BIOCHEMICAL CHANGES OF URINE AMONG FEMALE LONG DISTANCE RUNNERS

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Key Words:

Biochemical Changes, Urine Analysis, Long Distance Runners

ABSTRACT

This study was designed to analyze selected biochemical changes in the urine of female long-distance runners both before and after engaging in physical activity, aiming to evaluate the effect of hard exercise on the body's homeostatic balance. The investigation was delimited to 10 female long-distance runners, typically aged 18 to 20 years, from whom urine samples were collected before and after a 45-minute running period. The specific biochemical variables measured were Protein, pH, Ketone, and Specific Gravity, utilizing the urine strip test method, with the collected data subsequently analyzed using Analysis of Variance (ANOVA). Statistical findings demonstrated a significant difference between the pre-test and post-test scores for all four measured parameters (urine protein, pH, ketone, and specific gravity) at the 0.05 level of significance. Therefore, the study concluded that significant differences exist in the levels of urinary protein, pH, ketone, and specific gravity following physical activity in long-distance runners

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Introduction

The definition of "physical activity" covers all movement of the body by voluntary muscles that culminates in the outlay of energy. It is a generic term that ought not to be misconstrued with "exercise," which is a type of physical activity that is repetitive, structured, planned and with the goal of promoting or enhancing physical fitness (Caspersen et al., 1985). The body of humans has an advanced homeostatic system to support the volume and chemical composition of its internal fluids, a process where the excretory system is the most important. The urinary system is the main route of excretion of the metabolic end products, in addition to the lungs (which excrete carbon dioxide), the gastrointestinal tract (which clears the indigestible solids), and sweat glands (which control heat and salt) (Guyton & Hall, 2006). Urine, the liquid end product of this system, is a mixture of complex chemicals that yield a glimpse of metabolic and physiological status. Hence, measurement of urinary biomarkers provides a non-invasive means of evaluating the effect of hard physical exercise on the homeostatic balance of the body. This research focuses on the determination of these biochemical changes resulting from exercise in the urine of long-distance runners.

Statement of the Problem

The main purpose of the study was to analyze the selected Biochemical changes in urine before and after the physical activity of female Long distance runners.

Delimitation

- The study was delimited to 10 Female Long distance runners.
- The age ranged between 18 and 25 years.

- The study was delimited to only urine samples.
- The subject was restricted to compete in district level and state level.
- The samples sizes were not large enough for wide generalizations.

Limitation

- The nutritional status of the subjects was considered limitation to the study.
- The socio-economic status of the participants was taken as a limitation for the research.
- Factors like personal habits, daily routine activities, environment, economic conditions and life styles of the sample group members were not taken into consideration for this study.
- The general mood of the sample and environmental conditions at the time of performing the test might differ from the actual context, and this may be considered as another limitation of this study.
- Psychological factors were not taken into consideration at the time of participating in the activity, and this may be considered as another limitation of this study.

Objectives of the study

Following objectives are the basis of present study

- To compare the biochemical changes in urinary chemicals of the Pre and Posttest of long distance runners.

- To find out the effectiveness of ketone level of Long distance runners.

Hypothesis

Based on the above objectives following hypothesis were formulated

- It is hypothesized that there will be a significant difference in the Pre and Posttest of urinary chemicals of long-distance runners.
- It is hypothesized that there will be a significant difference in the ketone level of long-distance runners.

Definition and explanation of important terms

Biochemistry

It is the study of the structure and interaction of the complex organic molecules found in living systems. It is the study of chemical processes within and relating to living organisms. (Cambridge Dictionary, 2018)

Human renal excretory fluid

A liquid by-product of metabolism produced by the kidneys, stored in the bladder, and excreted through the urethra (Sherwood, 2016)

Athlete

A person who is trained or skilled in exercises, sports, or games requiring physical strength, agility, or stamina is called as athlete (Merriam Webster, 2018)

Significance of the study

- The study will help to know the Biochemical changes in the urine among athletes of Sprinters and Long-distance runners.

- The study will be helpful to prepare the fitness program for the athletes.
- The study will help to monitor the health risk factors of athletes.

PROCEDURE

The study was to investigate the selected biochemical changes in urine among long distance runners before and after physical activity. In this study the bio chemicals of urine such as Protein, Ph, Ketone and specific gravity were measured.

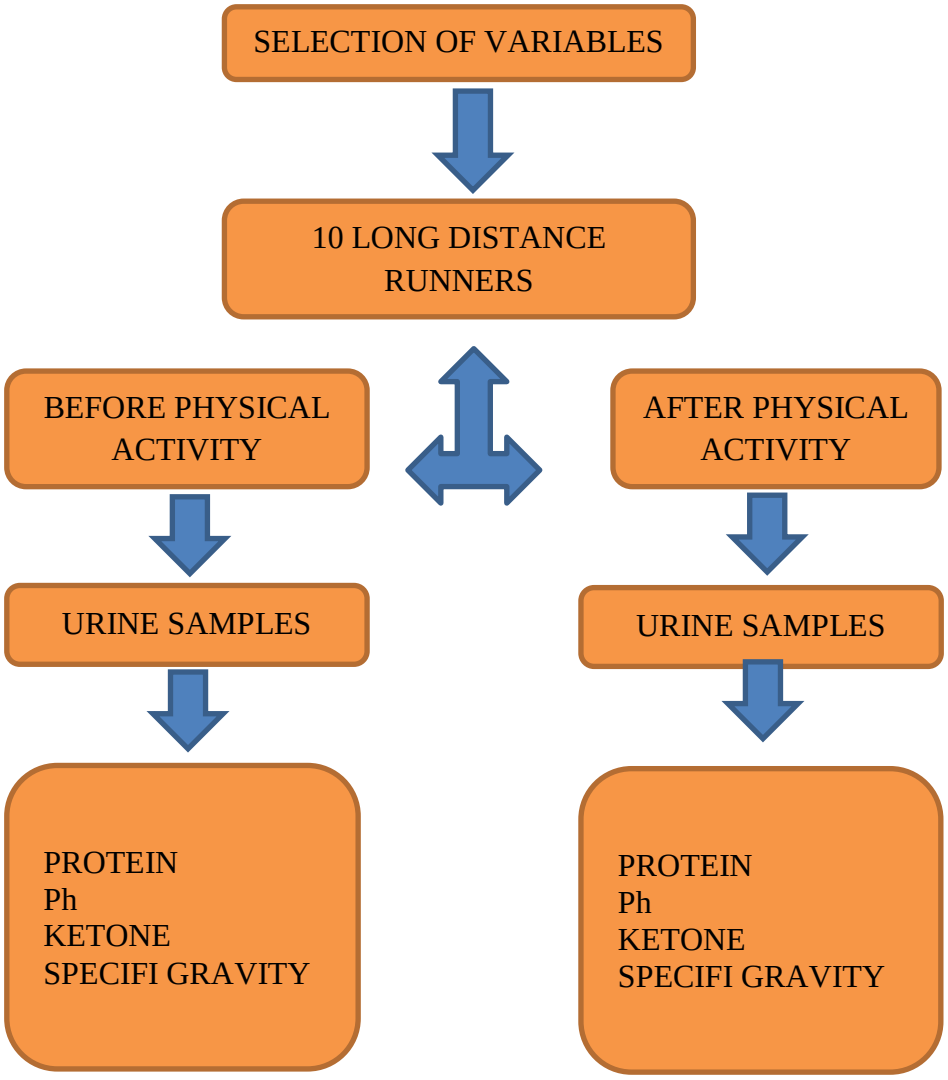
Selection of the subjects

For the study 10 female long distance runners were randomly chosen from the St. Joseph academy of higher education and research, Moolamattom. The age group was 18 to 20 years.

Selection of variables

Variables are the conditions that the experimenter manipulates, controls or observes. They are concepts that are used for a specific purpose in educational research. In this study urine samples of the athletes prior and subsequent to the physical activity were collected and following variables were tested through urine strip test method.

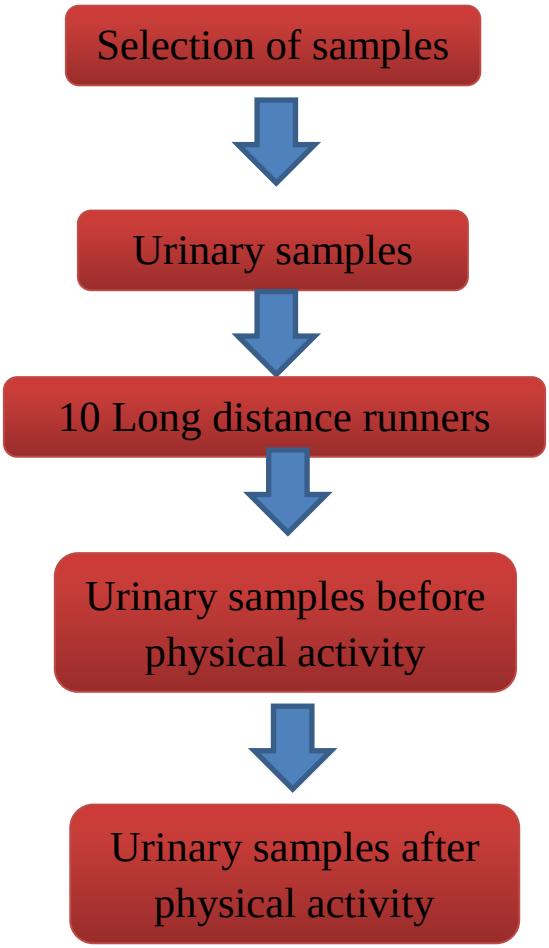
1. Protein
2. Ph
3. Ketones
4. Specific Gravit



Selection of samples

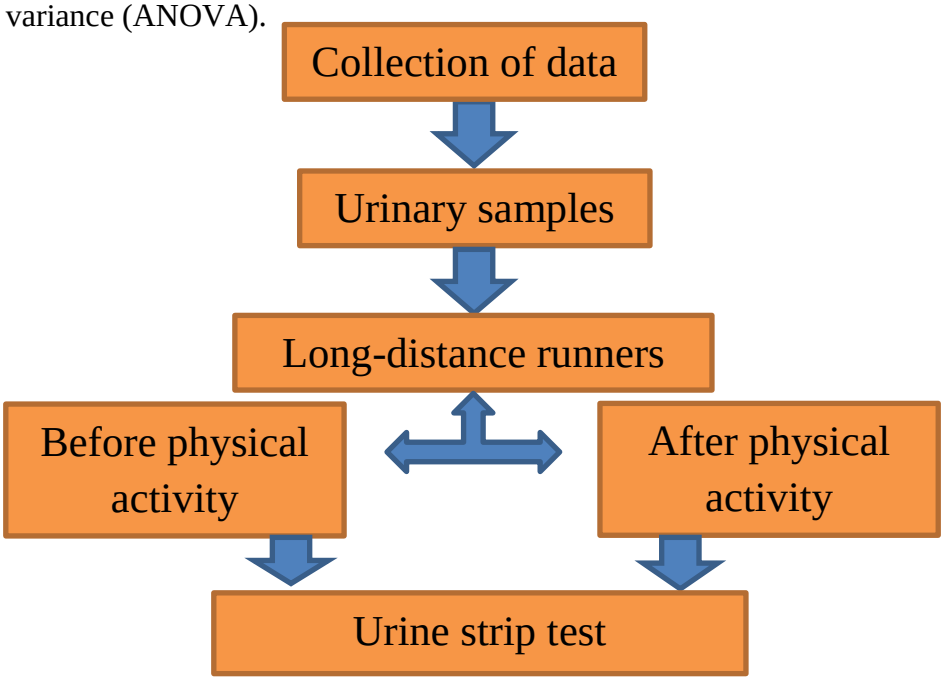
The investigator selected 10 female long distance runners from St. Joseph Academy of Higher Education and Research, Moolamattom as the subject. Their age range was 18 to 20 years. After the selection of the

subject investigator explained about his study. Then investigator asked the subject to give their urinary samples before their physical workout. Investigator gave the urine collecting container to the subject and collected the urinary samples of 10 long distance runners and separated in a different container with name slip. Then the investigator allows the subjects to their daily routine physical workout. After the physical workout investigator again gives another urine collecting containers to the subjects and urinary samples were collected with different containers with name slip. For this study total of 20 urinary samples were collected.



Collection of data

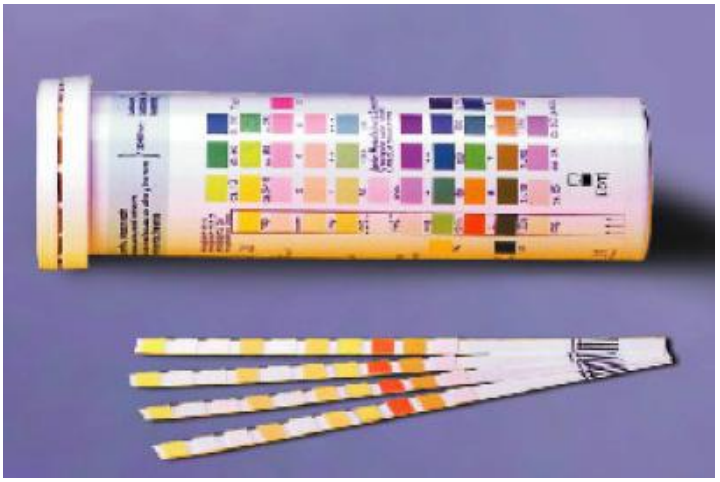
For the present study the investigator collected the urinary samples of 10 long distance runners before and after physical activity. Total of 20 urine samples were collected and separated in different containers. For the collection of data, the investigator first collected the urine samples before the physical activity of 10 female long distance runners and was separated in a different container with name slip. After the collection the investigator sends their subjects for 45 minutes and continues running. During the time of running the investigator tested the urine samples with urine strip test method of the 10 subjects and recorded data such as urine protein, Ph, ketone and specific gravity. After the completion of 45 minutes running the investigator collected the urine samples 10 male long-distance runners and is separated in a different container with name slip. Finally, these samples were tested by using urine strip test method and again recorded the data such as urine protein, Ph, ketone and specific gravity. Finally the recorded results were analyzed with statistical techniques like Analysis of variance (ANOVA).



Tools Used in the Present Study

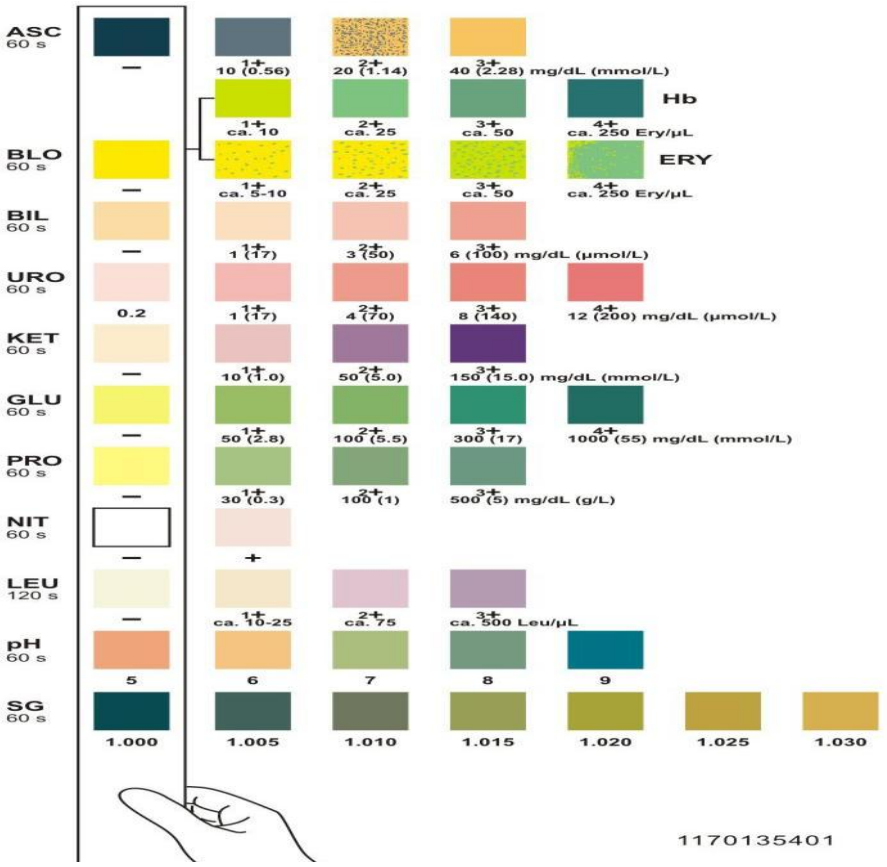
Urine test strip

A urine test strip was used for the study, commonly referred to as a dipstick, is a simple yet effective diagnostic tool widely used in routine urinalysis to detect pathological changes in a patient's urine. These strips, usually composed of a plastic or paper ribbon approximately 5 mm in width, are impregnated with chemical reagents that undergo a color change when exposed to urine. Standard multiparameter test strips can contain up to ten different reagent pads, enabling the simultaneous detection of proteins, glucose, ketones, hemoglobin (blood), bilirubin, urobilinogen, nitrite, leukocyte esterase, as well as the measurement of urine pH and specific gravity. The test is typically interpreted within 60 to 120 seconds after immersion, though certain parameters may require longer reaction times. Paper strips often contain reagents directly adsorbed onto the surface and are usually specific for a single reaction, such as pH testing, while plastic strips allow for multiple analyses simultaneously. Repeated use of these multiparameter strips is generally considered the first step in diagnosing a wide range of medical conditions and infections (Patient.info, 2023; Wikipedia, 2025).



Method

The test procedure involves completely submerging the strip in an adequately mixed sample of urine for a short period, then removing it and holding it at the edge of the receptacle so any excess urine may drip off. The strip is then left for the specified reaction time, usually around one to two minutes, during which the chemical reaction occurs. Lastly, the produced colour patterns are assessed by comparing them to the reference colour scale provided by the manufacturer.



Statistical procedure to be employed

To find out whether there was any significant difference between the means of the pretest and post test scores of the subjects following statistical techniques are used.

- Arithmetic mean
- Standard deviation
- Analysis of variance (ANOVA)

ANALYSIS OF DATA AND RESULTS OF THE STUDY

The major objective of the present study was to analyze the biochemical changes in human renal excretory fluid that is urine in long distance runners before and after their physical activity. Following urine biochemical such as Protein, Ph., Ketone and Specific gravity were tested by urine strips. The statistical methods utilized were Arithmetic mean, standard deviation and for comparison between pre and posttests ANOVA. The data gathered for the current study were examined keeping in mind casting light upon the objectives of this research. The data analysis and interpretation are given below. The significance level was fixed at 0.05 levels to test the hypothesis.

Table 1

Computation of mean and standard deviation of Pretest and post test scores on Urine biochemical of the long distance runners

Variables	10 Long distance runners			
	Pre test		Post test	
	AM	SD	AM	SD
Protein	12.7	2.49	20	4.71
PH	6.2	0.25	5.4	0.51
Ketones	4.5	0.96	13.5	2.41
Specific Gravity	1.009	0.0052	1.024	0.005

Table 4.1 shows that mean and standard deviation of protein level in pretest was 12.7 and 2.49 and in posttest was 20 and 4.71 respectively. Mean and standard deviation of Ph. level in pretest was 6.2 and 0.25 and in posttest was 5.4 and 0.51 respectively. Mean and standard deviation of Ketone level in pretest was 4.5 and 0.96 and in posttest was 13.5 and 2.41 respectively. Mean and standard deviation of Specific gravity level in pretest was 1.009 and 0.0052 and in posttest was 1.024 and 0.005 respectively.

Table 2

Summary of ANOVA on urine protein level of long distance runners before and after the physical activity

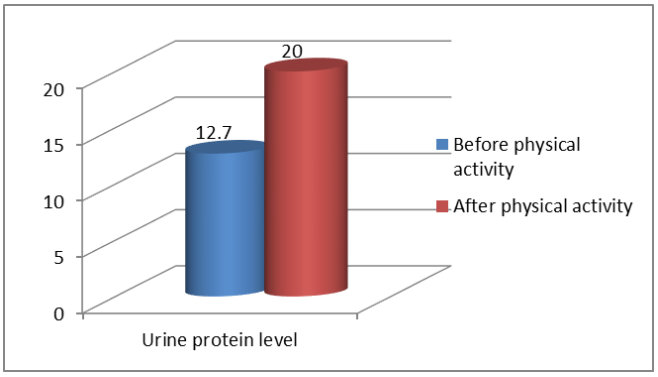
Source of variance	Sum of Squares	df	Mean sum of squares	F Cal	F table
Between groups	266.45	1	266.45	18.73	4.41
Within groups	256.1	18	14.22		
Total	522.55	19			

The *F*-ratio value is 18.73. The *p*-value is .0004. The result is significant at $p < .05$.

The table 4.2 reveals that the calculated F – ratio with degree of freedom (1, 18) is 18.73 is greater than the F table value with degree of freedom (1, 18) is 4.41 at 0.05 level of significance. Hence we conclude that there is a significant difference exists between urine protein levels before and after the physical activity of long distance runners.

Figure 1

Comparison of urine protein levels of long distance runners before and after the physical activity



Note. The above graph shows that the mean score of urine protein level of after the physical activity is greater than urine protein level before the physical activity.

Table 3

Summary of ANOVA on urine Ph. level of long distance runners before and after physical activity

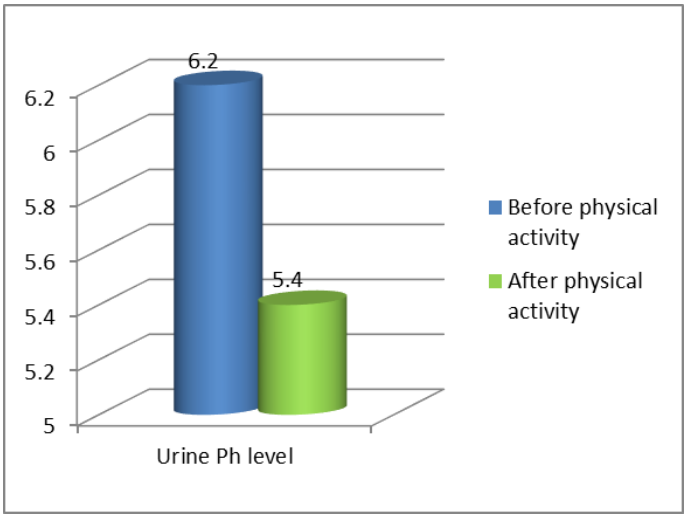
Source of variance	Sum of squares	df	Mean sum of squares	F Cal	F table
Between groups	3.2	1	3.2	19.20	4.41
Within groups	3	18	0.1667		
Total	6.2	19			

The *F*-ratio value is 19.20. The *p*-value is < .0003. The result is significant at $p < .05$.

The table 4.3 reveals that the calculated F – ratio with degree of freedom (1, 18) is 19.20 is greater than the F table value with degree of freedom (1, 18) is 4.41 at 0.05 level of significance. Hence we conclude that there is a significant difference exists between urine Ph levels before and after the physical activity of long distance runners.

Figure 2

Comparison of urine Ph levels of long distance runners before and after the physical activity



Note. The above graph shows that the mean score of urine Ph level of after the physical activity is less than the urine Ph level before the physical activity.

Table 4

Summary of ANOVA on urine ketone level of long distance runners before and after physical activity

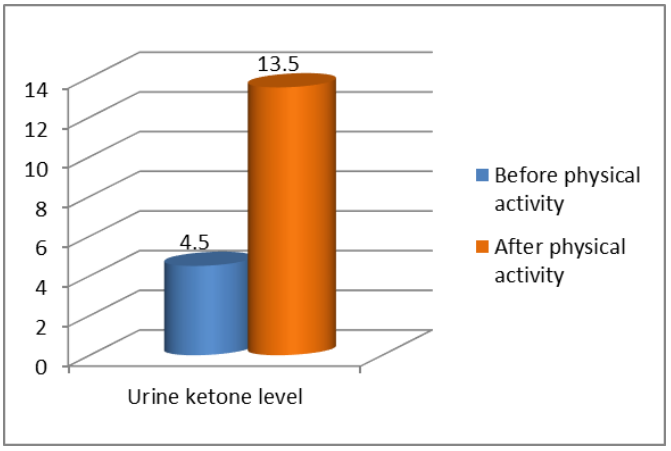
Source of variance	Sum of squares	df	Mean sum of squares	F Cal	F table
Between groups	405	1	405	119.50	4.41
Within groups	61	18	3.38		
Total	466	19			

The *F*-ratio value is 119.50. The *p*-value is < .00001. The result is significant at $p < .05$.

The table 4.4 reveals that the calculated F – ratio with degree of freedom (1, 18) is 119.50 is greater than the F table value with degree of freedom (1, 18) is 4.41 at 0.05 level of significance. Hence we conclude that there is a significant difference exists between urine Ketone levels before and after the physical activity of long distance runners.

Figure 3

Comparison of urine Ketone levels of long distance runners before and after the physical activity



Note. The above graph shows that the mean score of urine Ketone level of after the physical activity is Greater than the urine Ketone level before the physical activity.

Table 5

Summary of ANOVA on urine specific gravity of long distance runners before and after physical activity

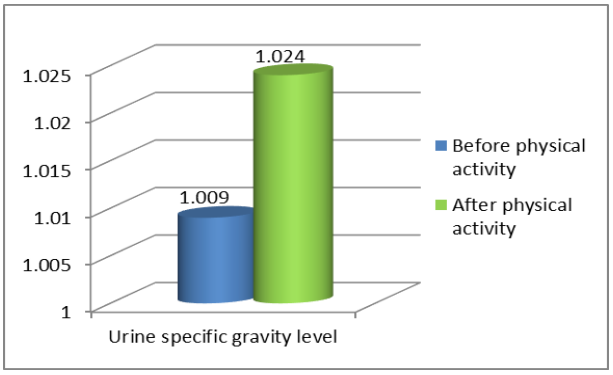
Source of variance	Sum of squares	df	Mean sum of squares	F Cal	F table
Between groups	0.0012	1	0.0012	42.85	4.41
Within groups	0.0005	18	0.000028		
Total	0.0017	19			

The *F*-ratio value is 42.85. The *p*-value is .00001. The result is significant at $p < .05$.

The table 4.5 reveals that the calculated F – ratio with degree of freedom (1, 18) is 42.85 is greater than the F table value with degree of freedom (1, 18) is 4.41 at 0.05 level of significance. Hence we conclude that there is a significant difference exists between urine specific gravity levels before and after the physical activity of long distance runners.

Figure 4

Comparison of urine specific gravity levels of long distance runners before and after the physical activity.



SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

For the purpose of the study the investigator selected 10 female long distance runners from St. Joseph Academy of Higher Education and Research, Moolamattom. After the selection of the subject's investigator collected urine samples of 10 long distance runners before and after the 45 minutes running. The investigator first tested the urine samples before running by using urine strip test method and he collected data such as protein, ketone, Ph, specific gravity of urine. Then subjects were administered for 45 minutes running and finally collected the urine and tested with the same method and obtained the post scores. The collected data was statistically tested by using ANOVA method. The level of significance was fixed at 0.05 level of confidence.

Conclusions

The following conclusions were drawn from the interpretation of the data

1. The study result shows that there was a significant difference between urine protein levels before and after the physical activity of long-distance runners.

2. The study result shows that there was a significant difference between urine Ph. levels before and after the physical activity of long-distance runners.

3. The study result shows that there was a significant difference that exists between urine Ketone levels before and after the physical activity of long-distance runners.

4. The study reveals that there was a significant difference between urine specific gravity levels before and after the physical activity of long-distance runners.

Recommendation

In the light of the conclusions drawn, the following recommendations are made

1. A study of similar nature may be conducted for schoolboys
2. Elite sports people can be chosen as subjects for a similar study.
3. Similar study may be conducted at the international level of long distance runners, and may be conducted to different sports and games.
4. Similar study may be conducted to different environmental conditions.

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