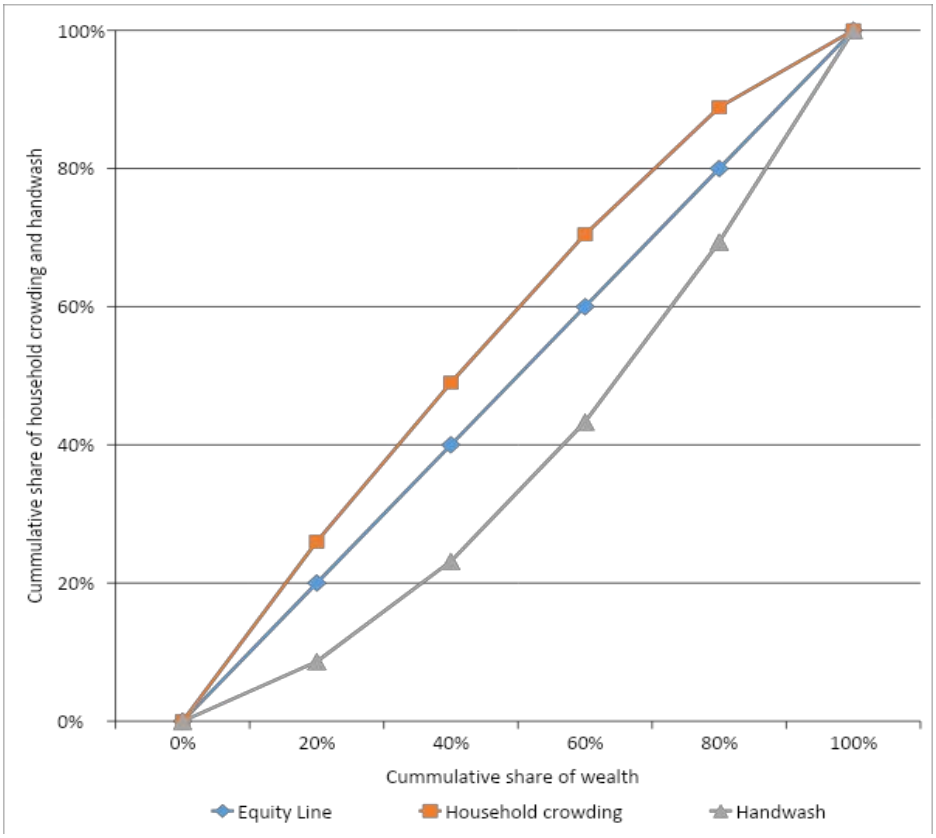


Figure 3: Concentration curve for household crowding and handwashing with soap or detergent among Households in India (NFHS-4)

Table 3: Decomposition analysis for the contribution of selected background characteristics in the economic inequality in household crowding and availability of soap and detergent for Handwashing (NFHS-4)

Variables	Household Crowding				Use of soap and detergent for Hand-wash			
	Elasticity	CI	Absolute contribution to CI	Percent contribution to CI	Elasticity	CI	Absolute contribution to CI	Percent contribution to CI
Urban place of residence	-0.032	0.427	-0.014	34.7	0.125	0.427	0.053	47.3
SC/ST caste group	0.047	-0.236	-0.011	27.6	-0.054	-0.236	0.013	11.4
Muslim religion	0.028	0.001	0.000	0.0	0.002	0.001	0.000	0.0
Non-Hindu/non-Muslim religion	-0.011	0.239	-0.003	6.8	0.008	0.239	0.002	1.7
Possession of BPL card	0.053	-0.213	-0.011	28.1	-0.034	-0.213	0.007	6.3
Water source outside house/plot	0.061	-0.114	-0.007	17.3	-0.108	-0.114	0.012	10.9
Western Region	0.044	0.132	0.006	-14.3	0.079	0.132	0.010	9.3
Northern Region	0.054	0.067	0.004	-9.0	0.095	0.067	0.006	5.6
Southern Region	-0.025	0.215	-0.006	13.8	0.060	0.215	0.013	11.6
North-eastern Region	-0.015	-0.192	0.003	-7.0	0.006	-0.192	-0.001	-1.1
Central Region	0.004	-0.185	-0.001	2.0	0.019	-0.185	-0.003	-3.0
Explained CI			-0.040	100			0.112	
Actual CI			-0.145				0.230	
Residual			-0.105				0.118	

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Odor Identification in Older Adults: Evidence from the Yakumo (2019)- Results by Gender and Age

By Naomi Katayama, Shoko Kondo, Satofumi Sugimoto, Tadao Yoshida, Masaaki Teranishi, Michihiko Sone, Yasushi Fujimoto, Hironao Otake, Hirokazu Suzuki, Takafumi Nakada, Naoki Saji, Seiichi Nakata & Tsutomu Nakashima

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Abstract- An examination of taste and olfactometry in Yakumo-Cho inhabitants' examination carried out in 2005, and the result reported in Academia Journal of Medicinal Plants 2018. This study examined olfactory function. A personal function test is calculated from the Yakumo study database, and the odor stick identification tests administered to healthy older adults. The participants were community dwellers who voluntarily participated in the Yakumo Study and had managed everyday life by themselves. The participants were engaged in a variety of jobs, not only white-collar but also agriculture, fishery, and forestry. Therefore, the city regarded as a representative of today's Japanese society. From the database, 298 participants (169 females and 129 males) were selected form data in August, 2019. The Odor Stick Identification Test (OSIT-J) was used to assess odor perception. The aromas used in the OSIT-J include curry, perfume, Japanese cypress, India ink, menthol, rose, wood, Smelly socks/ sweat, fried garlic, condensed milk, gas for cooking, and Japanese mandarin aromas.

Keywords: odor, threshold, odor stick identification test (OSIT-J), senior citizens, yakumo-study.

GJMR-K Classification: NLMC Code: WV 190



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Odor Identification in Older Adults: Evidence from the Yakumo (2019)- Results by Gender and Age

Naomi Katayama [α], Shoko Kondo [σ], Satofumi Sugimoto [ρ], Tadao Yoshida [ω], Masaaki Teranishi [¥], Michihiko Sone [§], Yasushi Fujimoto [χ], Hironao Otake [ν], Hirokazu Suzuki [Θ], Takafumi Nakada [ζ], Naoki Saji [£], Seiichi Nakata [€] & Tsutomu Nakashima [₣]

Abstract- An examination of taste and olfactometry in Yakumo-Cho inhabitants' examination carried out in 2005, and the result reported in Academia Journal of Medicinal Plants 2018. This study examined olfactory function. A personal function test is calculated from the Yakumo study database, and the odor stick identification tests administered to healthy older adults. The participants were community dwellers who voluntarily participated in the Yakumo Study and had managed everyday life by themselves. The participants were engaged in a variety of jobs, not only white-collar but also agriculture, fishery, and forestry. Therefore, the city regarded as a representative of today's Japanese society. From the database, 298 participants (169 females and 129 males) were selected form data in August, 2019. The Odor Stick Identification Test (OSIT-J) was used to assess odor perception. The aromas used in the OSIT-J include curry, perfume, Japanese cypress, India ink, menthol, rose, wood, Smelly socks/ sweat, fried garlic, condensed milk, gas for cooking, and Japanese mandarin aromas. Each fragrance enclosed in microcapsules made of melamine resin. However, the olfactory test result was better for females. The reason is that 11 males out of 129 male participants (8.5%) and two females of 169 female participants (1.2%) had abnormal values in olfactory test results. Of the 12 odor, Fried garlic, Smelly socks/ sweat, and Curry recognized by more than 80%. But, of the 12 odor, Rose, Wood, India Ink, and Household gas were by less than 60%. Household gas was the most cognitively different odor between males and females, with males being 22.3% less cognitive than females. As olfactory decay is closely related to dementia, such as Alzheimer's disease. It is necessary to do that be increase the number of cases in the future. And it is also need to investigate the relationship between lifestyle and eating habits in the future.

Keywords: odor, threshold, odor stick identification test (OSIT-J), senior citizens, yakumo-study.

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I. Introduction

The Japanese Government uses a large amount of funds for the care of elderly individuals because of a super-aged society. The elderly individual may have a decline in the sense of smell. There is a concern that with increasing age, individuals would soon be unable to identify through the sense of smell. Furthermore, nasal congestion and olfactory disorders occurring after inflammation that is caused by allergic rhinitis, modern-day hay fever, and colds also inhibit the sense of smell [1,2,3].

The odor of food is intimately related where our appreciating palate formed by a combination of olfaction (olfactory sense) and gustation (gustatory sense). Such a combination of smell and taste is referred to as 'flavor' and is an element in the appreciation of food.

Signals passing through the olfactory bulb travel to the brain along these olfactory nerves, where the signals interpreted, and the smell is recognized[4]. The medial aspect of the temporal lobe that remembers smell also stimulated at this point, and the brain can identify the odor based on a memory of previously experienced smells. In other words, smell identification requires an already-accumulated set of experienced smells[5,6].

Both olfaction and gustation start to decline in humans around the age of 50 to 59, with 40% of the elderly experiencing a noticeable the decline[7]. A person's first awareness of decline in olfaction as our primary dependence for identification of flavor occurs when one is unable to distinguish food by taste alone.

Olfaction also performs an important and essential role in our ability to detect dangers, including the smell of leaking gas, the burning odor of fire, and the putrid smell of rotten food. Olfaction is also responsible for the enrichment and psychological stimulation in our everyday lives, such as with the scents and smells of foods and flavors[8]. In an already aged society, healthy olfaction is a necessary part of creating a safe and fertile living environment and for improving an individual's quality of life.

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This study aims to understand the age-related decline in olfactory function in participants aged 40 to 49 years, 50 to 59 years, 60 to 69 years, 70 to 79 years, and 80 to 89 years. We identified the odors particularly to distinguish for individuals of these age groups. This resultmight help draw attention to issues faced by individuals in their daily lives and facilitate improvement in their quality of life. Our previous paper[9] reported that: the olfactory test result was better for females. The reason is that 27 males out of 190 male participants (14.2%) and 16 females of 260 female participants (6.2%) had abnormal values in olfactory test results.

Furthermore, in this study, when 12 kinds of odors is examined individually, it was revealed that some smells were easy to recognize, and some were difficult todo.

II. Materials and Methods

a) Participants

The participants were community dwellers who voluntarily participated in the Yakumo Study and had managed their everyday life themselves. The Yakumo Study conducted since 1981 as a joint project between the town of Yakumo in Hokkaido and the Nagoya University Graduate School of Medicine. Professionals in the fields of epidemiology, internal medicine, orthopedics, neuropsychology, ophthalmology, otolaryngology, and urology joined the Yakumo Study. The analyzed data were based on the database from 2019 to the neuropsychology and otolaryngology teams. The participants had been engaged in a variety of jobs, not only white-collar but also agriculture, fishery, and forestry. Therefore, this town can regarded as representative of today's Japanese society. From the database, 298participants (169 females and 129 males) were selected form data in August 2019 (Table 1).

Table 1: Age composition of participants in Yakumo inhabitants examination (n=298).

Participants	40's	50's	60's	70's	80's
Male (129)	**10**	**24**	**49**	**40**	**6**
Female (169)	**23**	**40**	**66**	**37**	**3**
Total (298)	**33**	**64**	**115**	**77**	**9**

b) Assessment of odour identification

The Odor Stick Identification Test (OSIT-J) was used to assess odour perception. This test possesses high reliability and validity[10]. The OSIT-J includes 12 different odorants to be identified. As odor perception is not necessarily culture-free, the Japanese version was employed [11,12]. The procedure resembles that of the San Diego Odor Identification Test[13]. The aromas used in the OSIT-J include curry, perfume, Japanese cypress, India ink, menthol, rose, wood, smelly socks / and sweat, roasted garlic, condensed milk, gas for cooking, and Japanese mandarin aromas. Each fragrance enclosed in microcapsules made of melamine resin. These microcapsules were mixed with an odorless solid cream and then shaped to look like a lipstick. During the inspection test, the examiner applied each odorant to a piece of paraffin paper. After the application, the examiner handed the paper to the participant, who would then sniff the one and identify the odor. Participants selected each answer from a set of cards, each of which listed the name of an odorant, including the correct answer. Each correct answer scored as one point with the total performance score ranging from 0 to 12 points. We defined it as follows: normal range as more than 6, borderline as 3 to 5, and abnormal as less than 2 points. All of these methods are the same as in the previously reported paper[9].

c) Questionnaire survey on cognitive odor perception

A direct questionnaire survey conducted on subjective odor perception. Participants chose their odor perception from three choices: well recognized, recognized, and unrecognized. The results tabulated.

d) Ethical review board

This study conducted with the approval of the Ethical Review Board (Nagoya women's university Ethics Committee: 'hitowomochiitakennkyuunikansuruiinnkai'). The approval number is 30-14.

III. Results

a) Questionnaire survey on cognitive odor perception

Tabel 2. Shows, Ten males (7.8%), and two females (1.2%) answered that they could not perceive odor well. Males do not recognized it six times as strong as females. More than 90% of males and females, subjective odor was recognizable.

b) Assessment of odor identification

Olfactometry performed using odorstick (Diichiyakuhin Co. Ltd) [14]. However, the olfactory test result was better for females. Table 3 shows, it is as a result of the fact that 11 males out of 129 male participants (8.5%) and two females of 169 female participants (1.2%) had abnormal values in olfactory test results.

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Table 2: Results of Questionnaire Survey on subjective olfaction at Yakumo Tow Resident's medical examination Age・Sex distribution (number of participants: (%)) (n=298)

	Male (n=129)			Female (n=169)		
	Well Recognized	Recognizid	Unrecognizable	Well Recognized	Recognizid	Unrecognizable
40's (M=10, F=23)	4 (40.0%)	6 (60.0%)	0 (0.0%)	8 (34.8%)	14 (60.9%)	1 (4.3%)
50's (M=24, F=40)	6 (25.0%)	16 (66.7%)	2 (8.7%)	17 (42.5%)	22 (55.0%)	1 (2.5%)
60's (M=49, F=66)	17 (34.7%)	28 (57.1%)	4 (8.2%)	14 (21.2%)	52 (78.8%)	0 (0.0%)
70's (M=40, F=37)	12 (30.0%)	25 (62.5%)	3 (7.5%)	22 (59.5%)	15 (40.5%)	0 (0.0%)
80's (M=6, F=3)	2 (33.3%)	3 (50.0%)	1 (16.7%)	1 (33.3%)	2 (66.7%)	0 (0.0%)
Total (M=129, F=169)	41 (31.8%)	78 (60.5%)	10 (7.8%)	62 (36.7%)	105 (62.1%)	2 (1.2%)

Twelve odors examined individually. The results shown in Tables 4 and 5. Of the 12 smells, Fried garlic, Smelly socks/ sweat, and Curry recognized by more than 80%. But, Rose, Wood, India Ink, and Household gas undrestood by less than 60%. Household gas was the most cognitively different odor between males and females, with males being 22.3% less cognitive than females.

Table 3: Cognitive number results from 12 simple olfactory tests Age/sex distribution (number of participants) (n=298)

	Recognized number of odors types Male (n=129)													
Male (n=129)	zero	one	two	three	four	five	six	seven	eight	nine	ten	eleven	twelve	Detection only
40's (n=10)	0	0	0	0	0	0	1	2	1	2	1	2	1	0
50's (n=24)	0	0	0	1	1	2	2	0	4	7	6	1	0	0
60's (n=49)	0	0	0	2	4	7	4	9	7	2	6	3	1	4
70's (n=40)	1	2	1	3	4	5	4	0	5	5	2	3	2	3
80's (n=6)	0	1	0	0	0	2	1	0	1	1	0	0	0	0
	Recognized number of odors types Female (n=169)													
Female (n=169)	zero	one	two	three	four	five	six	seven	eight	nine	ten	eleven	twelve	Detection only
40's (n=24)	0	0	0	1	0	1	0	0	7	4	5	4	2	0
50's (n=39)	0	0	0	0	0	1	1	1	6	7	7	12	4	0
60's (n=66)	0	0	1	0	4	0	6	5	10	8	9	17	6	0
70's (n=37)	0	0	1	1	1	6	4	2	8	7	6	1	0	0
80's (n=3)	0	0	0	0	1	0	0	1	1	0	0	0	0	0

Table 4: Results of 12 kinds of odor recognition test with odor stick (Number of participants) (n=298: 129 male, 169 female)

	Judgment	India ink	Wood	Perfume	Menthol	Orange	Curry	Household gas	Rose	Cypress	Smelly socks, and sweat	Condensed milk	Fried garlic
Total (n=298)	mistake	83	50	76	32	69	27	102	66	79	46	67	39
	Cognition	162	176	193	218	188	239	174	141	182	239	210	242
	ditection	45	56	24	39	39	25	22	70	29	12	19	17
	odorless	8	16	5	9	2	7	0	21	8	1	2	0
Female (N=169)	mistake	46	23	37	15	30	13	45	33	40	23	31	18
	Cognition	108	111	124	135	117	142	115	94	115	144	131	147
	ditection	13	25	7	4	21	10	9	30	12	2	6	4
	odorless	2	10	1	4	1	4	0	12	2	0	1	0
Male (N=129)	mistake	37	27	39	17	39	14	57	33	39	23	36	21
	Cognition	54	65	69	83	71	97	59	47	67	95	79	95
	ditection	32	31	17	24	18	15	13	40	17	10	13	13
	odorless	6	6	4	5	1	3	0	9	6	1	1	0

Table 5: Results of 12 kinds of odor recognition test with odor stick (%) (n=298: 129 male, 169 female)

	Judgment	India ink	Wood	Perfume	Menthol	Orange	Curry	Household gas	Rose	Cypress	Smelly socks, and sweat	Condensed milk	Fried garlic
Total (n=298)	mistake	27.9	16.8	25.5	10.7	23.2	9.1	34.2	22.1	26.5	15.4	22.5	13.1
	Cognition	54.4	59.1	64.8	73.2	63.1	80.2	58.4	47.3	61.1	80.2	70.5	81.2
	ditection	15.1	18.8	8.1	13.1	13.1	8.4	7.4	23.5	9.7	4.0	6.4	5.7
	odorless	2.7	5.4	1.7	3.0	0.7	2.3	0.0	7.0	2.7	0.3	0.7	0.0
Female (N=169)	mistake	27.2	13.6	21.9	8.9	17.8	7.7	26.6	19.5	23.7	13.6	18.3	10.7
	Cognition	63.9	65.7	73.4	79.9	69.2	84.0	68.0	55.6	68.0	85.2	77.5	87.0
	ditection	7.7	14.8	4.1	2.4	12.4	5.9	5.3	17.8	7.1	1.2	3.6	2.4
	odorless	1.2	5.9	0.6	2.4	0.6	2.4	0.0	7.1	1.2	0.0	0.6	0.0
Male (N=129)	mistake	28.7	20.9	30.2	13.2	30.2	10.9	44.2	25.6	30.2	17.8	27.9	16.3
	Cognition	41.9	50.4	53.5	64.3	55.0	75.2	45.7	36.4	51.9	73.6	61.2	73.6
	ditection	24.8	24.0	13.2	18.6	14.0	11.6	10.1	31.0	13.2	7.8	10.1	10.1
	odorless	4.7	4.7	3.1	3.9	0.8	2.3	0.0	7.0	4.7	0.8	0.8	0.0

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Next, we examined the recognition of 12 kinds of odors by age and sex for each one. The results shown in Table 6 and Table 7. In this study, there were few participants in their 40's and 80's, so we compared males, and females in their 50's, 60's and 70's. Almost all odors were poorly recognized in both males and females in their 60's than in their 50's. Especially the male fried garlic was 24.5% worse. Also, in females, it had a 35, 3% worse household gas in their 60's than in their 50's. It found that the odor suddenly became unrecognizable from the '60s.

Table 6: Individual results for 12 types of odor tests age・sex distribution (number of participants)

					Results for 12 types of odor tests	Number of correct answers	Male	(n=129)				
Male (n=129)	India ink	Wood	Perfume	Menthol	Orange	Curry	Household gas	Rose	Cypress	Smelly socks, and sweat	Condensed milk	Fried garlic
40's (n=10)	7	7	8	0	7	7	7	5	7	8	8	10
50's (n=24)	12	13	15	19	14	22	15	10	17	20	17	21
60's (n=49)	20	25	26	31	24	35	21	18	25	37	25	33
70's (n=40)	13	17	17	21	25	27	15	13	16	26	24	27
80's (n=6)	2	3	2	3	2	5	2	1	2	4	4	4
					Results for 12 types of odor tests	Number of correct answers	Female	(n=169)				
Female (n=169)	India ink	Wood	Perfume	Menthol	Orange	Curry	Household gas	Rose	Cypress	Smelly socks, and sweat	Condensed milk	Fried garlic
40's (n=24)	14	17	16	22	17	20	15	15	18	22	17	20
50's (n=39)	26	25	35	38	28	37	35	26	27	36	34	38
60's (n=66)	46	47	50	41	48	47	43	40	48	56	51	55
70's (n=37)	21	21	22	23	22	25	21	13	19	27	27	32
80's (n=3)	1	1	1	1	2	2	1	0	3	3	2	2

Table 7: Individual results for 12 types of odor tests age・sex distribution (%)

					Results for 12 types of odor tests	Correct answer rate (%)	Male	(n=129)				
Male (n=129)	India ink	Wood	Perfume	Menthol	Orange	Curry	Household gas	Rose	Cypress	Smelly socks, and sweat	Condensed milk	Fried garlic
40's (n=10)	70.0	70.0	80.0	0.0	70.0	70.0	70.0	50.0	70.0	80.0	80.0	100.0
50's (n=24)	50.0	54.2	62.5	79.2	58.3	91.7	62.5	41.7	70.8	83.3	70.8	87.5
60's (n=49)	40.8	51.0	53.1	63.3	49.0	71.4	42.9	36.7	51.0	75.5	51.0	67.3
70's (n=40)	32.5	42.5	42.5	52.5	62.5	67.5	37.5	32.5	40.0	65.0	60.0	67.5
80's (n=6)	33.3	50.0	33.3	50.0	33.3	83.3	33.3	16.7	33.3	66.7	66.7	66.7
					Results for 12 types of odor tests	Correct answer rate (%)	Female	(n=169)				
Female (n=169)	India ink	Wood	Perfume	Menthol	Orange	Curry	Household gas	Rose	Cypress	Smelly socks, and sweat	Condensed milk	Fried garlic
40's (n=24)	58.3	70.8	66.7	91.7	70.8	83.3	62.5	62.5	75.0	91.7	70.8	83.3
50's (n=39)	66.7	64.1	89.7	97.4	71.8	94.9	89.7	66.7	69.2	92.3	87.2	97.4
60's (n=66)	69.7	71.2	75.8	62.1	72.7	71.2	65.2	60.6	72.7	84.8	77.3	83.3
70's (n=37)	56.8	56.8	59.5	62.2	59.5	67.6	56.8	35.1	51.4	73.0	73.0	86.5
80's (n=3)	33.3	33.3	33.3	33.3	66.7	66.7	33.3	0.0	100.0	100.0	66.7	66.7

IV. Discussion

It showed that the number of participants who show abnormal values in the olfactory test result is more than twice that of males as compared with females. This result was almost the same as the previous paper[9]. Also, as before, it was shown that the olfactory test results worsened as the age increased. Since olfactory test results have been reported by many researchers to be related to dementia such as Alzheimer's disease[15]. It is necessary to further investigate the number of cases in the future. Especially since males have poor olfactory test results as compared with females, this showed in the previous paper; it is necessary to investigate the relationship with lifestyle and eating habits in the future. Recently, it has reported that when a person suffers from COVID-19, he/she cannot sense the smell due to olfactory disorder[16]. Research on olfaction will become more and more necessary in the future.

Twelve odors examined individually. The results are shown, of the 12 odors, Fried garlic, Smelly socks/sweat, and Curry were recognized by more than 80%. But, of the 12 smells, Rose, Wood, India Ink, and Household gas were understood by less than 60%. Household gas was the most cognitively different odor between males and females, with males being 22.3% less cognitive than females. It was a good result for both males and females to be familiar with curry that eats well in life, fried garlic with a burnt smell, and Smelly socks/sweat that helps prevent food poisoning. However, it is that household gas is difficult to understand. This is because the odor must be instantly applied to aboid the danger of gas poisoning and gas explosion.

Next, we examined the recognition of 12 kinds of odors by age and sex for each one. The results are shown, in this study, there were few participants in their 40's and 80's, so we compared males and females in

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their 50's, 60's, and 70's. Almost all odors were poorly recognized in both males and females in their 60's than in their 50's. Especially the male fried garlic was 24.5% worse. Also, in females, it had a 35,3% worse household gas in their 60's than in their 50's. It found that the odor suddenly became unrecognizable from the 60's. Since the perception of odors in participants in their 60's deteriorates sharply compared to those in their 50's. We believe that it is necessary to undergo a regular odor check after the '60s.

Moreover, the number of cases is small in the age of '80s in each one statistically processed at this time. Therefore, the result of this study does not go out of the range of the hypothesis. It is a future task as same as before.

V. Conclusions

In Yakumo Study, from the database, 298 participants (169 females and 129 males) were selected form data in August 2019. The aromas used in the OSIT-J include curry, perfume, Japanese cypress, India ink, menthol, rose, wood, Smelly socks/ sweat, fried garlic, condensed milk, gas for cooking, and Japanese mandarin aromas. The olfactory test result was better for females. The reason is that 11 males out of 129 male participants (8.5%) and two females of 169 female participants (1.2%) had abnormal values in olfactory test results. Of the 12 odors, Fried garlic, Smelly socks/ sweat, and Curry recognized by more than 80%. But, of the 12 smells, Rose, Wood, India Ink, and Household gas understood by less than 60%. Household gas was the most cognitively different odor between males and females, with males being 22.3% less cognitive than females.Almost all smells were poorly recognized in both males and females in their 60's than in their 50's. As olfactory decay is closely related to dementia such as Alzheimer's disease. It is necessary to that increase the number of cases in the future. Recently, it reported that when a person suffers from COVID-19, he/she cannot sense the smell due to olfactory disorder. We believe that regular olfaction testing is necessary to maintain the health of the elderly. And it is need to investigate the relationship between lifestyle and eating habits in the future.

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The Capacity of Adolescent- Friendly Reproductive Health Services to Promote Sexual Reproductive Health among Adolescents in Bindura Urban of Zimbabwe

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Abstract- This study seeks to understand the capacity of Adolescent-Friendly Reproductive Health services (AFRHS) in promoting Sexual Reproductive Health (SRP) among adolescents in Bindura Urban of Zimbabwe. Qualitative methodology was employed to understand the utilisation of AFRHS. Health service utilisation was assessed through key informant interviews, focus group discussions, observations and documentary search. The data collection methods used allowed the researcher to get insight on adolescents' experience and the factors associated with their accessing SRH services from AFRHS; the meaning of AFRHS for adolescents; health care providers' attitudes towards adolescents seeking SRH services; and community perceptions and readiness to accept AFRHS. The findings showed that both socio-cultural and health facility factors influence utilisation of SRH services. Many of these factors stem from the moral framework encapsulated in socio-cultural norms and values related to the sexual health of adolescents, and health care providers' poor value clarification. This study provides an empirical understanding of the reasons and factors associated with SRH service utilisation, which goes much deeper than program provision of AFRHS in Zimbabwe.

Keywords: *adolescence, health friendly services, sexual reproductive health, sexuality, world health organization, socio-cultural norms.*

GJMR-K Classification: *NLMC Code: WQ 200*

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Keywords: adolescence, health friendly services, sexual reproductive health, sexuality, world health organization, socio-cultural norms.

I. Introduction

One of the major contributions made in response to the SRH care needs of adolescents came from the health sector with the Adolescent-Friendly Reproductive Health Services (AFRHS) initiative. The concept was introduced following the 1994 Cairo conference that prioritised the SRHS of adolescents and young people (UN, 1995). Since then, attempts have been made globally by the health sector to address young people's SRH issues. The introduction of AFRHS into the current health delivery system is one example of healthcare improvements that were recommended, particularly for developing countries. The World Health Organization (WHO) defined AFRHS as an approach which brings together the qualities that young people demand, with the high standards that have to be achieved in the best public services" (McIntyre, 2002).

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The concern about ASRH has grown following reports that sexual activity, early pregnancies and Sexually Transmitted Infections (STIs) including HIV infection rates are increasing at unprecedented rates among adolescents (UNICEF, 2007; Sandoy et al., 2007). The importance of facility-based AFRHS has long been recognised by health policy makers as manifested in an increasing number of countries. From its outset, AFRHS focused on improving the availability, accessibility and quality of SRH services because AFRHS were developed against the backdrop of inadequacies on the part of health systems to provide SRHS in an efficient, effective and equitable manner to young people (UNFPA, 2003). While most barriers to adolescents' utilisation of SRHS have been attributed to quality of SRHS; a critical analysis of the barriers to ARHS promotion reveals that cultural norms that influence people's behaviours and actions related to sexual and reproductive matters are also extremely important (Senderowitz, 1999). Furthermore, the current rapid social, political and economic transformations in Southern Africa appear to have a profound impact on the social norms affecting adolescents (Blum, 2007).

Previous research findings indicate that that socio-cultural norms influence adolescents to adopt unsafe sex practices in most African countries (Chimbiri, 2007). Other evidence also shows that some health workers become judgemental or hostile to unmarried people who come for SRHS. Health workers have also been accused of being reluctant to teach adolescents about SRH (Mbugua, 2007) and provide them with SRH services (Chirwa and Kudzala, 2001). This is because prevailing cultural norms in some countries proscribe young, unmarried people having sex (Chirwa and Kudzala, 2001). Some health facilities in some countries also have restrictive policies (such as consent requirement to access SRHS) that hinder unmarried adolescents to access SRHS (UNFPA, 2003). Moreover, in most societies, the SRH needs and rights of unmarried adolescents are not acknowledged. Thus, because of culture, government policies and plans do not include policies and resource allocations that can

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promote implementation of SRHS targeting unmarried adolescents (UNICEF, 2003).

a) Overview of Adolescent Reproductive Health Rights in Zimbabwe

This section looks at the current legal and policy provisions on sexual and reproductive health services in Zimbabwe. Section 76 (1) of the Constitution of Zimbabwe (2013) states that:

Every citizen and permanent resident of Zimbabwe has the right to have access to basic health-care services, including reproductive health-care services.

The Public Health Act of 2018 is not particularly explicit, but its Section 35 has been read to provide that children – defined as persons under the age of 18 – require parental or adult consent to access medical health services. Section 52(2) of the Medicines and Allied Substances Control (General) Regulations, 1991, Statutory Instrument 150 of 1991 (made in terms of the Medicines and Allied Substances Control Act [Chapter 15:03] provides as follows:

"No person shall sell any medicine to any person apparently under the age of 16 years;

a) In the case of a household remedy or a medicine listed in Part I of the Twelfth Schedule, except upon production of a written order signed by the parent or guardian of the child known to such person;

b) In the case of any other medicine not referred to in paragraph (a) except upon production and in terms of a prescription issued by a medical practitioner, dental practitioner or veterinary surgeon.

The limitation of access to ASRHS to persons above 16 years of age is often linked to the age of sexual consent, which in Zimbabwe is set at 16 by the Criminal Law (Codification and Reform Act). The notion is that a person under the age of 16 cannot legally have sexual intercourse and, therefore, can only access SRHS without a police report or adult company. This, however, disregards the fact that Zimbabwe does not penalise consensual sex between children aged 12 and 16.

Section 70 (2a) of the Criminal Law (Codification and Reform Act) reads:

Where extra-marital sexual intercourse or an indecent act occurs between young persons who are both over the age of twelve years but below the age of sixteen years at the time of the sexual intercourse or the indecent act, neither of them shall be charged with sexual intercourse or performing an indecent act with a young person except upon a report of a probation officer appointed in terms of the Children's Act [Chapter 5:06] showing that it is appropriate to charge one of them with that crime.

A child under the age of 16 years cannot legally consent to sexual intercourse at law; it is then presumed that a child under the age of 16 years does not need contraceptives or other SRHS, which is a belief that prejudices children. This is because children between 12 and 16 years can among themselves have consensual sexual intercourse without offending any penal provision. That legal position aside – and most children are in fact not aware of that legal position – it is fact that children are engaging in sexual activity among themselves at early ages. Such children require access to sexual and reproductive health services as an intervention. In Zimbabwe, the push to remove age restrictions from access to sexual and reproductive health has been conflated with the lowering of the age of consent. This confusion is compounded by the government's stated intention to raise the age of sexual consent from 16 to 18, in line with the constitutional provision that only people aged 18 and above are allowed to marry. The conflation of sexual consent and the age of marriage, informed by cultural and religious attitudes, is evident in the government's position on the matter.

b) Key statistics

In Zimbabwe the following estimates have been made with regards to ASRHS:

- That the 15-24 age group population of girls and young women is 1.365 million.
- HIV prevalence for the 15-24 demographic is around 7.04%.
- 22% of adolescent females aged between 15-19 years have begun childbearing.
- 1 in every 6 teenagers (17%) has given birth and another 5% are estimated to be pregnant with their first child.
- The proportion of girls aged 15-19 who have begun childbearing increases with age, from 3% among girls aged 15 to 48% among 19-year-olds.
- 48% of young people do not know their HIV status as they need parental consent for testing.
- 16,000 new HIV infections are attributed to young women who have never been married.
- 70,000 illegal abortions are performed in Zimbabwe annually, many of them involving adolescents under 16 years old.

c) Purpose of the Study

This study seeks to understand the capacity of AFRHS to promote SRH among adolescence in Bindura Urban of Zimbabwe.

d) Research Objectives

i. To identify the capacity of the ASRHS providers in meeting the SRHR needs of adolescents in Binndura urban of Zimbabwe.
ii. To examine the impact of socio-cultural norms in influencing adolescent sexual behaviours.
iii. To identify the challenges being faced by ASRHS in meeting the needs of adolescents.

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II. Literature Review and Theoretical Framework

Researchers have tried to understand adolescents from different theoretical viewpoints focusing particularly on biological and neurological development and the influence of socio-ecological environments as determinants of their behaviour. The sociological view understands adolescence emerging from the socio-economic changes resulting from the arrival of institutionalised schooling practices in the 20th century (Caldwell et al., 1998; Demos & Demos, 1969; Modell & Goodman, 1990). The biological view of adolescence highlights physical maturation due to hormonal and emotional changes at puberty as an important signal of this period (Patton & Viner, 2007; Spear, 2012). The biological maturation perspective, introduced by Hall (1916), explains that the development of the individual throughout adolescence is determined by biological and genetic forces. Patton et al. (2016) explains that during adolescence brain development occurs together with pubertial process including gonadal hormone change along with maturation of sub-cortical structure in brain that allows understanding sex differences. Yet socio-cultural, nutritional environmental context and exposure such as substance use also influence adolescents' expressions and experiences of this period (Patton et al., 2016; Steinberg, 2001). The biological maturity perspective is also associated with elevated rates of risky behaviours due to the hormonal changes characterising this period (Kipke, 1999).

Ecological perspectives have similarly explained that contextual social and environmental factors like economic status, cultural background, and the general environment contribute to the social norms and values, opportunities and reinforcements the condition that determine the behaviours of adolescents (Millstein & Igra, 1995). Often, risky behaviours including high-risk sexual behaviour like early and unprotected sexual intercourse, forced sex and multiple sexual partners, and inter-generational sex, sexually transmitted infections and HIV are associated with family poverty, poor parental monitoring, peer influence and poor exposure of adolescents to SRH information (Ssewanyana, 2018; Underwood, Skinner, Osman, & Schwandt, 2011).

a) *Definition of Adolescence*

Generally, adolescence is considered a time of transition from childhood to adulthood during which there are physical changes associated with puberty (Adamchak., et al 2000; Senderowitz and Paxman, 1985). From this biological perspective, adolescence is defined as a period of lifespan of between the ages 10 to 19 years (WHO, 2003b). The period of adolescence is characterised by a number of changes including physical and emotional changes, the search for identity and greater maturity in reasoning. It is considered as the period during which the individual progresses from the initial appearance of secondary sex characteristics to that of sexual maturity, whereby individual's psychological processes and patterns of identification develop from those of a child to an adult. Thus, adolescence is considered as a time of transition from childhood to adulthood, during which young people experience changes following puberty, but do not immediately assume the roles, privileges and responsibilities of adulthood (Jejebhoy and Bott, 2003).

Socially, the notion of adolescence is not the same everywhere. Although the utilization of the concept of adolescence is so widespread in SRH literature, the term usually alludes to different phenomena. Because it is a culturally defined phenomenon, adolescence is a term whose meaning is variously defined in the literature (Dawes and Donald, 1994; Schlegel 1995; Caldwell et al., 1998). Furthermore because adolescence is experienced differently in every society; and even within societies there may be vast differences in how some youth experience adolescence as compared to others. Adolescents and young people are not a homogenous group; their lives vary enormously by age, sex, marital status, class, region and cultural context.

Due to the variations in the definition, adolescence is both a period of opportunity as well as time of vulnerability and risk. Schlegel (1995) defines adolescence as a life phase that involves the management of sexuality among unmarried individuals, social organisation and peer group influence among adolescents, and training in occupational and life skills. It is the time when new options and ideas are explored. As such, it is a phase in life marked by vulnerability to health risks, especially those related to unsafe sexual activity and related reproductive health outcomes like unwanted and unplanned pregnancy and STIs, and by obstacles to the exercise of informed reproductive choice (Munthali et al., 2004).

Adolescence is the life stage crucial for the opportunity of lifelong good health, a time when future patterns of adult health are established (Sawyer et al., 2012). At the same time, adolescents are often associated with increased risk-taking behaviour due to hormonal changes, neurological changes and exposure to social environment during puberty (Galvan et al., 2006; Patton et al., 2016; Steinberg, 2011). During this period, adolescents seek greater independence and responsibility, and more autonomy over their decisions and actions as they try to form identities and become conscious that choices can be of their own making (Marcia, 1980; Montgomery, 2005). Sawyer et al. (2012) define adolescence as a life phase that is mostly exciting and comes with numerous opportunities, where adolescents learn from peers, parents, society, and

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communication technologies which, as a whole, shape and direct their future. From another side, researchers emphasise that adolescence is also a phase when young people begin to explore their sexuality and may engage in early sexual activities as part of their sexual curiosity (Regmi et al., 2010a; Skinner, Smith, Fenwick, Fyfe, & Hendriks, 2008). Early-age engagement in sexual activities has been shown to be a strong marker for future poor sexual health and risk behaviour patterns (Cavazos-Rehg et al., 2010; Zuma et al., 2014). Sexual initiation at a younger age is often associated with unintended adolescent pregnancies (Baumgartner, Geary, Tucker, & Wedderburn, 2009; Idele et al., 2014; Magnusson, Masho, & Lapane, 2012), risk of sexually transmitted infections and HIV/AIDS (Shrestha, Karki, & Copenhaver, 2016; Stryhn & Graugaard, 2014), and subsequent risk behaviour in later life, including having multiple sexual partners (Li et al., 2015; Shrestha et al., 2016; Zuma et al., 2014) and more negative attitudes towards condom use (Sandfort, Orr, Hirsch, & Santelli, 2008). The ongoing decline in the age at which sex is first had, and an increased instance of sexually active adolescents in many countries has raised serious concerns among global public health experts, who associate these factors with negative health outcomes for these individuals as they reach adulthood.

b) Factors influencing access to and utilisation of adolescent sexual and reproductive health services

Despite the focus given to the provision of SRH services, adolescents continue to face challenges in accessing reproductive health services (Chandra-Mouli et al., 2015b). The challenges that impact on SRH utilisation are often a result of complex social, environmental, cultural, economic and psychosocial factors (WHO, 2011). A review conducted by Tylee et al. (2007) for a *Lancet* series on adolescent health noted that research, mainly from developing countries, has indicated that almost 70-90% of young people visit primary health care facilities at least once a year, but rarely for SRH issues; the major reasons were for treatment of respiratory or dermatological problems. The review further noted that in developing countries young people are not willing to seek professional help for sensitive SRH issues and, furthermore, it is adults who would decide their SRH needs (Tylee et al., 2007).

There could be various reasons why young people are not willing to seek services for SRH issues, and research that endeavours to understand this non-utilisation is key to improving the quality of life for young people. This understanding could help prevent SRH morbidity, and provide an evidence base for designing health promotion interventions. The complexity of SRH service utilisation could be clarified by different models of health care utilisation. There are several models that explain health care utilisation. For example, the psychosocial health belief model (Rosenstock, 1974) is based on individuals' beliefs about health problems and perceptions of the benefit that motivates health seeking; the Andersen-Newman behavioural model of health service use (Andersen & Newman, 1973) emphasises social determinants, the health service system and individual determinants that influence health service utilisation; and in Kroeger's model (Kroeger, 1983) the major elements are the characteristics of the patient, of disorder perception, and of the health service.

The health service utilisation of adolescents is embedded in complex contextual elements related to demographics and social structures, and health system factors that influence adolescent SRH. Hence, the focus in discussing SRH service utilisation is on identifying factors that may influence the health-seeking behaviours of adolescents. The health belief model of Rosenstock (1974) centres on an individual's belief and perceptions and omits the environmental influences and social structures that might influence the decision of adolescents to utilise SRH services. Therefore, this model is not appropriate to understanding the factors affecting adolescent SRH service utilisation. Andersen and Newman (1973) emphasises social determinants, and Kroeger (1983) emphasises patient characteristics and demographic and social variables, and hence, these two models might best explain factors associated with adolescents' SRH service utilisation. However, these models are not sufficiently comprehensive when considered on their own. Health service utilisation is likely to be better understood when a combination of both models is applied.

The Andersen-Newman (1973) model of health service utilisation established that an individual's health care seeking is influenced by three components: predisposing, enabling and need as factors that facilitate or impede utilisation of services by individuals. In this model predisposing factors are demographic and social structures; enabling factors are those allowing the use of services such as income, access to service and availability; and need factors such as conditions of ill-health or disease motivate service seeking. This model has been previously applied and tested in investigations of a range of health services and in health systems research, including adolescent SRH care seeking.

Azfredrick (2016), using this model to examined reproductive health service utilisation by adolescent girls, showed that enabling factors like parental support, finances, and type of health facility were important determinants of adolescents deciding to seek SRH services. Shabani, Moleki, and Thupayagale-Tshweneagae (2018), in their exploratory descriptive and contextual qualitative research among 20 male adolescents in South Africa, noted that predisposing factors like health belief, and enabling factors like the availability of quality ASRH services were important for SRH service utilisation.

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Similarly, Kroeger's (1983) model emphasised patient characteristics, which embrace features of predisposing factors from Anderson-Newman (1973), and demographic and social variables. It then considers the characteristics of disorders such as the nature and severity of a disease. The third most important aspect of the framework which is particularly relevant for adolescent SRH service utilisation is the focus on the enabling environment of health facilities, including geographical accessibility, acceptability, quality of care, and cost associated with services (Kroeger, 1983).

While the Anderson-Newman and Kroeger models provide comprehensive frameworks for looking at the factors associated with adolescents' SRH service utilisation, the WHO's "quality of care" framework expands on Kroeger's enabling factors. The quality of care framework is a guide to improving health services provision such that patients' service utilisation improves (WHO, 2006b). This framework was utilised to define the AFHS domain for quality health care that includes accessible, acceptable, equitable, appropriate and effective services (WHO, 2012). Components include accessibility and acceptability, which also feature in Kroeger's model, but in addition, quality of care includes equitable, appropriate and effective service.

III. Research Design and Methodology

A case study research design of Bindura urban was utilised in order to understand the capacity utilisation of adolescent reproductive health rights services. In Bindura there are very few adolescent reproductive health service providers as evidenced by the field work research. Qualitative research methodology was used. The advantage of qualitative research is that it takes a naturalistic approach concerned with understanding reality and assumes that reality is a complex and dynamic phenomenon which is constructed through the interactions of human agents in their social world (Creswell, 1994; Ritchie & Lewis, 2003). This study was interested in understanding the reasons for the low utilisation of sexual and reproductive health services by adolescents from adolescent-friendly health services. Thus, a qualitative approach is well-suited to achieving this insight.

Creswell (2013) reiterates that qualitative researchers typically gather data in multiple forms and, drawing on Creswell, the study chose to apply data collection methods such as key informant interviews, observations, focus group discussions, and document analysis. As Creswell argues, employing multiple forms of data collection, rather than relying on a single source of data is an aid to making sense of the issue under study, in this case, the complexities surrounding the utilisation of adolescent-friendly health services. Key informants were drawn from employees of health care facilities (such as nurses, peer counsellors and home based care providers), parents and guardians while focus group discussions were held with adolescents from Bindura urban.

IV. Discussion of Findings

This section presents findings from the study. Various views from different research participants will be indicated as expressed by the participants.

a) Factors influencing access to and utilisation of adolescent sexual and reproductive health services

Despite the focus given to the provision of ASRH services, adolescents continue to face challenges in accessing reproductive health services (Chandra-Mouli et al., 2015b). The challenges that impact on SRH utilisation are often a result of complex social, environmental, cultural, economic and psychosocial factors (WHO, 2011). A review conducted by Tylee et al. (2007) for a *Lancet* series on adolescent health noted that research, mainly from developing countries, has indicated that almost 70-90% of young people visit primary health care facilities at least once a year, but rarely for SRH issues; the major reasons were for treatment of respiratory or dermatological problems. The review further noted that in developing countries young people are not willing to seek professional help for sensitive SRH issues and, furthermore, it is adults who would decide their SRH needs (Tylee et al., 2007).

b) Individual factors for adolescents' sexual and reproductive health service utilisation

Although there are several individual-level determinants associated with health service utilisation, by young people, the literature emphasises education level and sexual relationship status, as major factors.

c) Education

Education was ranked as one of the most important factors contributing to capacity utilisation of AFRHS by the research participants. One of the nurses interviewed during the study indicated that:

> "To me education is very important. I have realised that most of the adolescents who come here seeking our services have gone up to secondary level. This is different from the rural areas and farming communities where some adolescents have only gone up to Grade seven while others are not even able to read and write."

The above sentiments were also supported by a Peer Educator who mentioned that:

> "The most likely explanation is that educated adolescents had better access to information, more knowledge about the availability of the services, and a better understanding that their sexual health could benefit from preventive health care."

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Adolescents from one focus group discussion indicated the importance of education. They highlighted that:

> "At school we learn about sexual reproductive health rights in our guidance and counselling classes. We know our sexual reproductive rights."

A number of studies have identified that adolescents who are educated at least up to higher secondary level are more likely to use SRH services, especially family planning and voluntary counselling and testing services (Feleke, Koye, Demssie, & Mengesha, 2013; Hutchinson & Mahlalela, 2006; Nwachukwu & Odimegwu, 2011). Feleke et al. (2013) in their study of adolescents in northwest Ethiopia noted that adolescents with secondary education were three times more likely to use Voluntary Counselling and Testing (VCT) services compared to those who did not have formal education.

d) Adolescent sexual relationships

Young people's sexual relationships are strongly associated with SRH service utilisation, and hence, this has led researchers to look more closely at this link. Falling in love, being in a romantic relationship, and the first experiences of sexual intimacy and sex are universal and normal during adolescence. In fact, being in an adolescent relationship is a powerful predictor of sexual activity. One of the adolescents who participated in the study mentioned that:

> "At our age we need to experiment about adult life by falling in love. Some of us want to feel how sex is. We read a lot about sex and relationships; we watch romantic movies where we see people getting into intimate relationships."

A parent who participated in the study argued that:

> "Although premarital relationships and sexual activities have traditionally not been acceptable in Zimbabwe, urbanisation and exposure to international media and the internet have slowly changed the way young people in Zimbabwe think about sex and relationships."

Being in an adolescent relationship is a powerful predictor of sexual activity. These relationships are central to young people's lives and play an important developmental role, signalling implications for their future health and adjustment (Furman & Shaffer, 2003). Adolescents now have more liberal attitudes towards relationships and sex (Regmi et al., 2011). Regmi et al. (2011) also found that adolescent girls in romantic relationships often tend to feel intimacy with their male partners more intensely than their partners and prefer long-term relationships, while males prefer short-term relationships that fulfil their sexual desire (Regmi et al., 2011). Being in a sexual relationship is reported to be a powerful catalyst for young people to seek SRH care, especially for contraceptives (Feleke et al., 2013). Relationship length, partner communication, and intimacy are also consistently associated with contraceptive practices (Feleke et al., 2013). In their community-based quantitative cross-sectional study, Feleke at al. (2103) observed that adolescents aged 15-19 years who were in long-term, romantic sexual relationships were 6.5 times more likely to use family planning services from health care facilities compared to those who were not.

e) Gender Norms

Both Anderson-Newman and Kroeger models place gender in their frameworks as one of the factors influencing health-seeking behaviour. Whether one is male or female, gender norms are likely to have an influence on various SRH behaviours and health service utilisation. Generally, girls use more SRH services at health facilities since they offer more contraceptive options, and for maternal health care services.

One Counsellor at a Youth-friendly centre mentioned that:

> "At this centre we have more girls coming for our services than boys. Girls are in need of contraceptives than boys. There more services for girls than for boys."

Another Counsellor also indicated that:

> "Gendered norms often give men a dominant position which they can use to limit women's ability to control their own SRH."

Adolescents who participated in the focus group discussions highlighted the importance of gender norms in accessing SRH services. One focus group member mentioned that:

> "In most cases boys do now want to seek reproductive health services. They are shy to be seen collecting condoms for example. As for girls I think it's easy to go to these youth friendly centres because they have a lot to gain."

Several studies have demonstrated that gender differences and unequal power relationships between men and women hinder communication between partners about SRH issues, which may be an obstacle for women's access to SRH services, resulting in poor sexual health (Pulerwitz et al., 2010; Puri et al., 2010; Woog, Singh, Browne, & Philbin, 2015). Woog et al. (2015) in their review of 70 national representative surveys of developing countries highlighted that in most of these countries, husbands or partners are the primary decision makers on the use of reproductive health services for adolescent women, overriding the female voice in those decisions. Much of the evidence to date indicates that this lack of power in decision making results in poor utilisation of SRH services by women. However, a study conducted among 1290 male and female adolescents in northwest Ethiopia found that more than half of sexually active adolescents who used

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voluntary counselling and testing (VCT) services were females (Feleke et al., 2013).

f) Peer influence on adolescents' SRH service utilisation

There is extensive literature explicating the influence of peers on adolescents' SRH. Peers are a crucial element in adolescence; adolescents often pay close attention to their peers' behaviour to gain their approval, and peers' opinions often hold the most weight (Drolet & Arcand, 2013). Research participants in the study emphasised on the importance of peer influence. One focus group discussion participant argued that:

> "We learn more from our peers. We want to imitate each other. So there is much competition and pressure among us. In most cases we listen more to our peers than our parents."

A parent who participated in the study indicated that:

> "Here in our community of Chipadze suburb we have problems of peer pressure. Our children listen more to their friends than us parents. They engage in a lot of activities such as drug and substance abuse and sexual intercourses because of peer pressure."

A Peer Educator who participated in the study argued that:

> "The support system offered by strong peer connections has been documented as leading to positive health strategies such as protecting against a broad range of risky behaviours during adolescence."

Peers are often the main source of information about sex for young people and influence the way that information is spread (Bam et al., 2015; Regmi et al., 2010b). However, peers are also associated with increased risk, since they not only provide information on sex but may also encourage and pressure friends to initiate sexual activities (Adhikari et al., 2018; Regmi et al., 2010b; Salih, Metaferia, Reda, & Biadgilign, 2015). Adhikari et al. (2018) in their research among Nepalese adolescents noted that adolescents who had discussed sexual matters with their peers had a 2.6-fold higher chance of having pre-marital sex compared to those who had not discussed sex.

g) Family influence on adolescents SRH service utilisation

The literature consistently shows a clear and strong link between the family environment, adolescent sexual behaviour and SRH service utilisation (Adebayo Ayodeji, Ajuonu Ezidinma, & Betiku Benson, 2016; Challa et al., 2018; Feleke et al., 2013).

A Peer Counsellor who participated in the study mentioned that:

> "Family structures such as single-parent households, changes to parents' marital status through divorce or remarriage, and having an older sexually active sibling at home, have all been closely related to early initiation of sexual activity among adolescents."

Research participants from focus group discussions also highlighted that:

> "Most of us here come from single parent homes. Some from child headed households. We have no one to provide us information on sexual reproductive health. We mainly rely on our friends."

For example, a descriptive cross-sectional study conducted in southwest Nigeria among secondary school students showed a significant association between mother-child communication, parental monitoring and parental disapproval of sex and the sexual experience of adolescents (Adebayo Ayodeji et al., 2016). While the actual mechanisms of the relationship between family structure and adolescent sexual behaviour have not been comprehensively explained, lower parental supervision and greater independence has been proposed as a potential conditioning factor for early initiation of sexual activity and poor preventive health care seeking (Adhikari & Tamang, 2009; Biddlecom et al., 2009; Marchand & Smolkowski, 2013). This suggests that parental monitoring and involvement in young people's lives plays a supportive role in adolescent development and sexual behaviour (DeVore & Ginsburg, 2005).

h) Socio-cultural beliefs and values influencing the SRH of adolescents

The socio-cultural environment of many societies is the container of norms around what are acceptable and unacceptable sexual behaviours, especially for unmarried adolescents. Those who do not observe these social norms may face social ostracism which effectively acts as a form of social control over adolescents' sexual behaviour (Marston & King, 2006). A Counbsellor who participated in the study noted that:

> "Most Zimbabwean societies are very conservative. It is taboo to talk about sex before marriage. Unmarried adolescents seeking sexual health services are stigmatised, discriminated against, and socially isolated. Discrimination, which may be self-, socially- or institutionally-imposed, can hamper young people's access to SRH services."

A research participant from one focus group discussion indicated that:

> "It's very difficult for me to just be seen walking into a youth-friendly centre. People will think I need to collect contraceptives or I am pregnant. Most of us are shy. So sometimes we pretend to be accompanying our married friends so that we are also able to access these services."

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Senderowitz (2000) reported that in developing countries the provision of reproductive health information, education and counselling services has been challenging because these are matters of great cultural sensitivity. In some societies, including Nepal, providing SRH information is considered taboo because this is believed to encourage premarital sexual activity (Pradhan & Strachan, 2003; Puri et al., 2010; Ross, 2006). Therefore, many societies tend to withhold sexual health information from young people until it is felt necessary to provide it, typically during puberty or on marriage (Senderowitz, 2000). While schools and health workers could act as mediators of SRH information for young people (Bearinger et al., 2007), several studies reveal that the cultural background of teachers and health workers significantly influences the way they provide such information. In Nepal, although school curricula include reproductive health education for grades 9 and 10 (adolescents aged 15-16 years), teachers are often reluctant to discuss sensitive topics such as SRH because they are concerned about being censured by their own colleagues and society for teaching these topics (Pokharel, Kulczycki, & Shakya, 2006). Researchers have also found that some health workers refuse to provide contraceptive services because they do not approve of premarital sexual activity (Challa et al., 2018; Rivera, Cabral de Mello, Johnson, & Chandra-Mouli, 2001).

i) Availability of SHR Services

This study noted that there were a lot of SHR services in Bindura urban. These included the Zimbabwe National Family Planning Council (ZNFPC), Hope Humana, and Bindura Municipality clinics and various Non Governmental Organisations offering reproductive health services.

A counsellor who participated in the study mentioned that:

> "We have so many youth-friendly centres here in Bindura urban that youth can utilise. What is worrying is the low uptake of our services. Most of these adolescents are engaging in unprotected pre-marital sex. In most cases they their services from the informal market."

A nurse indicated that:

> "The service centres are many. Unfortunately we only see these adolescents coming here when they fell pregnant or have an STI. In most cases they would have sought for treatment from people in their community. So in some cases when they come here it will be too late."

The availability of health services and adequate supplies to support these services are considered essential components for fulfilling young people's rights to health care. However, in many developing countries, adolescents are unable to obtain health services for their SRH, and one of the most commonly cited reasons is that primary health care services are not available in their communities and/or they live in areas where restrictive laws and policies might prevent access (for example, laws prohibiting the supply of contraceptives to unmarried young people) (Tylee et al., 2007; World Health Organization, 2001).

j) Accessibility of health services

It is obvious that for young people to utilise SRH services, they need to be adolescent-friendly. At the same time, it is essential that these services are accessible to young people. A Counsellor who participated in the study highlighted that:

> "Our services are easily available and accessible. We also offer privacy. Clients can come in and are guaranteed of that privacy. We also have peer educators who move around communities offering reproductive health services such as distribution of condoms."

A nurse who participated in the study indicated that:

> "Our services are easily available and accessible. We also offer these services at very low prices in order to cater for those who cannot afford. Some of the services are offered for free while others require a minimal fee."

Accessibility of health services is explained in relation to costs associated with the services and the distance that people need to travel to reach them (Sawyer & Patton, 2015; Tylee et al., 2007). Available services may not be accessible to young people for a variety of reasons. First of all is cost, as discussed by Morreale, Kapphahn, Elster, Juszczak, and Klein (2004). Kennedy et al. (2013) noted in their study that cost is associated not only with the services and commodities provided by the facility but also with transport. Young people, as a group affected by high rates of unemployment and having little access to household resources, are particularly vulnerable to cost. A large-scale population-based survey conducted in Kenya and Zimbabwe showed that low cost was one of the most important features for young people deciding whether to use reproductive health services (Erulkar, Onoka, & Phiri, 2005).

k) Trust between Health Care Providers and Adolescents

In a society where premarital sexual activity is not socially sanctioned, for adolescents to access and utilise SRH facilities they must be able to trust the health care providers. One participant from the focus group discussions indicated that:

> "Privacy and confidentiality are currently inadequate, substantiated not only by the adolescents' experiences and what they have stated, but also by my observations of the health facilities."

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Another participant argued that:

> "I don't feel comfortable visiting those youth friendly centres. You never know what they will do with the information. Sometimes my parents would end up hearing that I have been to the centre to collect condoms or to seek treatment for an STI."

The lack of privacy and confidentiality experienced by adolescents contribute to a lack of trust in health care providers. Trust is identified as an essential element in a successful provider-patient relationship (Birkhäuer et al., 2017; Gopichandran & Chetlapalli, 2013) which determines adolescents' willingness to seek care and utilise health services (Mohseni & Lindstrom, 2007; Russell & medicine, 2005). Having trust in their local health care providers is crucial for unmarried adolescents in a culturally conservative society wherein their sexual behaviour is not acceptable.

V. Conclusion

The following conclusions can be drawn from the study:

Adolescents are people aged 10-19 years, the period of the phase of life called adolescence. How adolescence is defined will vary according to perspectives such as biological development and social and ecological factors that shape the behaviour of adolescents. There is, however, limited information available in a developing country like Zimbabwe about how the socio-cultural context shapes the sexual health of adolescents.

Adolescents in developing countries face negative consequences due to gender inequality, less educational opportunity, early marriage and early childbearing, and vulnerability to STI and HIV/AIDS as risks to their SRH and well-being. AFRHS is one of the global responses to the need to address adolescents' SRH issues. Over time, AFRHS have been bundled with additional interventions such as community engagement, school education and peer support programs to fit unique cultural contexts respective to country and geography. Literature suggests that AFRHS alone has not brought about significant SRH service utilisation by adolescents. Health system factors also significantly affect SRH service utilisation by adolescents.

The current evidence emphasises the importance of context-specific research to understand the issues around adolescents' SRH and health service utilisation. Such research would provide an evidence base for the design of health programs to increase utilisation of health services by young people (Agampodi et al., 2008; Bearinger et al., 2007; Kennedy et al., 2013). Adolescents' perceptions and experiences of seeking SRH services, and the meaning of AFHS were explored.

Adolescent-friendly health services may conceptually be the ideal way of providing effective SRH services to adolescents. However, as this study has shown, their implementation requires revisiting and rethinking what "adolescent-friendly" means within the Zimbabwean context, particularly from the viewpoint of the socio-cultural setting. While the WHO's guidebook for developing national quality standards for AFHS gives emphasis to the physical structure of facilities, their geographical location, the cost of services to adolescents, and ready availability of supplies, this study has raised the question of how "friendly" these facilities truly are for adolescents living in a society which views adolescent sexual behaviour through a moral lens. Services provided can be physically accessible and affordable to adolescents, but unless the moral framework of those providing the services changes, these services are unlikely to be fully utilized by adolescents. Thus, there is a need to address not only the structural components of these facilities, but also build the capacity of health care providers to set aside their own moral values in favour of professional practices that put the needs of the adolescents first without judgment and in a manner that develops trust in them and the services they provide. At the same time, it is essential to involve whole communities and policymakers in raising awareness of the gendered nature of the prevailing ideology underpinning the moral framework around adolescent sexual behaviour.

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Comparison between Threshold of Sourness Perception and Blood Pressure for Resident Health Examination in Yakumo Town

By Naomi Katayama, Mayumi Hirabayashi, Akemi Ito, Shoko Kondo, Yui Nakayama, Takafumi Nakada, Seiya Goto, Satofumi Sugimoto, Tadao Yoshida, Masaaki Teranisi, Michihiko Sone, Yasushi Fujimoto, Hironao Otake, Hirokazu Suzuki, Naoki, Saji, Seiichi Nakata, Tsutomu Nakashima, Kenji Kondo & Takaki Miwa

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Abstract- Since Japan is a super-aged society, various problems are occurring for the elderly. The nutritional problems of the elderly are complex, and measures currently took to solve the one by focusing on malnutrition–related items. Therefore, in this study, we focused on the sourness, which can identify the spoilage of food and could be expected to reduce salt. For 16 years, we have conducted research on taste and olfaction in Yakumo town in Hokkaido, Japan, Where the population does not move much. In this report, we report on the results of the taste test using TASTDISC (Sourness) in 2019 at Yakumo Town Resident Examination, which has been ongoing since 2007. From the database, 298 participants (169 females and 129 males) were selected form data in August 2019.

Keywords: sourness; gender; healthy elderly people; taste function; yakumo study.

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Comparison between Threshold of Sourness Perception and Blood Pressure for Resident Health Examination in Yakumo Town

Naomi Katayama [α], Mayumi Hirabayashi [σ], Akemi Ito [ρ], Shoko Kondo [ω], Yui Nakayama [¥], Takafumi Nakada [§], Seiya Goto [χ], Satofumi Sugimoto [ν], Tadao Yoshida [Θ], Masaaki Teranisi [ζ], Michihiko Sone [£], Yasushi Fujimoto [€], Hironao Otake [₣], Hirokazu Suzuki [₴], Naoki, Saji [₲], Seiichi Nakata [₳], Tsutomu Nakashima [₫], Kenji Kondo [₥] & Takaki Miwa [₢]

Abstract- Since Japan is a super-aged society, various problems are occurring for the elderly. The nutritional problems of the elderly are complex, and measures currently took to solve the one by focusing on malnutrition–related items. Therefore, in this study, we focused on the sourness, which can identify the spoilage of food and could be expected to reduce salt. For 16 years, we have conducted research on taste and olfaction in Yakumo town in Hokkaido, Japan, Where the population does not move much. In this report, we report on the results of the taste test using TASTDISC (Sourness) in 2019 at Yakumo Town Resident Examination, which has been ongoing since 2007. From the database, 298 participants (169 females and 129 males) were selected form data in August2019. The sourness test performed using the sourness test paper with liquid TASTEDISC (Sanwa Chemical Laboratory Co., Ltd) which include five different densities of Tartaric acid on a liquid with test paper namely:, 1(0.02%), 2(0.2%),3(2.0%), 4(4.0%), 5(8.0%). As a result, 17 males out of 129male participants (13.2%) and tenfemales of 169 female participants (5.9%) had abnormal values in sour taste test (Tastedisc) results. The tolerance range (in this study, it called the normal range) of sourness, blood pressure (systole, diastole), and body composition (BMI, body fat percentage, abdominal circumference) compared with other values. As a result, there was no statistically significant difference in the sourness threshold between the normal range of blood pressure, BMI, and others. However, there was a statistically significant difference in the result of sourness between the normal range of body fat percentage and the other one. And also, in female cases, participants with a long waist circumference had a statistically significant lower sourness threshold than those with short waist circumference. Feeling sourness can also protect us from ingesting dangerous foods (corruption and poison). We would like to increase the number of participants and clarify the relationship between sourness, eating habits, and other factors.

Keywords: sourness; gender; healthy elderly people; taste function; yakumo study.

I. Introduction

Since Japan is a super-aged society, various problems are occurring for the elderly. There are many older asults on the waiting list to get into the welfare facilities, and many households forced to provide home care. The nutritional problems of the elderly are complex, and measures currently took to solve it by focusing on malnutrition–related items such as flail, sarcopenia, and locomotive syndrome. One of the causes of under nutrition is the phenomenon of nutrient intake due to the difficulty of understanding the taste, loss of appetite, and reduction of the total diet. Flavors, that is, matching both taste and smell, are need in a diet, and low thresholds for typical five tastes (sweetness, saltiness, sourness, bitterness, and umami) affect health. Therefore, in this study, we focused on the sourness, which can identify the spoilage of food and can expect to reduce salt.

II. Materials and Methods

a) Participants

The participants were community dwellers who voluntarily participated in the Yakumo Study and had managed their everyday life themselves. The Yakumo Study conducted since 1981 as a joint project between the town of Yakumo in Hokkaido and the Nagoya University Graduate School of Medicine. Professionals in the fields of epidemiology, internal medicine, orthopedics, neuropsychology, ophthalmology, otolaryngology, and urology joined the Yakumo Study. The analyzed data were based on the database to2019 from the neuropsychology and otolaryngology teams.

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The participants had been engaged in a variety of jobs, not only white-collar but also in agriculture, fishery, and forestry. Therefore, this town can regard as representative of today's Japanese society. From the database, 297participants (168 females and 129 males) were selected form data in August 2019 (Table 1).

Table 1: Age composition of participants in Yakumo inhabitants examination (n=297).

Participants	40's	50's	60's	70's	80's
Male (129)	10	24	49	39	6
Female (168)	23	40	65	38	3
Total (297)	33	64	114	77	9

b) Assessment of sweetness taste identification

The sourness test performed using test paper with liquid TASTEDISC (Sanwa Chemical Laboratory Co., Ltd) which include five different densities of Tartaric acid on a liquid with test paper namely:, 1(0.02%), 2(0.2%),3(2.0%), 4(4.0%), 5(8.0%). The inspection method is as follows. 1) Show participants the taste choice paper: Sweet, Salty, Sour, Bitter. Taste something, but I don't know, No taste. 2) Hold the filter paper with tweezers. The sweetening solution is dropped on the disc and moistened. 3) The moistened disc gently placed on the canaliculus chordae tympani innervation area of the participant's tongue. The canaliculus chordae tympani innervation area is located 2 cm left and right from the tip of it. 4) Instruct the user to answer one of the taste choice paper in 2~3 seconds with the mouth open. 5) The examiner then removes the disc from the participant's tongue with tweezers. 6) If a correct answer is not obtained, the test is continued using a solution having a higher concentration in order. 7) After gargling with water to prevent residual teste, perform the next taste test at intervals of 1 minute or more. This method was in accordance with the test method of the teste test kit (TASTEDISC: Sanwa Chemical Laboratory Co., Ltd).

c) Ethical review board

This study conducted with the approval of the Ethical Review Board (Nagoya women's university Ethics Committee: 'hitowo mochiita kennkyuuni kansuru iinnkai'). The approval number is 30-14.

d) Statistical processing

The test results were confirmed to be normal distribution by F-test. Data that were the tolerance range (in this study, it called the normal range) distributed were compared with Student-t without correlation of parametric test. The data that is not normally distributed was compared without correlated Mann-Whitney one of the non-parametric test.

III. Results

a) Participant's body composition and

Data on body composition and blood pressure of participants showed by age. The males showed in Table 2. And the females are shown in Table 3. All data showed as averages by age. For both males and females, the mean values of blood pressure for each one were in the normal range. Body fat percentage was higher in females than in males, and BMI and body fat were almost tolerance range (in this study, it called the normal range) for both males and females.

Table 2: Souriness test (Tastedisc) results and blood pressure and body composition results (Average for Males in their 40's to 80's)

	Number	Age	Height	Weight	Waist	BMI	Body fat rate	Systolic blood pressure	Dyastolic blood pressure
			cm	g	cm	kg/m/m	%	mmHg	mmHg
Average of 40's Male	10	45.5	170.1	74.2	84.8	25.7	23.7	136.8	80.9
Average of 50's Male	24	54.8	168.0	71.3	86.7	25.4	24.4	131.0	81.3
Average of 60's Male	49	64.8	167.3	68.9	86.5	24.6	24.7	138.3	83.1
Average of 70's Male	40	73.0	164.7	66.2	84.6	24.4	23.7	145.5	79.7
Average of 80's Male	6	84.8	159.1	63.5	87.4	25.1	24.3	134.7	66.2
Total average of Male	129	64.9	166.4	68.7	85.8	24.8	24.2	138.9	80.8

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Table 3: Sourness test (Tastedisc) results and blood pressure and body composition results (Average for Females in their 40's to 80's)

	Number	Age	Height cm	Weight g	Waist cm	BMI kg/m/m	Body fat rate %	Systolic blood pressure mmHg	Dyastolic blood pressure mmHg
Average of 40's Female	23	45.2	158.0	57.2	76.7	22.8	33.2	122.3	70.1
Average of 50's Female	40	54.3	155.5	56.4	76.8	23.3	33.4	131.6	77.4
Average of 60's Female	66	64.5	153.8	55.7	77.7	23.5	33.9	137.1	77.0
Average of 70's Female	37	72.8	150.6	52.8	76.2	23.3	33.1	140.1	74.7
Average of 80's Female	3	82.0	147.4	49.6	78.1	22.9	31.1	149.0	77.0
Total average of Female	169	61.6	154.0	55.3	77.0	23.3	33.4	134.7	75.7

b) Simple sourness threshold test result

Sour taste identification performed by using test paper TASTDESC (Sanwa Chemical Laboratory Co., Ltd). Table 4 shows the Sourness measurement results for male and female by age. The sourness test performed using the sourness test paper with liquid TASTEDISC (Sanwa Chemical Laboratory Co., Ltd) which include five different densities of Tartaric acid on a liquid with test paper namely:, 1(0.02%), 2(0.2%),3(2.0%), 4(4.0%), 5(8.0%). As a result, 17 males out of 129male participants (13.2%) and ten females of 169 female participants (5.9%) had abnormal values in sour taste test (TASTEDISC) results. The normal range for males was 44.2%, and the normal range for females was 46.2%.

Table 4: Sourness test (Tastedisc) results (Number of Males in their 40's to 80's)

	Tastedisc		
(n=298)	Normal 0.02%, 0.20%	Observation 2.0%, 4.0%	Consultation 8.0% ormore
Male 40's (n=10)	6	4	0
Male 50's (n=24)	10	10	4
Male 60's (n=49)	24	17	8
Male 70's (n=40)	16	21	3
Male 80's (n=6)	1	3	2
Male total (n=129)	57	55	17
Female 40's (n=23)	16	6	1
Female 50's (n=40)	20	19	1
Female 60's (n=66)	26	34	6
Female 70's (n=37)	14	21	2
Female 80's (n=3)	2	1	0
Female total (n=169)	78	81	10

c) Statistical processing results

The sour test result was statistically processed. Table 5 and Table 6 show the results of the comparison of the Sourness test results using TASTDISC with the tolerance range (in this study, it called the normal range) systolic and diastolic blood pressure values and others. The results did not show a statistically significant difference in either case.

Table 5: Results of statistical comparison of Sourness test results between fasting systolic blood pressure level less than 120 (Normal value) and 120 or more

	Systolic biood pressure (mmHg)		Tastedisc test result (Normal=1, Ovservation = 2, Consultation =3)	
	Less than 120	120 or more	Systolic blood pressure e Less than 120	Systolic blood pressure 120 or more
Average±Standard deviaton	108.934±19.003	144.616±16.889	1.622±0.542	1.637±0.670
F test	P=0.0001**		P=0.010*	
Unpaired student − t test				
Mann-Whaitny test	P=0.0001**		P=0.821	

* P<0.05 , ** P<0.01

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Table 6: Results of statistical comparison of S0urlness test results between fasting diastlic blood pressure level less than 90 (Normal value) and 90 or more

	Diastolic blood pressure (mmHg)		Tastedisc test result (Normal=1, Ovservation = 2, Consultation =3)	
	Less than 90	90 or more	Diastolic blood pressure Less than 90	Diastolic blood pressure 90 or more
Average±Standard deviaton	73.984±8.903	97.180±8.329	1.640±0.628	1.646±0.668
F test	P=0.291		P=0.173	
Unpaired student − t test	P=0.0001**		P=0.919	
Mann-Whaitny test				

* P<0.05 , ** P<0.01

Table 7 show the results of comparison of the bitterness test results using TASTDISC with the tolerance range (in this study, it called the normal range) BMI and others. The results did not show a statistically significant difference in either case.

Table 7: Results of statistical comparison of Sourness test results between fasting BMI level less than 25.0 (Normal value) and 25.0 or more

	BMI(kg/m/m/)		Saltness test result (Normal=1, Ovservation = 2, Consultation =3)	
	Less than 25.0	2.50 or more	BMI Less than 25.0	BMI 2.50 or more
Average±Standard deviaton	27.548±2.143	32.993±2.439	1.681±0.637	1.557±0.638
F test	P=0.0001**		P=0.501	
Unpaired student − t test				
Mann-Whaitny test	P=0.0001**		P=0.101	

* P<0.05 , ** P<0.01

Table 8 shows the results of the comparison of the sourness test results using TASTDISC with the tolerance range (in this study, it called the normal range) Body fat and other. The results showed that there was a statistically significant difference between the normal Body fat range and the other. Participants with a high body fat percentage were able to feel sourness at lower concentrations than those with right body fat percentage.

Table 8: Results of statistical comparison of Sourness test results between fasting Body fat level less than 25.0 (Normal value) and 25.0 or more

	Body fat (%)		Saltness test result (Normal=1, Ovservation = 2, Consultation =3)	
	Less than 25.0	25.0 or more	Body fat % Less than 25.0	Body fatt % 25.0 or more
Average±Standard deviaton	27.548±2.143	32.993±2.439	1.771±0.669	1.579±0.621
F test	P=0.0001**		P=0.200	
Unpaired student − t test				
Mann-Whaitny test	P=0.0001**		P=0.020*	

* P<0.05 , ** P<0.01

Table 9 and Table 10 shows the results of the comparison of the sourness test results using TASTDISC with normal Waist circumference range and the other. In Japan, the tolerance range (in this study, it called the normal range) waist circumference of the male is less than 85 cm (Table 9), and female is less than 90 Cm (Table10). The results did not show a statistically significant difference in the male cases. But, in female cases, participants with a long waist circumference had a statistically significant lower sourness threshold than those with short waist circumference.

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Table 9: Results of statistical comparison of Sourness test results between waist level less than 85.0 (Normal value) and 85.0 or more for Male

	Waist (cm)		Saltness test result (Normal=1, Ovservation = 2, Consultation =3)	
	Less than 85.0	85.0 or more	Waist Less than 85.0	Waist 85.0 or more
Average±Standard deviaton	78.327±4.478	91.603±4.721	1.661±0.668	1.712±0.716
F test	P=0.334		P=0.286	
Unpaired student − t test	P=0.0001**		P=0.677	
Mann-Whaitny test				

* P<0.05 , ** P<0.01

Table 10: Results of statistical comparison of Sourness test results between waist level less than 90.0 (Normal value) and 85.0 or more for Female

	Waist (cm)		Salttness test result (Normal=1, Ovservation = 2, Consultation =3)	
	Less than 90.0	90.0 or more	Waist Less than 90.0	Waist 90.0 or more
Average±Standard deviaton	75.729±7.477	93.733±4.338	1.165±0.595	1.250±0.452
F test	P=0.0019**		P=0.142	
Unpaired student − t test			P=0.039*	
Mann-Whaitny test	P=0.0001**			

* P<0.05 , ** P<0.01

IV. Discussion

There are many reports in the past that the taste deteriorates with increasing age1). Also, the perceived concentration of taste changes with temperature 2, 3). In this research, we focused on sourness, but there are five basic tastes (sweet, salty, sour, bitter, and umami) 4, 5, 6). Also, there are various teste inspection methods7). But this time, we used TASTDISC to get a taste of sourness. The cognitive threshold of sourness examined for 298 participants (129 males and 169 females) in Yakumo-town, Hokkaido, Japan, where population migration is low. As a result, 17 males out of 129male participants (13.2%) and ten females of 169 female participants (5.9%) had abnormal values in sour taste test (Tastedisc) results. The tolerance range (in this study, it called the normal range) of sourness, blood pressure (systole, diastole), and body composition (BMI, body fat percentage, abdominal circumference) compared with other values. As a result, there was no statistically significant difference in the sourness threshold between the normal range of blood pressure, BMI, and others. However, there was a statistically significant difference in the one of sourness between the normal range of body fat percentage and the other one. And also, in female cases, participants with a long waist circumference had a statistically significant lower sourness threshold than those with short waist circumference. Sourness thresholds were righter in participants with high body fat than in participants with low body fat. Our past sweet taste data show that participants with heavy body fat have high sweetness perception thersholds8). The sweetness data was statistically significantly different from the sourness data this time. Although the result was similar, in our past cognitive threshold of salty taste, there was no statistically significant item in the contents examined for sourness this time9).In the future, we would like to inspect the bitterness and umami. And, we would like to understand the actual taste sensation of the elderly by clarifying the differences between the five taste tests and blood pressure, body composition, and eating habits. We would like to obtain underlying data for preparing a diet suitable for the elderly to prevent malnutrition by grasping the taste of the elderly.

V. Conclusions

We obtained sour test results, TASTDISC, at the time of health check-up in Yakumo Town, Hokkaido, where population migration is low. From the database, 298 participants (169 females and 129 males) were selected form data in August 2019. The sourness test performed using the sourness test paper with liquid TASTEDISC (Sanwa Chemical Laboratory Co., Ltd) which include five different densities of Tartaric acid on a liquid with test paper namely:, 1(0.02%), 2(0.2%), 3(2.0%), 4(4.0%), 5(8.0%). As a result, 17 males out of 129male participants (13.2%) and ten females of 169 female participants (5.9%) had abnormal values in sour taste test (Tastedisc) results. The tolerance range (in this study, it called the normal range) of sourness, blood pressure (systole, diastole), and body composition (BMI, body fat percentage, abdominal circumference) compared with other values. As a result, there was no statistically significant difference in the sourness

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threshold between the normal range of blood pressure, BMI, and others. However, there was a statistically significant difference in the one of sourness between the normal range of body fat percentage and the other range. And also, in female cases, participants with a thick waist circumference had a statistically significant lower sourness threshold than those with a short waist circumference. Sourness thresholds were lower in participants with high body fat than in participants with low body fat. It is necessary to increase the number of participants and analyze the one in the future.

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Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for writing a good quality Medical Research Paper

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of medical research then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.



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6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.



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Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.



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Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

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Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

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Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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