

1-1-2016

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Recommended Citation

Baby, Anu Ms; B, Sulochana Ms; and T, Latha Ms (2016) "Comparison of body temperature of elderly with adult in South India," *Manipal Journal of Nursing and Health Sciences*: Vol. 2: Iss. 1, .

Available at: <https://impressions.manipal.edu/mjnhs/vol2/iss1/8>

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Comparison of body temperature of elderly with adult in South India

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Abstract

Background: Ageing is a gradual process, characterized by continued development and maturation. Every year there is an increase in the elderly population. Body temperature is an indicator of health status. However, thermoregulatory function is thought to decline with ageing. Therefore, it is significant to know the normal body temperature in elderly. **Objective:** Compare the normal body temperature among adults and elderly using Omron MC-510 tympanic thermometer. **Methods:** A cross sectional descriptive survey design was adopted for the study. Elderly (n=360) and adults (n=360) were screened for the presence of factors affecting core body temperature. Readings were recorded using Omron MC-510 tympanic thermometer twice in a day in the morning (8am-9am) and evening (4pm-5pm) for the selected subjects. Data was analyzed using descriptive statistics. Comparison of adult and elderly normal body temperature was performed using inferential statistics. **Results:** The normal body temperature of the elderly was found to be 35.9°C and that of the adults was found to be 36.9°C. **Conclusion:** Study concluded that the normal body temperature in elderly is lower than that of the adults. There was a difference in normal body temperature between adults and elderly by 1°C.

Keywords: normal body temperature, elderly, adults, tympanic thermometer, core body temperature

Introduction

Vital signs are the key components of good therapy. These measurements reveal the functioning of the body. Sets of vital signs that are beyond the normal ranges indicate the need for some form of treatment and interventions. Thermoregulation is a finely controlled process and a homeostatic mechanism. Maintenance of core body temperature i.e., between

36.5°C to 38.5°C depends on appropriate functioning of the body. When these values change there will be malfunction within the body system and the more in the change, the more the malfunction (Denial, Moran, & Liran, 2002). It is reported that temperature above 41.5°C or below 33.5°C causes a deterioration in the proper functioning of the body, which may result in injury and eventually death (Aita & Yoshizumi, 1994). The abnormal physiology of internal organ in the body and infection can increase the body temperature. Imbalance for heat absorbed from external environment, metabolic heat production and the amount of temperature released from the body may lead to abnormal temperature (Chudecka, Lubkowska, & Kempinska-Podhorodecka, 2014). In the clinical environment, body temperature may be affected by many facts. The nurse must be able to interpret any conflicting assessment findings. In order to ensure the best and safe care, knowledge regarding the normal body temperature is essential,

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How to cite this article: Baby, A., Sulochana, B., & Latha, T. (2016). Comparison of body temperature of elderly with adult in South India. *Mpl J of Nurs Health Sci*, 2(1), 25-30.

also requirement of accurate measurement of body temperature is most important in clinical practice (Barman, Snyder, Kozier, & Erb, 2009). In healthy individuals the body temperature vary from 36.8+/-0.4°C and it could be due to many factors. It is very important to measure the body temperature in the morning on waking and at rest in a standardized way (Mandell, Dolin, & Bennett's, 2009). The temperature assessment in rectal is the most accurate compared to oral assessment. However, tympanic membrane temperature recording is estimated to be the best reflect of the core body temperature. The rectal temperature assessment is still in practice in critical units and it remains as a reference in most parts of the world; similarly, it also involves risk of rectal injury. (Mari, Pouchot, & Vinceneux, 1997). The axillary measure of temperature is the safer method to check, but not reliable (Falzon, Grech, Caruana, Magro, & Attard-Montalto, 2003). In nineteenth century, Carl Reinhold August Wunderlic, a German physician had set 98.6°F as “normal” after collecting and analyzing over 25,000 patients and report from Harvard Health Letter contradicts it (Philip, Mackowiak, & Worden, 1994).

Researchers are interested in finding whether the normal body temperature differs between adult and elderly population. Human organs and metabolic processes function at a normal body temperature. Thermoregulatory mechanisms decline with ageing. The ability to detect changes in body temperature with speed and effectiveness are also reduced contributed by the alterations in the physiological system of the elderly. The immune system also changes and is slower to respond. Elderly are at high risk for developing potentially fatal disturbances. Any diagnostic delays may compromise the health and life of an elderly. A study done at nursing home among (Gomolin, Aung, Wolf-Klein, & Auerbach, 2005) elderly individuals have demonstrated that the mean oral body temperature was lower than 98.6°F and the review done on “body temperature variations in older people” finds that the benchmark is not normal in case of elderly population. It is stated that body temperature of 98.6 ° F should be considered as a sign of pyrexial illness (Shu-Hua, Leasure, & Yu-Tzu, 2010).

Health care focuses on wellness rather than on illness. Disability and disease are not considered unavoidable sections of ageing any longer. Increased medical knowledge, improved preventive health practices and technological advances have helped more lives to live longer and healthier. Elderly population now constitutes a significant group in the society.

Objectives

The objective of the study was to compare the normal body temperature of adults with elderly. The knowledge about the normal body temperature among elderly will assist in diagnosing pyrexial illness and intervene at the earliest. The primary focus of the study was to establish the normal range of body temperature among the elderly.

Materials and Methods

This study adopted a descriptive cross sectional survey design in assessing the normal body temperature of adults and elderly residing in the selected villages of Udupi district, Karnataka, India. The researcher visited conveniently 127 households by door-to-door survey and 756 individuals were assessed based on the selection criteria. The criteria checklist consisted of factors affecting normal core body temperature and body temperature. After screening the individuals 360 adults and 360 elderly were included for the study. Thirty-six individuals were not included in the study who presented with one or more factors affecting the core body temperature. The screening checklist developed by the researcher assessed the participants for the presence of all the factors affecting core body temperature (Table 1). The study samples were the adults (30-45years) and elderly (60 years and above) free of factors affecting core body temperature residing in the selected villages under study. Early adulthood is a period after rapid physical and physiological development of adolescence where an individual tries to fit into adulthood. Late adulthood may show changes as in any elderly and their age group is in close approximation with that of elderly. Therefore, middle adulthood was considered the best age group for comparison between the adults and elderly. The participants for the study were selected by purposive sampling.

Table 1: Sample selection criteria for screening adults and elderly subjects for the study

Selecting criteria for screening	
1.	Any following presentation from last 24 hrs
	<ul style="list-style-type: none"> • Sore throat • Cold/running nose • Body ache • Burning sensation during micturition • Cough • Pain in the ear
2.	Do you have any of the following?
	<ul style="list-style-type: none"> • Palpitation • Right ear deformity • Fresh wound • Diabetes mellitus • Hypertension • Cardiac failure • Recent weight loss/ gain • Any other_____ • Any surgery in the past
3.	Previous surgery of the ear
4.	Any deformities or discharges in the ear
5.	BMI 30 equal or more
6.	Previous history of cranial injury
7.	On any thyroid medication
8.	Substance intake last 24hrs like Antipyretics, Analgesics, Antibiotics, Alcohol

Permission from institutional ethics committee, administrative permission from the village panchayat president and informed consent from the participants for the study were obtained. The thermometer was shielded with disposable probe covers fixed to the tympanic thermometer sensor to prevent introduction of infection and damage by a foreign body or cerumen in the ear. Procedure was initiated by hand hygiene by using hand sanitizer to prevent any harm to subjects and to self.

The study participants were placed in comfortable position in a chair with adequate light in the room and the assessment was performed by using the Omron 510MC tympanic thermometer. Ear pinna of the participants was pulled upward and backward to straighten the ear canal after which tympanic thermometer was inserted and reading was obtained in one second. Body temperature was measured twice in a day for a subject i.e., from 8am-9am in the

morning and 4pm-5pm in the evening considering the circadian rhythm of body temperature. Some elderly subjects expressed fear and anxiety related to the insertion of tympanic thermometer. Therefore, the researcher had to demonstrate the procedure among the adults who were present during the assessment procedure at home and then carried out on elderly people. The researcher used OMRON MC-510 tympanic thermometer. It detects the infrared heat given off by the eardrum and surrounding tissues in one second. Disposable probe covers were used to prevent cross infection and any damage to the tympanic thermometer.

The thermometer was calibrated and the standard used was Handy Calibrator Rtd. and the range was placed between 34 and 42.2°C. Intra device reliability of the instrument was obtained by measuring the temperature twice for every subject within a given time period of two hours in a day. The intra device reliability of the instrument was calculated as one ($r=1$) and therefore was considered to be reliable. There was expression of fear and anxiety among the elderly during insertion.

Results

The data was analyzed using SPSS 11.5 version.

The demography of the adults and elderly was collected using demographic pro-forma and the information is presented in table 2.

Table 2. Description of frequency and percentage distribution of the adult and elderly population (n=360+360=720)

Sample Characteristics	Adults		Elderly	
	Frequency	Percentage	Frequency	Percentage
Gender				
Male	160	44.4	133	36.9
Female	200	55.6	227	63.1
Occupation				
Housewife	157	43.6	189	52.5
Coolie	48	13.3	20	5.5
Shopkeeper	10	2.8	8	2.2
Unemployed	77	21.4	92	25.6
Farmer	12	3.3	-	-
Others	56	15.6	51	14.2
BMI				
Normal weight (18.5 – 24)	321	89.2	354	98.3
Overweight (≥ 25)	39	10.8	6	1.7

The data in table 2 show that the most of the adults (55.5%) and elderly (63.1%) subjects were females. Most of the adults (43.6%) and elderly (52.5%) were home makers. Majority of the adults (89.2%) and elderly (98.3%) had normal BMI.

The data presented in table 3 show that the mean normal temperature of the adults were obtained as 36.7°C (SD=0.19) and 37°C (SD=0.16) in the morning and evening respectively whereas mean normal body temperature of the elderly were between 35.7°C (SD=0.45) and 36°C (SD=0.39) in the morning and evening respectively. The mean body temperature reading of 36.9°C (SD=0.16) was obtained on an average in a day for adults. However, the body temperature reading among elderly on the average in a day was found to be 35.9°C (SD=0.41). The mean difference of 1°C normal temperature was found between adult and elderly subjects.

The comparison of normal body temperature between adults and elderly subjects is presented in figure 1. It was found that $t_{(618)} = 40.732$ with 95% CI (-1.0 -0.90), $p < 0.001$, which is statistically significant. Therefore, it is concluded that there was a significant difference between the normal body temperature of adults and elderly.

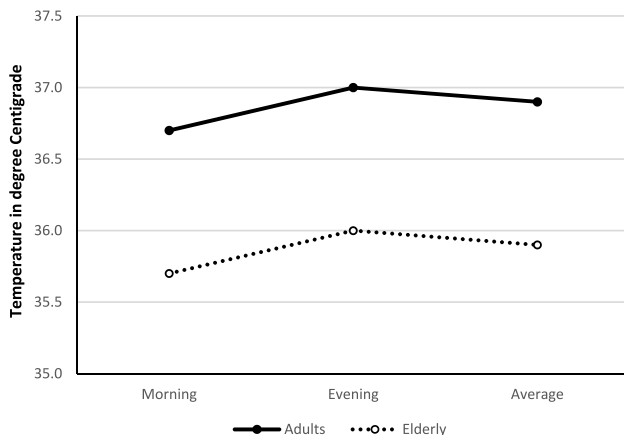


Figure 1: Comparison of Normal body temperature between adults and elderly subjects

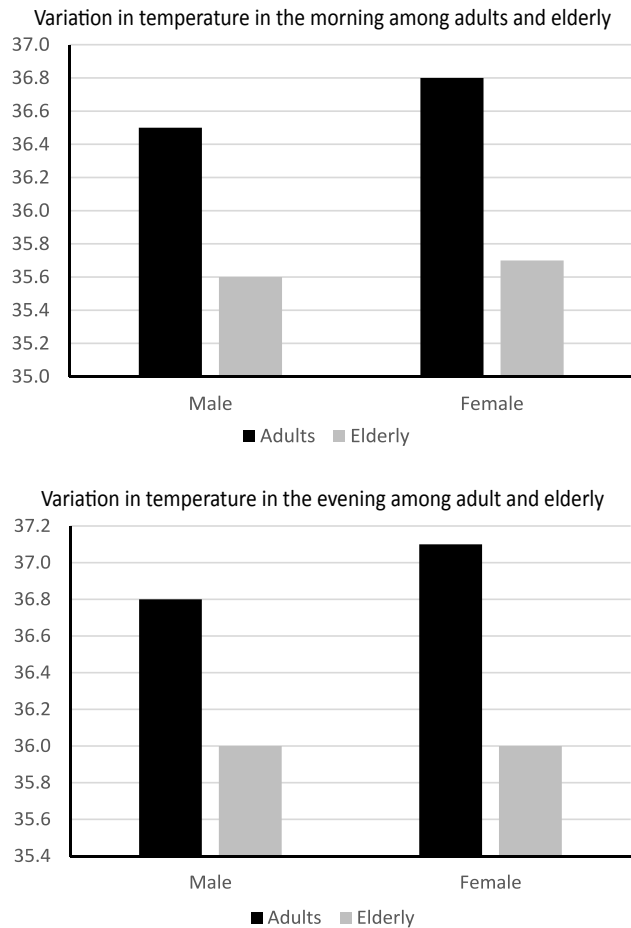


Figure 2. Variation in normal body temperature of elderly and adult based on gender

The data in figure 2 show that there is a variation of 0.3°C – 0.4°C in body temperature from morning to evening among adults and elderly people.

Discussion

Richards & Pocock, (2009) reported that the homeostatic thermoregulation mechanism in the human body and the narrow range of core body temperature i.e., 36°C – 37.5°C is acceptable in clinical practice. In the human body, cell metabolism results in generation of heat in varying amounts. Hence, body temperature is not evenly distributed across the body (McCallum & Higgins, 2012).

Table 3. Mean tympanic temperature and difference of normal temperature among adults and elderly (N=360+360=720)

Assessment of Temperature	Minimum		Maximum		Mean		Mean difference (°C)
	Adult (°C)	Elderly (°C)	Adult (°C)	Elderly (°C)	Adult (°C)	Elderly (°C)	
Body Temperature in the morning	36.3	34.4	37.3	36.7	36.7	35.7	1.0
Body Temperature in the evening	36.5	35.0	37.3	36.8	37.0	36.0	1.0
Average Body Temperature in the day	36.4	34.7	37.3	36.8	36.9	35.9	1.0

The present study findings report that the normal body temperature of the elderly people is lower than that of the adults i.e., estimated to be 35.9°C and that of adults was 36.9°C support the findings of (Darowski, Najim, Wein, & Guz, 1991). Their study results concluded that a temperature of 37.5°C is outside the normal range for an elderly patient. Therefore, suspicion should be raised for condition associated with pyrexia. A systematic review conducted on a topic body temperature norms in the elderly population by (Shu-Hua, Leasure, & Yu-Tzu, 2010) reported the data from 22 papers yielded that the normal body temperature among elderly people is lower than the adults' accepted value that is traditionally followed.

The findings of the study are clearly suggestive of the need for improvements in the geriatric nursing care. The elderly people are highly susceptible to infection and at increased risk for mortality and morbidity. Infection usually presents in a typical fashion among the elderly. Fever, which is considered a cardinal sign of infection, either may be absent or blunted. These can contribute towards diagnostic delays of pyrexial illness. If we look into the elderly population, often they have physiological impairment, reduced functional reserve, reduced immunity along with many other co-morbid illnesses. Thus, fever that is indicative of serious bacterial or viral infections among the older people is missed out. Older people are also at the risk for hospitalization that again makes them prone to acquire nosocomial infection. Body temperature which is considered to be a vital sign is an important indicator of any vital alteration in the human body. Early diagnosis and timely interference will facilitate in plummeting mortality and morbidity among elderly population. Therefore, understanding of what is normal, is significant to interpret any deviation. The present study finding paves way for a health team member to critically think before he/she arrives at any diagnosis or ensue any steps.

Thermoregulation is suggested to be impaired in the elderly due to age-related factors, such as reduced proportion of heat-producing cells, decrease in total body water, delayed and reduced vasoconstriction and vasodilation response, a decreased sweating,

decreased metabolic rate and secondary infection to impairment and disease. The sedentary lifestyle of elderly might also lower heat production. These factors must have contributed towards the lower body temperature than that of the adults. (Pusnik & Miklavc, 2009), reported that measurement of core body temperature may seem simple, but several issues affect the accuracy of the reading. These include the measurement site, the reliability of the instrument and user technique. Non-invasive sites such as the rectum, oral cavity, axilla, temporal artery (forehead), and external auditory canal are accessible and are believed to provide the best estimation of the core temperature. The temperature measured between these sites can vary greatly, so the same site is used in the clinical setting. Assessment and evaluation of normal body temperature of an individual serves as an important component of decision making related to nursing and medical care.

The body temperature of the participants was not tested in the early morning when it is considered the lowest. We had taken only two readings in a day and only during one season. Further, the screening of the sample for the presence of factors affecting core body temperature was subjective. It appears to be a limitation of the study. Future research studies should edge at more clinical evidences from all these sides.

McCallum & Higgins, (2012) described in the article titled "Measuring body temperature" that none of the methods for measuring temperature is perfect. Once a site and a method have been selected, they must be used consistently to ensure accuracy and patient safety. Temperature assessment by tympanic thermometer through external auditory canal is quick (<1 minute), minimally invasive and easy to perform. While its accuracy and reliability is questioned in many studies in the past decade with differing outcomes, tympanic thermometry continues to be used. It also reflects that the machinist error and poor method are repeated problems, and hence training on assessment methods needs to be implemented in the curriculum. In the present study reported, earwax reduces the accuracy of readings. Therefore, it is necessary to inspect the external auditory canal before measurement (Farnell,

2005). Finally, it is important that proper method of temperature assessment should be adopted for accurate reading of body temperature. Advantages of this site are that the measurement does not appear to be influenced by oral fluids or diet, environmental temperature or other extraneous variables (Robb & Shahab, 2001). This evidence can be utilized in all the levels of prevention and phases of illness that can occur due to under diagnosis of pyrexial illness among the elderly.

Conclusion

The normal body temperature among elderly people is lower than that of the adults and hence should be measured and recorded regularly with precision, consistency, and diligence. When caring for individuals the nurse should especially be aware of patients' temperature because it serves as a useful sign of change in their clinical condition (McCallum & Higgins, 2012). Care must be taken to prevent diagnostic delays of pyrexial illness so that timely intervention is possible. Since infection presents in a typical fashion among elderly subjects, under diagnosis of pyrexia may lead to further complications. Therefore, evidence based practices need to be incorporated in the geriatric care to reduce the rate of mortality and morbidity.

Sources of support: None

Conflict of interest: None declared

Source of support in form of grants: None

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