



# Effects of Watermelon Juice on the Haematological Indices and Body Mass Index of Male Wistar Rats

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. Author OSO conceived the study, designed the protocol and contributed in the manuscript writing while author OEE coordinated the experiment, carried out the laboratory procedures. Finally, author ZVZ performed the statistical analysis and data interpretation. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Background:** Despite the various claims on the potential health benefits of consuming watermelon fruit, little has been said on its benefits on the blood and body mass index. The present study was therefore carried out to investigate the effect of oral administration of watermelon juice on haematological parameters and body mass index (BMI) of male Wistar rats.

**Methods:** Twenty-four (24) male Wistar rats weighing between 120 and 160g were selected into four groups of 6 rats each. Group 1 served as control with no treatment, Group 2 received 0.5ml of watermelon juice (WMJ), Group 3 received 1ml of WMJ and Group 4 received 1.5ml of WMJ. Weekly measurements of body weight and body length were recorded and after 5 weeks of

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administrations, blood samples were collected from the study animals via cardiac puncture after sedating them with 80% chloroform. The blood samples were put into properly labeled ethylenediaminetetraacetic acid (EDTA) bottles. Quantitative data emanating from the study were subjected to statistical analyses using SPSS software, version 21.0.

**Results:** The study found a statistically significant increase in lymphocytes and monocytes while there was no change in the neutrophils and eosinophils in the experimental groups with respect to the control. There was also a significant increase in red blood cell count while there was no significant change in the PCV, HCB, MCHC and MCV, with respect to the control. There was a significant increase in the plateletocrit and no significant change in MPV and PDW. Finally, there was a significant percentage increase in BMI in all the groups, which was least in the experimental group that was given the highest dosage of the watermelon juice.

**Conclusion:** These results underscore the potential benefits of watermelon juice supplementation on hematological parameters and BMI and warrant further investigation into its impact on overall health.

*Keywords: Watermelon juice; haematological indices; platelet count; differential white blood cell count and body mass index.*

## 1. BACKGROUND

Watermelon (*Citrullus lanatus*) is a member of the Cucurbitaceae family native to tropical areas of Africa near Kalahari Desert [1]. Botanists refer to it as a “pepo” which is a fruit having a thick rind and fleshy center [2]. It is largely consumed as refreshing summer fruit, much appreciated because of its refreshing capability, attractive colour, delicate taste and high water content to quench the summer thirst. Watermelon fruits yield about 55.3 % juice, 31.5 % rind and 10.4 % pomace. Carotenoids such as lycopene and  $\beta$ -carotene are responsible for the red and orange colors of the watermelon respectively. The sweetness of watermelon is mainly due to a combination of sucrose, glucose, and fructose. Sucrose and glucose account for 20–40 % and fructose for 30–50 % of total sugars in a ripe watermelon. Plants as nature gift has over centuries played a fundamental role in the development of modern human medicine as they constitute the active compounds in modern day drugs. Plant medicine (phytoamedicine) has been used in healthcare delivery in many parts of Africa and the rest of the world [3]. Report showed that most people (80%) in developing countries depend on plant medicine for their healthcare. Effective health cannot be achieved in Africa, unless orthodox medicine is complemented with traditional medicine [3]. Thus, the interest of many people around the world is gradually shifting towards fruits and vegetables because of their therapeutic benefits, economical values and easy accessibility. Watermelon (*Citrullus lanatus*) have become a welcome fruit for many Africans because of its affordability among others thus, its cultivation has

greatly increased in many African Countries to meet peoples demand. According to Erhirhie and Ekene [4], watermelon is one of the fruit that is wildy used in traditional herbal medicine. Different literatures reveal the richness of watermelon in phyto-constituents such as calcium, dietary fiber, flavonoids, iron, magnesium, phosphorus, potassium, vitamins and zinc [5]. Watermelon has been reported to contain carotenoids ( $\beta$ -carotene), including lycopene which has a protective effect through its antioxidant properties [5,6] thereby inactivating the reactive oxygen species (ROS) and reducing the free radicals. More so, water melon has been used for treating urinary tract infection, bed wetting, dropsy, renal stones, alcohol poisoning, hypertension, diabetic, diarrhea and gonorrhoea [3]; Erhirhie and Ekene). *C. lanatus* had been reported as one major fruits that is excessively consumed in Nigeria which tended to produce no severe health effects [7], but most people avoid eating the seed and rind due to their unappealing flavor.

## 2. MATERIALS AND METHODS

The watermelon to be administered to the animals was purchased from Choba Market, Obio-Akpor L.G.A of Rivers State. The watermelon skin was peeled and the seeds removed. The endocarp of the ripe fruit was then chopped into tiny slices and crushed to liquid with a blender. The liquid obtained was sieved through a clean cloth and sieve to get the watermelon juice and then stored in a refrigerator. Watermelon juice was prepared freshly every three (3) days throughout the treatment period to prevent fermentation.

Twenty-four (24) male wistar rats were purchased from the animal house of pharmacology Department of the University of Port Harcourt, Nigeria, for this study. The rats weighed between 77-110g and were divided into four groups (1, 2, 3 & 4) of six rats each according to their weight.

They were housed in well-ventilated cages in the animal house and were provided with sufficient feed (pellets) of a weight of 288g of the top feed, Nigeria and water supply. They were subjected

to natural photo period of about twelve (12) hours light/dark throughout the study period.

The animals were weighed weekly and their length taken accurately and then calculated to get the body mass index and it was properly documented throughout the length of the study. The animal's weight and height were taken weekly. This ensured getting the Body Mass index for each rat. It is calculated by dividing the animal weight by the height.

### 3. RESULTS

**Table 1. Effects of Oral administration of Water Melon (WM) juice on White Blood Cells (WBC) differentials in male Wistar rats**

Control and Treatment groups	Neutrophil (%)	Lymphocytes (%)	Eosinophil (%)	Monocyte (%)
Group 1: Control	6.66 ± 2.46	86.66 ± 3.42	1.16 ± 0.16	4.50 ± 0.02
Group 2: 0.5ml WM Juice	5.83 ± 0.70	91.50 ± 2.08	1.07 ± 0.00	5.83 ± 0.47
Group 3: 1ml WM Juice	5.24 ± 0.66	97.00 ± 3.83	1.04 ± 0.00	6.16 ± 0.63 <sup>a</sup>
Group 4: 1.5ml WM Juice	4.83 ± 0.40	102.00 ± 0.93 <sup>a</sup>	1.00 ± 0.00	8.33 ± 0.79 <sup>a</sup>

Values represent mean ± SEM, n=6; <sup>a</sup> Significant at p<0.05 when compared to Group 1

**Table 2. Changes in erythrocytes parameters following administration of watermelon juice for 5 weeks**

Control and Treatment groups	RBC (%)	PCV (%)	HGB (g/dl)	MCHC (g/l)	MCH (pg)	MCV (fl)
Group 1 (Control)	6.95±0.22	40.74±0.51	13.58±0.34	29.73±0.31	19.73±0.98	67.28±0.73
Group 2 (0.5ml Water melon juice)	7.08±0.55	39.09±0.27	13.03±0.84	29.25±0.23	18.95±0.77	65.55±0.67
Group 3(1.0 ml Water melon juice)	7.49±0.58	37.86±0.21	12.62±0.39	27.78±0.19	17.13±0.69	64.28±0.56
Group 4 (1.5ml Water melon juice)	7.53±0.58 <sup>a</sup>	28.49±0.13	12.13±0.13	25.50±0.05	16.33±0.64	61.23±0.35

Values represent mean ± SEM, n=6; <sup>a</sup> Significant at p<0.05 when compared to Group 1

RBC: Red blood cell count, PCV: Packed cell volume, HGB: Hemoglobin, MCV: mean corpuscular volume, MCH: mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration

**Table 3. Effects of Oral Water Melon (WM) juice administration on platelet indices in male Wistar rats**

Control and Treatment groups	Mean platelet volume (MPV) (fL)	Platelet distribution width (PDW) (%)	Plateletcrit (PCT) (%)
Group 1: Control	7.78 ± 0.65	9.53 ± 0.31	0.46 ± 0.53
Group 2: 0.5ml WM Juice	7.28 ± 0.44	8.88 ± 0.18	0.32 ± 0.02
Group 3: 1ml WM Juice	7.13 ± 0.29	8.68 ± 0.15	0.30 ± 0.05
Group 4: 1.5ml WM Juice	7.01 ± 0.11	7.10 ± 0.13	0.25 ± 0.02 <sup>a</sup>

Values represent mean ± SEM, n=6; <sup>a</sup> Significant at p<0.05 when compared to Group 1

**Table 4. Changes in BMI following administration of various doses of watermelon juice for 5 weeks**

Control and Treatment groups	BMI WEEK 1	BMI WEEK 5	BMI increase (%)
Group 1 (Control)	0.5642±0.05	1.0263±0.10	81.9*
Group 2 (0.5ml Water melon juice)	0.7342±0.05	1.2263±0.10	67.0*
Group 3 (1.0 ml Water melon juice)	0.6954±0.04	1.1096±0.03	59.6*
Group 4 (1.5ml Water melon juice)	0.6465±0.03	0.9120±0.01	41.1*

Values are presented in mean ± sem, n= 6. \* means values are statistically significant (p≤0.05) when compared to the control

## 4. DISCUSSION

### 4.1 Effect of Oral Administration of Watermelon Juice on White Blood Cell and its Indices in Male Wistar Rats

The present study recorded a significant increase in the plasma concentration of lymphocytes and monocytes, with respect to the control group while no significant change was observed in the plasma concentrations of the neutrophil and eosinophils, with respect to the control group (Table 1). This result is inconsistent with an earlier report by Iwalaye et al. [8] that established a significant white blood cell reducing ability of juice made from different portions of watermelon in mice. The above finding of the present study lays credence to the health beneficial effect of the watermelon juice as it has the tendency to maintaining the WBC level within normal range. Thus, frequent consumption of the fruit juice could exert beneficial effects on WBC level in a mammalian model. The outcome of this study is also an indicator that the constituents of the water melon juice (WMJ) is safe for or does not have adverse effect on the white blood cell differentials.

The above finding further validates earlier claims that citrulline, a major active compound in watermelon is a blood stabilizer; it explained that the compound is an amino acid and is converted by the body into arginine, which aids in the production of nitric oxide, a gas that promotes artery flexibility and relaxes blood vessels. Such benefits were said to improve blood flow, which helps reduce hypertension [9]. The extract therefore demonstrates a promising potential in maintaining the plasma level of white blood cells. This suggests its possible utility in bolstering the body's immune response, which is crucial for overall health and defense against infections.

### 4.2 Effect of Oral Administration of Watermelon Juice on Red Blood Cell Count and its Indices in Male Wistar Rats

From the present study, there was found a significant change in the plasma concentration of red blood cell count of the experimental animals with respect to the control group while there was no significant change in the packed cell volume, haemoglobin concentration and mean corpuscular haemoglobin concentration in the

experimental groups, with respect to the control. This result corroborates the work of Collins et al. [10], who found that watermelon juice at a higher dosage had a positive impact on red blood cell count. The current study finding suggests that watermelon juice may have potential benefits for improving red blood cell production in the body. One possible explanation for this effect could be the presence of certain nutrients in watermelon juice that are known to support red blood cell production. For example, watermelon is a good source of vitamin C, which is essential for the absorption of iron - a key nutrient for red blood cell formation. Additionally, watermelon also contains lycopene, an antioxidant that has been linked to improved blood flow and circulation. While watermelon is not particularly high in iron, it does contain a small amount of this mineral. However, the iron present in watermelon is not highly bioavailable (meaning it is not easily absorbed and utilized by the body) compared to other sources like red meat or leafy greens. Therefore, the direct impact of watermelon on hemoglobin concentration through its iron content is likely to be minimal. This result also corroborates that of Masrurah et al. [11], who reported that there was no significant effect of administering watermelon fruit to increasing HB levels in adolescents, however watermelon juice has been reported to potentially maintain normal erythrocyte parameters, including cell count, size, and hemoglobin content, even with continuous consumption.

### 4.3 Effect of Oral Administration of Watermelon Juice on Platelet Count and its Indices in Male Wistar Rats

The present study found a significant increase in the plateletocrit in the experimental groups with respect to the control group (Table 3). There was however found no significant difference in the mean platelet volume (MPV) and platelet distribution width (PDW), in the experimental groups with respect to the control group. Plateletocrit is a measure of the volume occupied by platelets in a given volume of blood, similar to hematocrit which measures the volume occupied by red blood cells. Elevated plateletocrit levels, also known as thrombocytosis, can have clinical significance and may indicate underlying health conditions or physiological responses.

This finding of the present is similar to the report of Oyesola et al. [12], which stated that the sub-chronic ingestion of 1ml of watermelon juice was

able to slightly raise neutrophil and platelets levels. Similarly, Burungale [13], confirmed that red fruits (including tomatoes, plumps, watermelons, etc.) are key to improved platelets.

Larger and more reactive platelets are indicated by an elevated MPV and an increase in MPV has been linked to inflammation and has been shown to reflect the inflammatory burden in various conditions, according to prior research [14]. It is therefore important to state that, the present result shows that the consumption of the watermelon juice is possibly associated with less platelet activation functions. This can imply an anti-inflammation potential of the juice.

From the above finding of the present study, it can be suggested that the constituents of the watermelon juice may possess platelets (and perhaps other blood cells) stabilizing attributes. It may thus, be recommended in some thrombotic dysfunctions. Therefore, aside from the earlier reported biological benefits of consuming watermelon juice in mammals, this study has specifically revealed that the fruit juice is safe for healthy platelet population in a typical mammalian model.

#### **4.4 Effect of Oral Administration of Watermelon Juice on Body Mass Index (BMI) in Male Wistar Rats**

Table 4 above shows the effect of watermelon on BMI after a 5-weeks period of ingesting watermelon juice. After a period of 5 weeks, the animals presented with 0.5 ml, 1.0 ml and 1.5ml volumes of watermelon juice showed significant increase of 67.0%, 59.6% and 41.1% in BMI respectively compared to the control group which had BMI increase of 81.9%.

Previous human studies have reported that reduced consumption of fruits is possibly associated with increased prevalence of overweight and/or obesity in children [15] and young to middle-age adults [16,17]. Other studies which monitored increased consumption of fruits in adults reported that fruits may be an effective strategy for decreasing energy consumption and for increasing and maintaining weight loss [16,18]. This study showed a decrease in BMI with increase in volume of watermelon juice consumed, suggesting that a high intake of watermelon juice and/or fruits may be useful in maintaining optimal weight and probably reducing the risk of chronic diseases. This

agrees with the humans studies stated above, by indicating a gradual loss in BMI from increase in the volume of watermelon juice administered. This is a potential way to increase and maintain an adequate body weight. This study could further support the body of evidence that beneficial effects on body weight through reduction in BMI may offer protective effects against and/or to reduce the relative risk of diabetes [19,20].

## **5. CONCLUSION**

In conclusion, the study yielded compelling findings regarding the hematological parameters and BMI changes in response to watermelon juice supplementation. The experimental groups exhibited noteworthy increases in lymphocytes, monocytes, red blood cell count, and plateletcrit compared to the control group. Conversely, neutrophils and eosinophils remained unchanged. Furthermore, while there were no significant alterations in PCV, HCB, MCHC, MCV, MPV, and PDW, the increase in BMI was significant across all groups. Interestingly, the group administered the highest dosage of watermelon juice displayed the least increase in BMI. These results underscore the potential benefits of watermelon juice supplementation on hematological parameters and warrant further investigation into its impact on overall health.

## **CONSENT**

It is not applicable.

## **ETHICAL APPROVAL**

The ethical approval to carry out this work was sought for and obtained from the ethics and research committee of the University of Port Harcourt and preserved by the author(s).

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## **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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