

## Kneading Bread Dough by Hand Affects the Mental Stress Decreases and Calories Burn: A Case Study

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### Abstract

Major aim was to examine the mental stress (S) and %intensity (%Int) during a 30-minute bread dough kneading, and minor aim was to compare the Maximum Heart Rate (HRmax), Resting Heart Rate (RHR), and Kneading-Dough Heart Rate (KD-HR) within and between genders. Volunteers were 20 Thai young adults (male = 10, female = 10), 19–24 years of age ( $21.10 \pm 1.80$ ). Research tools: (1) The Stress Test 5 (ST5:), (2) The Harvard in-30-min Burned Calories Table (Harvard Health Publishing), (3) The Analysis of Aerobic Exercise Intensity, and (4) A recipe of bread dough. Research equipment: (1) The Health Watch; Model: Xfit Lite II, and (2) The Stethoscope, Model: Dual Type, Funowa. Data analysis: Frequency, Percentage, Mean, and Standard Deviation were used for descriptive statistics, and the one-way analysis of variance was used for comparing within and between groups. This study results in (1) male group volunteers ( $M = 1.20 \pm 0.42$ ) show lower S levels than females ( $M = 1.60 \pm 0.51$ ), and also in mean of % intensity (male =  $37.09 \pm 3.38$ , female =  $49.40 \pm 3.17$ ) during the test, in which the results report the very light exercise level in male and almost all light exercise level in females, and (2) there was no significant difference of HRmax ( $F = 0.05, p > 0.05$ ) and of RHR ( $F = 0.31, p > 0.05$ ), nevertheless, there was statistically significant difference of KD-HR ( $F = 13.53, p < 0.05$ ) between male and female groups during the test. In conclusion, kneading-dough activity has not been explicitly investigated at large, nevertheless, the present study suggests that kneading dough can probably decrease mental stress and increase energy expenditure processing increases of %intensity and heart rate during kneading the bread dough in both males and females. Moreover, Health related organization probably takes into account the benefits of this kind of physical activity in order to promote it for the public to use.

**Keywords:** Bread Dough Kneading; Mental Stress; Calories

## 1. Introduction

Quality of life and longevity were identified relation to health maintenance, physiological fitness, effectively energy intake, energy retention, and energy expenditure (Paffenbarger, Blair, Lee, & Hyde, 1993) consisting of the terms work (enjoyable work: e.g. athletics, music, art, teaching; unenjoyable work: e.g., jogging, aerobics strictly for health reasons), personal care (e.g. six hours of sleep), recreation (simple entertainment, mental activities, sports/exercise, music, art, dance, hobbies, play/games, relaxation, social activity, humanitarian services, nature activities/outdoor recreation, travel/tourism), and leisure (e.g. three hours of sleep) (Leitner & Leiner, 2012).

Calories are strongly associated with aerobic exercise intensity during performing an activity based on calculating the maximum heart rate, resting heart rate, and %intensity desired (Piercy & Troiano, 2018). Kilocalories or metabolic equivalents (METs) as a predictor to estimate the total energy expenditure closely relates to the leisure-time physical activities (Lamb & Bordie, 1990). Each type of leisure-time physical activities showed different intensity levels of physical activity (METs) such as cardiovascular responses like heart rate, breathing, and sweating (Singhal & Siddhu, 2020), as well as both the free-time and occupational activity investigations represented the positive body composition, physical fitness, and blood factors (Lee, Lee & Yeun, 2017), particularly, athletes Scientists have found the significant improvement in psychological and physiological capacities with performing the low-intensity physical activity (Izquierdo-Alventosa, Inglés, Cortés-Amador, Gimeno-Mallench, Chirivella-Garrido, Kropotov, & Serra-Añó, 2020), particularly more improved by both moderate- and vigorous-intensity physical activity (Edwards & Tsouros, 2006).

Home cooking as a part of work can improve physical and mental health (Palar, Hufstedler, Hernandez, Chang, Ferguson, Lozano, & Weiser, 2019). Beside, cooking is a recreation activity in hobby category that has the purpose to make, construct, and create psychological drive not only for pleasure and satisfaction in the end of resulting objects (Edginton, Dieser, Lankford, & Kowalski, 2018), but also for enjoyment towards reduction of stress, creation of new experiences and physical activities (Edwards & Tsouros, 2006), as a key of appropriate knowledge, attitudes, and behaviours to ensure future health (Farid, Amirkhanzadeh, & Setayesh, 2019)

For data analysis, the tests of enjoyment at enjoyable activities by the Pittsburgh Enjoyable Activity Test (PEAT) scored lower levels of blood pressure, cortisol, waist circumference, body mass index, negative mental effect, and depression, as well as better physical function and psychological states (Pressman, Matthews, Cohen, Martire, Scheier, Baum, & Schulz, 2009). As upward, the Pressman's study based results showed that the cardiovascular responses can be predicting exercise intensity. The Health Watch, Model: Xfit Lite II is measurable heart rate, blood pressure, electrical heart activity, oxygen saturation, sleeping, exercise mode, distance, and connecting a smart phone at being rest and doing activities (Xfitwatch.com, 2020). As well, the Harvard in-30-min Burned Calories Table is usable for comparing exercise intensity level (Harvard Health Publishing) (Stethoscope, 2020). In addition, the Stress Test 5 (ST5) is usable for measuring the stress levels meaning high for much stress (8–9) to most stress (10–15) state (Department of Mental Health, Thailand, 2016).

As a reason, the present study chose three variables; heart rate to calculate the aerobic exercise intensity, as well as aerobic exercise intensity to compare intensity level, and mental stress level to investigate participants' stress in order to investigate whether a bread dough kneading activity can be useful for reduction of mental stress and analysis of energy use intensity.

## 2. Literature Review

2.1 Leisure is an activity of recreation as a way to reduce stress in daily living, as well, cooking is a recreation activity in hobby category that has the purpose to make, construct, and create psychological drive not only for pleasure and satisfaction in the end of resulting objects (Edginton et al., 2018), but also for enjoyment towards reduction of stress, creation of new experiences and physical activities (Edwards & Tsouros, 2006), as a key of appropriate knowledge, attitudes, and behaviours to ensure future health (Farid et al., 2019). Moreover, home cooking is defined to be a part of work which has not been only improving physical but also mental health (Palar, Hufstedler, Hernandez, Chang, Ferguson, Lozano, & Weiser, 2019).

2.2 kilocalories or metabolic equivalents (METs) as a predictor to estimate the total energy expenditure closely relates to the leisure-time physical activities (Lamb & Bordie, 1990). Each type of leisure-time physical activities showed different intensity levels of physical activity (METs) such as cardiovascular responses like heart rate, breathing, and sweating (Singhal & Siddhu, 2020), as well as both the free-time and occupational activity investigations represented the positive body composition, physical fitness, and blood factors (Lee et al., 2017), particularly, athletes Scientists have found the significant improvement in psychological and physiological capacities with performing the low-intensity physical activity (Izquierdo-Alventosa et al., 2020), particularly more improved by both moderate- and vigorous-intensity physical activity (Edwards & Tsouros, 2006).

2.3 females showed relative aerobic energy expenditure more than males during recreational weight training (Morgan, Woodruff, & Tiidus, 2003). Then, scientists have been reporting that a cause of the differences is woman has high body fat proportion than man (Wu & O'Sullivan, 2011). Performance in high intensity activity was associated with low %fat, however, no relation of body composition and physical activity in females (Westerterp & Goran, 1997).

2.4 The current study aimed to examine the mental stress and %intensity during a 30-minute bread dough kneading between genders, and to compare the Maximum Heart Rate, Resting Heart Rate, and Kneading-Dough Heart Rate within and between genders.

## 3. Methodology

### 3.1 Participants

Volunteers were 20 Thai young adulthoods (male = 10, female = 10), 19–24 years of age ( $21.10 \pm 1.80$ ). They were divided into two groups: male and female groups.

#### Inclusion Criteria:

1. Volunteers who had good health.
2. Volunteers who had stress levels of more than 4 (rating scales from less stress 0–4 to most stress 10–15).
3. Volunteers who were not allergic to the food compounds on skins.

#### Exclusion Criteria:

1. Volunteers who slept less than six hours before the trial.
2. Volunteers who did not had light breakfast 30 minutes before trial.
3. Volunteers who had no high intensity exercise within 24 hours before trial.

#### Withdrawal:

Volunteers who wanted to leave from the test, and not perform as followed the test.

#### 3.2 Research instruments

##### *The Stress Test 5 (ST5)*

The Stress Test 5 (ST5) was used for measuring stress levels at baseline and after tests used for examining how much stress that volunteers experienced in daily life including with physical- and emotional- stress everyday life, ranging between 0 = never, 1 = some, 2 = often, and 3 = usual. Prior to kneading bread dough, volunteers were assigned to sit and read for about 5-10 min., and then pre-tested by the questions, e.g. «*Sleeping problem?* Sleepless or long-time sleep?”, “less concentration?”, “irritable/ anxious/distraction?”, “irksome/bored?”, and “don’t want to meet people?”, and then rated on the scales. Immediately after kneading the dough, they were re-tested as the same questions (Department of Mental Health, Thailand, 2016).

##### *Stress Score Meaning:*

- |       |                   |
|-------|-------------------|
| 0–4   | = less stress     |
| 5–7   | = moderate stress |
| 8–9   | = much stress     |
| 10–15 | = most stress     |

##### *The Harvard in-30-min Burned Calories Table*

The Harvard in-30-min Burned Calories Table (Harvard Health Publishing) was used for comparing exercise intensity level of the current study with the Harvard in-30-min Burned Calories Table (Harvard Health Publishing, 2021).

**Table 1**

*Sample of the Harvard in-30-min Burned Calories Table*

Activities	< 57 kg.	58–70 kg.	71–84 kg.
sleeping	19	22	26
Watching TV.	23	28	33
Cooking	57	70	84
Planting	142	176	210
Gardening	135	167	200
Feeding a baby	105	130	155
Cleaning	135	162	189
Home setting	210	252	294

***The Bread Dough Recipe***

The recipe of bread dough was modified and proved as the face validity test to be eligible for the current-study volunteers by an expert in food compounds. The list of compounds as follows:

**Table 2**

*The modified bread dough recipe*

Compounds	Volumes	Scales	Prize (baht)
Wheat Flour powder:	600	grams	15.6
- Contains Gluten			
- Bleached with Benzoyl Peroxide (INS : 928)			
Salt:	1	teaspoon	0.33
- Sodium Chloride (NaCl) more than 99.9%			
- Iodine 0.002-0.224%			
- Anticaking Agent (INS : 535) less than 0.001%			
Instant Yeast:	2	tablespoons	7.33
- Dried Yeast ( <i>Saccharomyces cerevisiae</i> ) 98.85%			
- Sorbitan Monostearate (INS : 491) 1.00%			
- Ascorbic Acid (INS : 300) 0.15%			
Water	261	milliliters	0.60

Table 2 (Continued)

Compounds	Volumes	Scales	Prize (baht)
Fresh milk:	58	grams	2.61
- Total Fat 12%, Saturated Fat 25%			
- Cholesterol 8%			
- Protein 6 grams			
- Carbohydrate 10 grams			
- Sugar 10 grams			
- Sodium 85 milligrams			
Unsalted butter:	29	grams	4.93
- Soya Lecithin			
- Emulsifier			
- Nature Identical Flavour			
- Beta-Carotene			
- Skimmed Milk Powder 2%			
- Butter Oil 37%			
- Vegetable Oil 45%			
Pure Refined Sugar	12	grams	1.20
Total cost = 32.60 baht. per one dough			

\* to bake bread at 350-375 degree Fahrenheit for about 45-60 minutes (upon the thickness of the dough)

### *Analysis of Aerobic Exercise Intensity*

Analysis of Aerobic Exercise Intensity has been widely used with calculating percent of Maximum Heart Rate (HRmax) or Heart Rate Reserve (HRR). The exercise intensity can be defined as three levels: (1) Light = 50-63, (2) Moderate = 64-76, and (3) Vigorous = 77-93 (Thomson, Gordon, & Pescatello, 2010). The analysis formula as follows;

$$\text{Heart Rate Reserve (HRR)} = \text{Maximum Heart Rate (HRmax)} - \text{Resting Heart Rate (RHR)}$$

$$\text{Target Heart Rate (THR)} = [(\text{HRmax} - \text{RHR}) \times \% \text{intensity desired}] + \text{RHR}$$

### *The Health Watch*

The Health Watch, Model: Xfit Lite II measurable heart rate, blood pressure, electrical heart activity, oxygen saturation, sleeping, exercise mode, distance, and connecting a smart phone at being rest and doing activities (Xfitwatch.com, 2020). For reliability test, comparison of heart rate results between the Xfit Lite II and a heart rate test method (using a Stethoscope Model) resulted in no statistically significant difference, but there were differences in mean scores. Consequently, the results measured by this device could be error  $\pm 0.04$ . Consequently, the device could be used for measuring heart rate during sit and read, and kneading bread dough in order to define and examine exercise intensity level of each volunteer.

### *The Stethoscope*

The Stethoscope, Model: Dual Type, Funowa, made in Japan (Stethoscope, 2020) was used for reliability test of the health watch by comparing the reliability of heart rate between of the health watch and of the stethoscope, for 50 times. Further, researchers analysed the Mean, Standard Deviation, and correlation (using the Pearson Produce Moment Correlation) values of each device.

## **Procedures**

A study plan, information sheet, consent form, and research tools were prepared for this study. In the standard consent procedures, volunteers were given general information about risk and benefit, each test session and how to behave during the test, and then they signed up a consent form. Before trial, volunteers were assigned to sit and read for 10 minutes, as well as to wear watches on their dominant wrists, and then, to be measured their resting heart rates by using the health watch and stress levels by using the ST5. After that, they were assigned to perform four sessions. Session (1) preparing the bread compounds and kitchen equipment on kneading table, this session took approximately 10 minutes. Session (2) combining all compounds together and kneading bread dough, and then, at 5, 15, and 25 minute time their heart rates were measured, this session lasted 30 minutes. Session (3) all resting, setting, and baking the dough took approximately 90 minutes. At last, volunteers responded to the ST5 proceeded for about 5 minutes. Whole processes of pre-tests, baking bread, and post-tests lasted 145 minutes.

In case of adverse event occurring, we prepared the first aid kit such as chemical allergic drug, soup, water and sink, cottons, gauze dressings, scissor, dressing tape, plasters, 70% ethyl alcohol, Povidone-iodine solution, cold pack, aromatic ammonia spirit, cotton stick. If the adverse event was severe, we will send the patient to clinic that was 500 metres away from experimental room. At the end of this study, all participants were thanked for continuously intending to the trial.

### **3.3 Data collection and analysis**

The data were analysed as follows;

1) Database was calculated using Frequency, Percentage, Mean and Standard Deviation.

2) The %Intensity was used to compare to burned calories by using the Harvard in-30-min Burned Calories Table.

3) The Maximum Heart Rate, Resting Heart Rate, and Kneading-Dough Heart Rate %Intensity within and between male and female groups, using the Two-way Analysis of Variance.

4) The mental stress level was compared between male and female groups, using the One-way Analysis of Variance.

## 4. Results

**Table 3**

*Database of all Volunteers' the Maximum Heart Rate, Resting Heart Rate, Kneading-Dough Heart Rate, %Intensity, and Meaning using the Harvard in-30-min Burned Calories Table.*

No.	* Gender	Age (years)	-	RHR (time/ min)	KD-HR (time/ min)	** %Intensity	*** Meaning
1	1	23	197	69	115	35.94	very light exercise
2	1	24	196	68	106	29.69	very light exercise
3	1	21	199	78	120	34.72	very light exercise
4	1	21	199	75	119	35.49	very light exercise
5	1	21	199	79	125	38.35	very light exercise
6	1	21	199	72	120	37.80	very light exercise
7	1	21	199	73	119	37.31	very light exercise
8	1	19	201	83	131	40.68	very light exercise
9	1	20	200	80	129	40.84	very light exercise
10	1	19	201	79	128	40.17	very light exercise
11	2	24	196	72	135	50.82	light exercise
12	2	24	196	68	111	48.45	very light exercise
13	2	23	197	78	129	42.86	very light exercise
14	2	23	197	80	140	51.29	light exercise
15	2	21	199	81	139	49.16	very light exercise
16	2	19	201	82	136	45.38	very light exercise
17	2	19	201	79	140	50.00	light exercise
18	2	19	201	80	145	53.72	light exercise
19	2	20	200	73	138	51.19	light exercise
20	2	20	200	75	139	51.20	light exercise

\* Gender: 1 = male, 2 = female

\*\* Target Heart Rate (THR) = [(HRmax – RHR) × %intensity desired] + RHR

\*\*\* The exercise intensity can be defined as three levels: Light = 50-63, Moderate = 64-76, and Vigorous = 77-93

Table 3, a total of 20 participants who volunteered to involve in this study (female = 50.0% and male = 50.0%), average age was 20.10 ( $\pm 1.80$ ). Male group volunteers ( $M = 121.20 \pm 7.45$ ) show lower the kneading-dough heart rate than females ( $M = 135.20 \pm 9.44$ ), and also in mean of %intensity (male =  $37.09 \pm 3.38$ , female =  $49.40 \pm 3.17$ ), in which the results report the very light exercise level in male and almost all light exercise level in females.



**Table 4**

*Descriptive Statistics of Volunteers' Maximum Heart Rate, Resting Heart Rate, Kneading Dough Heart Rate and %Intensity*

		<i>n</i>	Mean	Std. Deviation
HRmax	Male	10	199.00	1.56
	Female	10	198.80	2.09
	Total	20	198.90	1.80
RHR	Male	10	75.60	4.99
	Female	10	76.80	4.59
	Total	20	76.20	4.70
KD-HR	Male	10	121.20	7.45
	Female	10	135.20	9.44
	Total	20	128.20	10.95
% Intensity	Male	10	37.09	3.38
	Female	10	49.40	3.17
	Total	20	43.25	7.07

Table 4 shows that males had higher HRmax ( $M = 199.0 \pm 1.56$ ) and lower RHR ( $M = 75.60 \pm 4.99$ ) than females ( $HRmax M = 198.80 \pm 2.09$ ,  $RHR M = 76.80 \pm 4.59$ ) at baseline, however there is no significant difference (see table 3). At the kneading dough test, both groups can more increase KD-HR than at baseline. Moreover, males produce less KD-HR ( $M = 121.20 \pm 7.45$ , %Intensity  $M = 37.09 \pm 3.38$ ) than females ( $KD-HR M = 135.20 \pm 9.44$ , %Intensity  $M = 49.40 \pm 3.17$ ).

**Table 5**

*Comparisons of Volunteers' Maximum Heart Rate, Resting Heart Rate, Kneading Dough Heart Rate and %Intensity*

		Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.
HRmax	Between Groups	.20	1	.20	.05	.81
	Within Groups	61.60	18	3.42		
	Total	61.80	19			
RHR	Between Groups	7.20	1	7.20	.31	.58
	Within Groups	414.00	18	23.00		
	Total	421.20	19			

Table 5 (Continued)

		Sum of Squares	df	Mean Square	F	Sig.
KD_HR	Between Groups	980.00	1	980.00	13.53	.00*
	Within Groups	1303.20	18	72.40		
	Total	2283.20	19			
Intensity	Between Groups	757.43	1	757.43	70.35	.00*
	Within Groups	193.78	18	10.76		
	Total	951.21	19			

\*significant at the 0.05 level

Table 5 shows that there is no significant difference of HRmax ( $F = 0.05, p > 0.05$ ) and RHR ( $F = 0.31, p > 0.05$ ) between male and female groups, but there were statistically significant differences of KD-HR ( $F = 13.53, p < 0.05$ ) and %Intensity ( $F = 70.35, p < 0.05$ ) between male and female groups during dough kneading tests.

Table 6

*Descriptive Statistics of Volunteers' Mental Stress Level (Rating Scale 0-3)*

		n	Mean	Std. Deviation
Mental Stress_before	Male	10	2.50	.52
	Female	10	2.40	.51
	Total	20	2.45	.51
Mental Stress_after	Male	10	1.20	.42
	Female	10	1.60	.51
	Total	20	1.40	.50

Table 6 shows that males had higher mental stress level ( $M = 2.50 \pm 0.52$ ), than females ( $M = 2.40 \pm 0.51$ ) at baseline, however there is no statistically significant difference (see table 5). At during test, both groups can more reduce mental stress levels than before. Moreover, males had lower mental stress levels ( $M = 1.20 \pm 0.42$ ) than females ( $M = 1.60 \pm 0.51$ ).

**Table 7**

*Comparisons of Volunteers' Mental Stress Level (the ST5: Rating Scale 0 -3)*

		Sum of Squares	df	Mean Square	F	Sig.
Mental Stress_before	Between Groups	.050	1	.050	.184	.673
	Within Groups	4.900	18	.272		
	Total	4.950	19			
Mental Stress_after	Between Groups	.800	1	.800	3.600	.074
	Within Groups	4.000	18	.222		
	Total	4.800	19			

\*significant at the 0.05 level

Table 7 shows that there is no significant difference of mental stress levels between male and female group volunteers at both baseline ( $F = 0.18, p > 0.05$ ) and during ( $F = 3.60, p > 0.05$ ) tests.

## 5. Conclusion and Discussion

In the present study, researcher collected the data in Thai young adults compared between genders to examine whether they had different mental stress and %intensity levels during a 30-minute bread dough kneading, as well as to compare the Maximum Heart Rate, Resting Heart Rate, and Kneading-Dough Heart Rate to investigate whether they differed within and between genders.

This study results in no significant difference of mental stress levels at both baseline and during dough kneading test, however, the mean of stress levels at during kneading a dough was lower than at baseline. Correspondingly, Leisure is an activity of recreation as a way to reduce stress in daily living, as well, cooking is a recreation activity in hobby category that has the purpose to make, construct, and create psychological drive not only for pleasure and satisfaction in the end of resulting objects (Edginton et al, 2018), but also for enjoyment towards reduction of stress, creation of new experiences and physical activities (Edwards & Tsouros, 2006), as a key of appropriate knowledge, attitudes, and behaviours to ensure future health (Farid et al, 2019). Moreover, home cooking is defined to be a part of work which has not been only improving physical but also mental health (Palar et al, 2019). part of work which has not been only improving physical but also mental health.

As for the % Intensity, we found statistically significant difference of % Intensity during the test between males and females. Correspondingly, kilocalories or metabolic equivalents (METs) as a predictor to estimate the total energy expenditure closely relates to the leisure-time physical activities (Lamb & Bordie, 1990). Each type of leisure-time physical activities showed different intensity levels of physical activity (METs) such as cardiovascular responses like heart rate, breathing, and sweating (Singhal & Siddhu, 2014), as well as both

the free-time and occupational activity investigations represented the positive body composition, physical fitness, and blood factors (Lee et al, 2017), particularly, athletes Scientists have found the significant improvement in psychological and physiological capacities with performing the low-intensity physical activity (Izquierdo-Alventosa et al, 2020), particularly more improved by both moderate-and vigorous-intensity physical activity (Edwards & Tsouros, 2006).

The present study, there was no significant difference of maximum heart rate and resting heart rate. These might be normal information for participants recruited with the good health and same age variables, so they did not differ in. Nevertheless, there was statistically significant difference of heart rate during kneading dough between males and females. As following the existing evidences are that females showed relative aerobic energy expenditure more than males during recreational weight training (Morgan et al, 2003). Then, scientists have been reporting that a cause of the differences is woman has high body fat proportion than man (Wu & O'Sullivan, 2011). Performance in high intensity activity was associated with low %fat, however, no relation of body composition and physical activity in females (Westerterp & Goran, 1997).

## 6. Recommendations

Kneading-dough activity has not been explicitly investigated at large, nevertheless, the present study suggests that a 30-min kneading dough can probably decrease mental stress and increase energy expenditure processing increases of %intensity and heart rate during kneading the bread dough in both males and females. For the next study, researcher should be tested in different type of recreational activities to ensure energy expenditure which is worthy for mental and physical health enhancement and individual free-time management. Moreover, Health related organization probably takes into account the benefits of this kind of physical activity in order to promote it for the public to use.

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