

Effect of Methyl-Tertiary Butyl Ether on Body Weight Trend in Male Wistar Rats

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ABSTRACT

Background: Methyl tert-butyl ether (MTBE) is a chemical compound that has been added to gasoline to decrease environmental pollutants and increase motor combustion efficiency. Despite the ban, this substance is still used in some countries. This research was conducted to study the sub-chronic effects of oral MTBE on body weight trends, food, and water consumption.

Methods: Twenty male Wistar rats were categorized into four groups after the adaptation time. They received 0, 400, 800, and 1600 mg/kg body weight of MTBE by gavage. Body weight was measured for each rat every two days during 31 sequential days of MTBE treatment. Likewise, total food consumption (mg) and total water intake (ml) of each animal were recorded at the end of the experiment.

Results: Statistical analysis showed a significant decreasing trend for body weight in the 1600 mg/kg MTBE treatment group, as compared with the control group. However, no significant alteration was observed in the body weight trend in the other treatment groups. No obvious difference was found in food consumption and water intake in all experimental groups compared with the control. Further studies should be conducted to clarify the results of the current study.

Conclusion: The data collected from this study indicated that the administration of high doses of MTBE in male rats cause a significant decrease in body weight trends.

Keywords: MTBE, Body weight trend, Rat.

1. Introduction

MTBE is a fuel-oxygenated solvent used to reduce air pollutants and other hydrocarbon emissions in motor vehicle exhaust [1]. To leak MTBE from underground reservoirs into drinking water wells and health concerns, its use was stopped in Canada and the USA as a gasoline additive in 2006 [2], but it is still used in some countries. Various animal

studies have proved that administration of high levels of MTBE is related to carcinogenesis [3-5]. Therefore, it is classified as a possible human carcinogen in the list of dangerous chemicals [6]. It is proposed that MTBE toxicity may be related to oxidative stress due to the production of highly reactive oxygen species (ROS) [7-9]. In previous studies, we investigated the influence of MTBE on

hematological indicators [11], liver function parameters [10], and the expression of genes involved MTBE detoxification pathway [12]. Few animal investigations have been conducted about the influence of MTBE on body weight trends, final body weight, and food and water consumption [13-16]. However, the results of these studies have been further contradictory. Here we are going to investigate the sub-chronic effect of oral MTBE on the body weight trend, food consumption, and water intake in male Wistar rats.

2. Materials and methods

2.1. Animals and experimental design

Twenty male Wistar rats weighing 180-200 g (Average 8 weeks old) were provided by Shiraz University of Medical Sciences. MTBE with a purity of 98% was obtained from Shiraz Oil Refinery (Shiraz, Iran). The Rats were kept individually in stainless-steel cages under standard conditions in a temperature-controlled animal room (at 25 ± 2 °C) with controlled lighting (12-hour light/dark cycles). They received the standard animal food and were allowed *ad libitum* to tap water. After ten days of acclimatization, the experimental animals were classified into four groups which received 0, 400, 800, and 1600 mg/kg MTBE dissolved in peanut oil by gavage for 31 continuous days (MTBE doses were chosen based on the previous studies). Body weight, food consumption, and water intake were recorded every two days for each rat. None of the animals in all groups died during the experiment period. This study

was accomplished with the confirmation of the Animal Ethics Committee at Shiraz University. The ethical approval was certified by Behbahan Khatam Alanbia University of Technology (Certificate No: 7-3-106884bkatu).

2.1. Statistical analysis

Descriptive statistical values were expressed as the mean \pm standard error (SE). The influence of MTBE on body weight trend was analyzed for each animal during the study period using repeated measure analysis. Total food consumption and water intake in the experiment period were analyzed with a one-way analysis of variance and Duncan post-hoc test. Statistical analysis and all calculations were conducted using SPSS software (Version 20) and Excel software was used to draw the graph. The significance level for all cases was considered <0.05 .

3. Results

Alterations in body weight trend following 31 days of MTBE treatment are displayed in Figure 1. There was a significant reduction ($p < 0.05$) in body weight trend in the 1600 mg/kg group on the 15th day of MTBE treatment and this significant decreasing trend persisted until the end of the experiment. No obvious change was observed in the body weight trend in the other treatment groups (400 and 800 mg MTBE/kg), although the mean of the group in MTBE-treated animals was lower compared with control group.

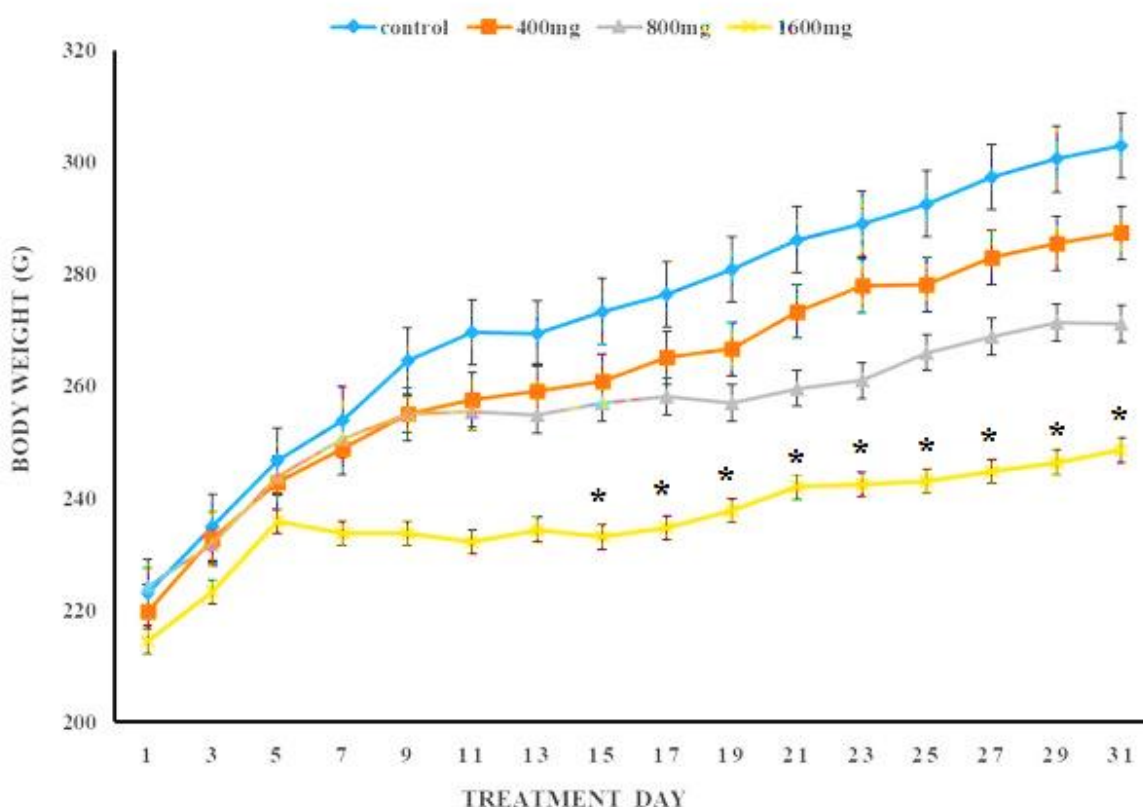


Figure 1. Effect of MTBE on body weight trend in the male rats.

The MTBE effect on total food consumption and total water intake in the experimental period is presented in Table

1. In this regard, there was no significant alteration between treatment groups relative to the concurrent control group.

Table 1. Effects of MTBE on food consumption and water intake in Wistar rats

Parameters	Control	MTBE concentration (mg/Kg)		
		400	800	1600
Food consumption	725 ± 52	641 ± 57	645 ± 20	597 ± 39
Water intake	1954 ± 141	1700 ± 146	1630 ± 59	1648 ± 158

4. Discussion

According to the information of the author, there are a few reports with inconsistent results about the effect of MTBE on the body weight trends. Similar to the current research, Williams *et al.* (2000) reported that the trend of reducing body weight at a dose of 1500 mg/kg started from day 15 of oral MTBE treatment in male rats [13]. Also, in another oral study, the average body weight of rats started to decrease in the 800 mg/kg/MTBE group only after two

weeks of treatment [5]. Alternatively, Li *et al.* (2008) reported that there was no meaningful difference in rat body weight among experimental and control groups during 4 weeks of oral MTBE treatment [9]. The results obtained from this research revealed that the administration of oral MTBE had no obvious influence on their food consumption and water intake (Table 1). These results are consistent with other publications [5,17,18]. However, Bermudez *et al.* (2011) reported a reduction in water intake and

food consumption in Wistar rats when they were exposed to high amounts of MTBE [14]. MTBE can disrupt the digestive system through reactive oxygen species [19,20]. As a result, a part of the energy from the consumed food is excreted from the body in different ways instead of being used for weight gain.

Conclusion

To sum up, the results of the current work demonstrated that contact with high levels of MTBE during 31 days was related to a significant decline in body weight trends in the male rats. However, MTBE treatment at mentioned doses had no negative effect on food consumption and water intake.

Conflict of Interest

No conflict of interest is declared by the author.

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None.

Ethics approval and consent to participate

The ethical approval was certified by Behbahan Khatam Alanbia University of Technology (Certificate No: 7-3-106884bkatu).

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