

The Biochemical Changes for Blood, Liver, and Kidney Under the Influence of Different Intensities Physical Loads.

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Abstract

The study aims to identify the impact of varying intensity physical loads on the level of blood proteins , liver enzymes ,kidney function and the rate of change of each blood proteins , liver enzymes and kidney functions during players exposure to physical loads (medium - Lower than maximum - maximum.(

The study sample contains 10 wrestlers in the age 9:12 year old and the experimental method was used, the most important results indicated that medium load leads to a slight decrease in blood proteins and cause a small increase in liver enzymes and kidney function while lower than maximum and maximum loads lead to increasing in blood proteins, liver enzymes and kidney function levels.

Keyword: Biochemical changes, Blood protein, Liver enzymes, kidney function.

Introduction:

There is no doubt that the practice of sports training lead to physiological changes to all the internal organs of the body when the process of physiological adaptation as a response to performing physical load is done by a different set of body organs (Abu EL-elaa Abdel Fattah,1997:p6).

Physical loads are the basis of the progress of athletes levels to achieve the physical, skill and physiological goals, while each physical load has a physiological effect on body organs of which it's intensity differ from one individual to another. physiological responses differ according to load and activity practiced, age and level of the players not only that but also players exposure to high intensity loads especially the juniors may lead to some damage especially when training loads were not rationed in a scientific manner (Bahaa Salameh,2002:p97).

Wrestling is a violent sport that may lead some functional changes to various vital organs ,so all coaches cannot raise level of athletes without having physiological information that help him in assessment whether those functional and physiological changes are temporary or permanent.

Abu El-elaa Abdel Fattah (1997), Mohamed Osman (2000) indicate that the process of rationing training load is the base for training programs in terms of intensity, size and rest set by the coach to get his players to the phenomenon of physiological adaptation and thus raise the performance level of athletic, If the training load was appropriate to the capabilities of the player, it would achieve the goal of it, but if it lower, the physiological

adaptation wouldn't been achieved and if it more, not only negative effects on the level of performance of the player but also to his health (Abu EL-elaa Abdel Fattah,1997:p6; Mohamed Osman,2000:p165).

Since the motor performance in wrestling requires powerful muscular work the processes of directing oxygen to the working muscles cannot meet the energy requirements of the rapid muscular so such energy is produced without oxygen or by anaerobic way.

Liver works on the excretion of enzymes assist in supplying the muscles by energy during the anaerobic work through converting lactic into glucose and those enzymes are considered keys to the occurrence of chemical interactions necessary for the production of energy, therefore without it, producing energy will not take place.

Kidneys work on getting rid of the remnants of the internal biological processes resulting from the production of energy and it could be considered as a vital index to the efficiency of the internal organs of the players.

It is no doubt that exposure wrestlers under the age of adulthood to maximum training loads leads to internal organs fatigue in addition to the risk of a defect in the secretions of the liver and kidneys fatigue, which threatening growth process and adulthood, so that This study attempts to identify the biochemical changes of the liver and the kidneys resulting from exposure young wrestlers to changing intensity physical loads.

Research aims

The research aims to identify the biochemical changes of the blood, liver and kidneys resulting from exposure wrestlers in the qualifying stage to changing intensity training loads through the identifying of: -

- 1- The differences between varying intensities physical loads in blood proteins level.
- 2- The differences between varying intensities physical loads in liver enzyme level.
- 3- The differences between varying intensities physical loads in kidney function level.
- 4- The rate of change in blood proteins, liver enzymes and kidney function as compared to its level in the rest period

Research queries

- 1- Are there any statistically significant differences between the physical loads in different intensities in blood proteins level for qualifying stage wrestlers?

- 2- Are there any statistically significant differences between the physical loads in different intensities in liver enzyme level for qualifying stage wrestlers?
- 3- Are there any statistically significant differences between the physical loads in different intensities in kidney function level for qualifying stage wrestlers?
- 4- What are the rate of change in blood proteins, liver enzymes and kidney function as compared to its level in the rest period?

Research procedures

Research Methodology

The researcher used the experimental approach as it suits research nature.

Research sample

Research sample selected intentionally and consisted from 10 wrestlers aged between 9-12 years who enrolled in Qalioubeya wrestling area.

Table (1)
Sample description (n = 10)

Variables	unit	Mean	Median	SD	Skewness
Age	Year	10.73	11	1.19	-0.23
Height	Cm	129.73	128	5.64	0.53
Weight	Kg	28.27	29	1.95	-0.56
BMI	Kg/m ²	16.86	16.46	1.58	0.8

Table (1) shows that the Skewness coefficient for each of age, height, weight and BMI was between ± 3 which indicates homogeneity of sample under investigation.

Methods and data collection tools

1- Determining load intensity

Training load is determined based on body on treadmill (Watt per each Kg) so if body weight for player (80 kg), we begin with load (80 watts) for (2 minutes) and doubles load every two minutes so that it becomes in minute (3,4) = 160 watts, and (5,6) = 240 watts) and gradually increase the load until it reaches the individual maximum possible performance load (Elgohari, Y., 2003: pp77-79).

2- Sample Withdraw

The blood and urine sample was withdrawn during 3: 10 minutes after the unit end by a specialist, putting it in test tubes. While the blood tubes contained EDITA, it daily transported in portable refrigerator to a Sherouk laboratory to conduct medical tests required.

3- Tools and equipment used

- Restameter attached medical scale to measure

height and weight

- Test tubes containing EDITA to prevent thrombosis.
- Test tubes airtight to take urine samples.
- Plastic injection (5cm) sterilized, are used for once.
- Portable refrigerator for saving the blood samples.
- Treadmill to determine the severity of load to the player before executing the training module

Main study

- Sample Homogeneity was performed in the physical efficiency lab, Physical Education Faculty Benha University.
- Main study was performed in period of 12/15/2013 to 12/22/2013, in the physical

efficiency lab Benha University for 4 days, to Determining load intensity by using Novak test (Watt/kg) on Treadmill in first day.

- player perform Medium load training module, duration 120 min in second day, then perform lower than maximum load module after 48 hour rest in third day, then perform maximum load module after 48 hour rest On fourth day.
- The blood and urine samples were withdrawn during 3: 10 minutes after the unit end.

Statistical Work

SPSS program is used in all statistical work, 0.05 significance level was adopted in this research.

Results and discussion

I – Results

- First query results

Table (2)

Description of the research sample for load intensity and biochemical Changes in rest time and medium load n= 10

Physiological responses		Unit	Rest time				Medium load			
			mean	median	SD	Skewness	mean	median	SD	Skewness
Blood protein	Total.Protein	gm/100 ml	6.44	6.5	0.3	0.48	6.43	6.45	0.37	-0.23
	Globulin	gm/100 ml	2.25	2.25	0.21	0.58	2.19	2.2	0.12	-0.74
	Albumin	gm/100 ml	3.77	3.73	0.17	2.05	3.78	3.8	0.12	-1.33
Liver enzymes	LDH	IU/L	151.6	155.5	19.55	-0.29	151.9	150	11.49	-0.48
	CPK	IU/L	124	128	10.24	-0.29	125.5	124	8.44	1.41
	AST	IU/L	14.7	15	3.56	-0.12	14.9	14.5	2.51	0.4
kidney function	Creatinine	mg/100 ml	3.74	3.5	0.49	0.7	3.79	4.15	0.84	-0.31
	Urea	mg/100 ml	23.9	22	3.6	0.78	24.1	24.5	2.6	-0.14

Table (2) indicates that the Skewness coefficient was between ± 3 for load intensity and biochemical changes which suggesting homogeneity of the sample in rest time and after performing medium loads

Table (3)

Description of the research sample for load intensity and biochemical changes after lower than maximum and maximum loads n= 10

biochemical changes		Unit	lower than maximum				maximum			
			mean	median	SD	Skewness	mean	median	SD	Skewness
Blood protein	Total.Protein	gm/100 ml	7.33	7.35	0.37	-0.23	8.03	8.05	0.37	-0.23
	Globulin	gm/100 ml	2.69	2.7	0.12	-0.74	3.89	3.9	0.12	-0.74
	Albumin	gm/100 ml	4.38	4.4	0.12	-1.33	5.78	5.8	0.12	-1.33
Liver enzymes	LDH	IU/L	186.9	185	11.49	-0.48	226.9	225	11.49	-0.48
	CPK	IU/L	143.5	142	8.44	1.41	157.5	156	8.44	1.41
	AST	IU/L	21.9	21.5	2.51	0.4	33.9	33.5	2.51	0.4
kidney function	Creatinine	mg/100 ml	4.29	4.65	0.84	-0.31	5.49	5.85	0.84	-0.31
	Urea	mg/100 ml	27.1	27.5	2.6	-0.14	36.1	36.5	2.6	-0.14

Table (3) indicates that the Skewness coefficient was between ± 3 for load intensity and biochemical changes which suggesting homogeneity of the sample after performing lower than maximum and maximum loads.

Table (4)
Analysis of variance between physical loads in blood protein

biochemical changes	Status	total Squares	Degrees of freedom	Mean squares	F
Total.Protein gm/100 ml	Within groups	12.87	2	6.43	46.7*
	Between groups	3.72	27	0.14	
	Total	16.59	29		
Globulin gm/100 ml	Within groups	15.27	2	7.63	532.6*
	Between groups	0.39	27	0.01	
	Total	15.65	29		
Albumin gm/100 ml	Within groups	21.07	2	10.53	697.1*
	Between groups	0.41	27	0.02	
	Total	21.47	29		

F significance at 0.05 level, and degree of freedom (2, 27) = 3.35

Table (4) results reveal that F value between physical loads in blood protein were greater than F significance at 0.05 levels which indicates presence of significant differences in all variables under consideration.

Table (5)
LSD between physical loads in blood protein

biochemical changes	Load	Mean	Physical Loads		
			Medium	Lower than maximum	maximum
Total.Protein gm/100 ml	Medium	6.43		0.90*	1.60*
	Lower than maximum	7.33			0.70*
	maximum	8.03			
Globulin gm/100 ml	Medium	2.19		0.50*	1.70*
	Lower than maximum	2.69			1.20*
	maximum	3.89			
Albumin gm/100 ml	Medium	3.78		0.60*	2*
	Lower than maximum	4.38			1.40*
	maximum	5.78			

Table (5) indicates that there are differences between the maximum load and both the medium and lower than maximum in favor of maximum ,and also found differences between the medium load and lower than the maximum load in favor of lower than maximum in the level of blood proteins.

Second query results

Table (6)
Analysis of variance between physical loads in Liver enzymes

biochemical changes	Status	total Squares	Degrees of freedom	Mean squares	F
LDH IU/L	Within groups	28166.67	2	14083.33	106.6*
	Between groups	3566.7	27	132.1	
	Total	31733.37	29		
CPK IU/L	Within groups	5146.67	2	2573.33	36.2*
	Between groups	1921.5	27	71.17	
	Total	7068.17	29		
AST IU/L	Within groups	1846.67	2	923.33	146.1*
	Between groups	170.7	27	6.32	
	Total	2017.37	29		

F significance at 0.05 level, and degree of freedom (2, 27) = 3.35

Table (6) results reveal that F value between physical loads in liver enzymes were greater than F significance at 0.05 level which indicates presence of significant differences in all variables under consideration.

Table (7)
LSD between physical loads in liver enzymes

biochemical changes	Load	Mean	Physical Loads		
			Medium	Lower than maximum	maximum
LDH IU/L	Medium	151.9		35*	75*
	Lower than maximum	186.9			40*
	maximum	226.9			
CPK IU/L	Medium	125.5		18*	32*
	Lower than maximum	143.5			14*
	maximum	157.5			
AST IU/L	Medium	14.9		7*	19*
	Lower than maximum	21.9			12*
	maximum	33.9			

Table (7) indicates that there are differences between the maximum load and both the medium and lower than maximum in favor of maximum ,and also found differences between the medium load and lower than the maximum load in favor of lower than maximum in the level of liver enzymes.

- Third query results

Table (8)
Analysis of variance between physical loads in kidney function

biochemical changes	Status	total Squares	Degrees of freedom	Mean squares	F
Creatinine mg/100 ml	Within groups	15.27	2	7.63	10.7*
	Between groups	19.23	27	0.71	
	Total	34.49	29		
Urea mg/100 ml	Within groups	780	2	390	57.6*
	Between groups	182.7	27	6.77	
	Total	962.7	29		

F significance at 0.05 level, and degree of freedom (2, 27) = 3.35

Table (8) results reveal that F value between physical loads in kidney function were greater than F significance at 0.05 level which indicates presence of significant differences in all variables under consideration.

Table (9)
LSD between physical loads in kidney function

biochemical changes	Load	Mean	Physical Loads		
			Medium	Lower than maximum	maximum
Creatinine mg/100 ml	Medium	3.79		0.5	1.70*
	Lower than maximum	4.29			1.20*
	maximum	5.49			
Urea mg/100 ml	Medium	24.1		3*	12*
	Lower than maximum	27.1			9*
	maximum	36.1			

Table (9) indicates that there are differences between the maximum load and both the medium and lower than maximum in favor of maximum ,and also found differences between the medium load and lower than the maximum load in favor of lower than maximum in the level of kidney function.

- Four query results

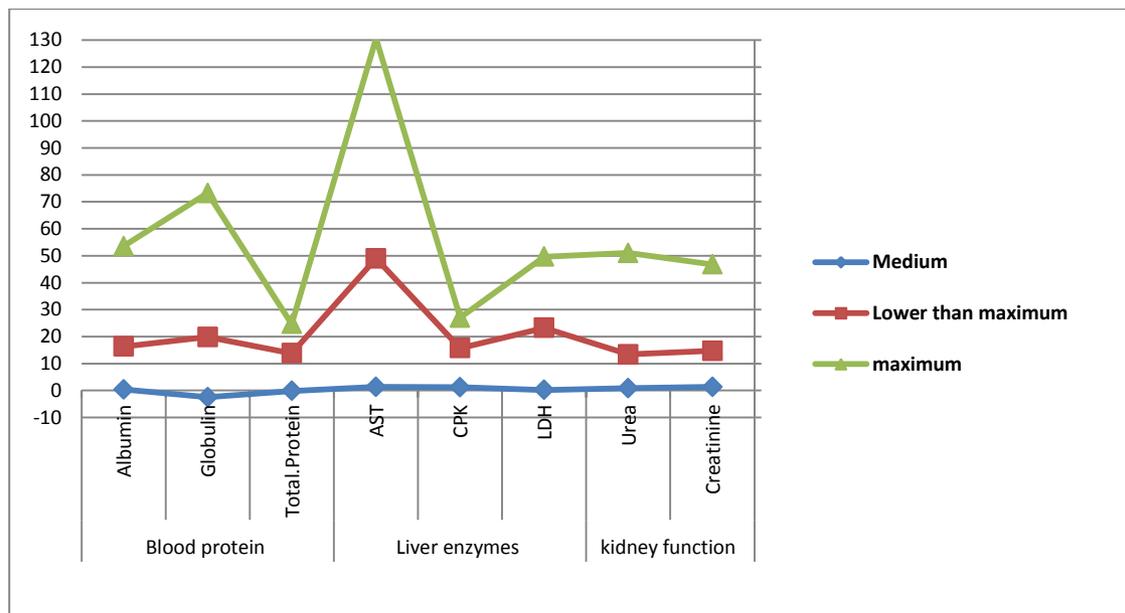
Table (10)
rate of change in the level of blood proteins and liver enzymes and kidney functions of the physical loads compared with the rest time

biochemical changes		Unit	physical loads		
			Medium	Lower than maximum	maximum
Blood protein	Total.Protein	gm/100 ml	↓ 0.16	↑ 13.82	↑ 24.69
	Globulin	gm/100 ml	↓ 2.51	↑ 19.82	↑ 73.27
	Albumin	gm/100 ml	↑ 0.4	↑ 16.33	↑ 53.52
Liver enzymes	LDH	IU/L	↑ 0.2	↑ 23.28	↑ 49.67
	CPK	IU/L	↑ 1.21	↑ 15.73	↑ 27.02
	AST	IU/L	↑ 1.36	↑ 48.98	↑ 130.61
kidney function	Creatinine	mg/100 ml	↑ 1.34	↑ 14.71	↑ 46.79
	Urea	mg/100 ml	↑ 0.84	↑ 13.39	↑ 51.05

↑ Increase ↓ Decrease

Table (10) and chart (1) shows the rate of change in the level of blood proteins and liver enzymes and kidney functions of the physical loads Compared with the rest time

Chart (1)
shows rate of change in the level of blood proteins, liver enzymes and kidney functions of the physical loads compared with the rest time



II - Discussion

- First query discussion

Table (2:3) show that arithmetic mean of the research variables at rest confined between 2:25: 151.60 while confined in medium load between 2.19: 151.90 and confined between 2.69: 186.90 in lower than maximum while the arithmetic mean of the maximum load of was between 3.89: 226.90

It is clear from Table (4:5) that there are statistically significant differences between the maximum load and the medium and lower than maximum loads in the level of total protein in favor of the maximum load, where the mean of maximum load was 8.03 g/100 ml of blood, while he was 6.43 and 7.33 g/100 ml of blood for each of the medium and lower than maximum respectively

It also found differences between physical loads in the level of Globulin in favor of the maximum load where the level of Globulin in the blood for maximum load was 3.89 g/100 ml of blood, while it was 2.19 and 2.69 g/100 ml of blood for each of medium and lower than maximum respectively. It also found differences between physical loads in the level of Albumin in favor of the maximum load, where the mean maximum load was 5.78 g/100 ml of blood, while it was 3.78 and 4.38 g/100 ml of blood from each medium and lower than maximum respectively.

- Second query discussion

Table (6·7) that show there is statistically significant differences between physical loads in the level of the LDH enzyme in favor of the maximum load, where the mean of maximum load was 226.90 IU/L, while it was 151.90 and 186.90 IU/L for each of the medium and lower than maximum respectively, it also found differences between physical loads in the level of CPK enzyme in favor of the maximum load, where the level of the enzyme in the blood for the maximum load was 157.50 IU/L, while it was 125.50 and 143.50 IU/L for each of medium and lower than maximum respectively.

It also found differences between the physical loads in the level of AST enzyme in favor of the maximum load, where the mean for maximum load was 33.90 IU/L, while it was 14.90 and 21.90 IU/L for each of medium and lower than maximum respectively.

The study interpret that the continuation of the player of in the maximum load leads to biochemical changes as a result of the continued need of muscle to oxygen especially after the failure of the body to provide the amount of oxygen required for muscle work leading to the transformation of the aerobic system to the anaerobic system, by which the role of the liver enzymes become very clear since it responsible for rebuilding the ATP in addition to its main role in converting lactic to Pyruvic acid which used by the liver to convert it into glucose that known as the Krebs cycle, all of that explains the high levels of the liver when performing physical exercises with maximum loads.

Where Bomba (1999) Indicates that any physical activity leads to physiological and vitality and psychological changes based on repetition (size) or intensity of the load or frequency of performance (density) and the greater the main factors responsible for training (size,intensity,density) that will lead to an increase of the resulting physiological changes.(Bomba,1999: p188)

The results of the study of Bdran Ghorbani and Abbas Ali (2013) indicates that when maximum physical loads

performed for a long time clearly lead to an increased level of liver enzymes

Where each of studies Paula Brankiko & etal (2007), Christopher& etal (2010), Julio Calleja& etal (2007) and Saeed el-shaker & Mustafa Nasr (2012) confirm that creatine kinase enzyme increases by increasing the severity of physical load and the rate of increase become higher when the physical load is a maximum or approaching to the maximum load, especially in activities or training units performed severely at maximum for more than 60 min.

The LDH enzyme works to disarm the hydrogen atom from lactic acid resulting from the muscle, which turns into Pyruvic that each of studies Julio Calleja & etal (2007), Saeed el-shaker & Mustafa Nasr (2012) and Mohammad Gadira & etal (2012) suggests that the physical effort at lower than maximum or maximum load leads to the increase of LDH enzyme.

While Nahed Beja & etal 2013(18) study suggests that the exercise at high Intensity loads leads to the increase of AST enzyme.

- Third query discussion

Table (8·9) show that there is statistically significant differences between the physical loads in the level of Creatinine in the urine in favor of the maximum load, where the mean of maximum load was 5.49 mg/100 ml of blood, while it was 3.79 and 4.29 mg/100 ml of blood for each medium and lower than maximum load respectively ,it also found differences between physical loads in the level of urea in the urine in favor of the maximum load, where the mean of maximum load was 36.10 mg/100 ml of blood, while 21.10 and 27.10 mg/100 ml of blood for each medium and lower than maximum load respectively

The study Explain that, at the beginning of physical exercise most internal organs respond as a result of training load to get their energy requirements and oxygen to complete the muscle work, while rising the intensity of load to increase muscles need of energy which leads to high proportion of creatinine, a proof that the load has reach the maximum intensity.

with the continued exercise for long periods, the creatinine proportion increase and become clearly visible in the urine with the advent of urea, in addition to Muscle fatigue because of excessive load which represents a threat to the player especially in young players.

Kaczko Suzuki & etal (2006) study suggests that the high-intensity physical exercise, which reach to the maximum

load or high-intensity sport competitions lead to increase the level of creatinine and uric acid that creatinine rate of change reached to 14.58%

- Fourth query discussion

Table (10) shows that the medium load rate of change was limited between 0.16% 2.51 where the lowest enzyme total protein and the highest rate of change in the level of globulin was 2.51. It is noted that the change in the medium load measurements increased slightly except for the level of total protein and globulin in the blood protein decreased slightly than the measurements at rest.

Researcher interpret that medium load does not pose any physical burden on the players, especially who prepared to the level of sport competition

the high levels of LDH and CPK enzymes as a result of the muscle not fully using the anaerobic system due to availability of oxygen which explains the slight increase of LDH and CPK because their role confined in converting lactic to pyruvic acid and the production of ATP under anaerobic system as well as a result of lower intensity of medium load, it will not lead to players fatigue and this explains the low rate of globulin in the blood.

Wafa Abdul Redha & etal (2010) study indicate that the percentage of albumin and globulin increase slightly and probably decrease after medium intensity physical exercise, and it does not affect the level of albumin, but leads to a slightly decrease of globulin.

It is clearly that the rate of change of lower than maximum confined between 13.39: 48.98% where it was in lowest rate of change in Urea and the highest rate of change in AST enzyme level was 48.98%. While the change in the lower than maximum was by increase in comparison with all the variables in rest.

The researcher explains that possibilities of feeling tired increase in the lower than maximum load while the onset of fatigue, especially with the continued exercise for a long time the role of liver enzymes significantly increase and blood proteins increase to and as a result the role of AST enzyme increase .

This is in line with G Duncan and others (2013)(12) study which indicated that the low-intensity physical loads or lower than maximum loads which does not last for long periods of time often do not lead to clear differences in muscle enzymes level

It is clearly that the rate of change in the maximum load was limited to 24.69: 130.61%, where the lowest

percentage of total protein level 24.69% and the highest rate of change of AST enzyme was 130.61%

the study explain that the maximum intensity lead to the use of anaerobic system, especially with the continued exercise for long periods after the failure of the muscles in the production of energy by using the aerobic system which clearly increases the liver enzyme with the increase in blood proteins are a result of the continued of maximum exercise increase the proportion of liver enzymes, especially enzyme AST and is responsible for the decomposition of amino acids, leading to increased rates of urea and creatinine in the urine, which represents a sign of the emergence of fatigue.

Conclusions

In light of the e study and the research sample results we conclude that: -

- 1- Medium load leads to a decline in the level of blood proteins, but it usually does not affect or sometimes slight increase in the level of liver enzymes and kidney function.
- 2- Lower than maximum load leads to increase in blood proteins and liver enzymes a slight increase in kidney function
- 3- Maximum load leads to significantly increase in blood proteins and liver enzymes and kidney function, especially in load which lasts for two hours.
- 4- Maximum intensity physical load not only expose young players to the risk of overload but also, significantly affects the level of blood proteins, liver and kidney function.
- 5- Increase the period of training units, especially when using lower than maximum and maximum loads lead to exhaustion of the liver, kidney, and expose the player to the risk of excessive load

Recommendations

- 1- Using biochemical changes of blood, liver and kidney in rationing and determining the duration of training units, especially when using the Lower than maximum and maximum loads with pre-adulthood players.
- 2- When using maximum intensity physical loads, training unit shouldn't exceed 60 minutes and allows players to rest for 48 hours, especially when dealing with the pre-adulthood players

- 3- It is not preferred to form two consecutive maximum intensity physical loads for pre-adulthood players, but it should separate between them by medium load unit
- 4- By measuring the change rate of urea and creatinine in the urine and the level of proteins in the blood, the onset of fatigue and exhaustion to the players can be recognized clearly
- 5- Do more similar studies on other samples and different conditions by using a variety of training methods.

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